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INDEX.

[In this Index subjects, titles and authors' names are all included, for convenience, in one alphabetically arranged list. Where necessary, articles are indexed under two or more headings. Often the Index is consulted by persons who have only a vague or general idea of the title or nature of the article sought. In such a case a search under every heading that might relate to the subject should be made. A number of cross-references are given to assist in this purpose. The asterisk (*) is equivalent to "illustrated."]

A

"Accumulators." By Sir David Salomons. (Book Review)..... 450
Accumulators. (See also Storage Battery.)
Adams, E. C..... *79
Adams' "Electric Transmission of Water Power." (Book Review)..... 450
Adams' Electrical Rope-tightening Device for Telpher System..... *531
Advance Single-phase Motor..... *239
Advertising, Central-station. (See Central Station.)
Advertising, Modern Methods of. By Frank B. Rae, Jr..... 342
Agriculture, Electricity in. (See Horticulture.)
Air Brakes for Electric Cars..... 323
Air, Regeneration of, by Oxone..... 300, 380
Air Ships and Balloons, Exhibition of..... 23
Alcohol, Benzol and Gasoline versus Steam for Motor Cars in Europe..... *489
Alcohol (Free) in the Arts. Elihu Thomson on.. 220
Alcohol, Free, Bill Becomes a Law..... 344, 493
Alcohol, Free, and Its Relation to Electric Lighting. (Editorial)..... 316, 446
Alexander's "Electrical Engineering." (Book Review)..... 385
Alexanderson, E. F. (A Self-exciting Alternator).*221
Allen, John C. (Proper Handling of the New-business Department)..... 160
Allis-Chalmers Club, The..... 142
Allis-Chalmers Company, West Allis Works of the..... *279
Allis-Chalmers Electrical Works in Cincinnati..*528
Allis-Chalmers Engines, Some Large..... *140
Allis-Chalmers 1,800-horsepower Gas Engine Direct-connected to Alternator..... *122
Allis-Chalmer Railway Motor..... *86
Allis-Chalmers Shops at West Allis, Stationary Engineers Visit..... *551
Allis-Chalmers Steam Turbine..... *60, *381, *507
Almert, Harold..... *79
Almert, Harold, on Central-station Efficiency. (Editorial)..... 98
Almert, Harold. (Organization and Development of the New-business Department)..... 160
Alps, Buergenstock Electric Elevator in the. By Dr. Alfred Gradenwitz..... *154
Alternating Current versus Direct Current for Railways. (Editorial)..... 36
Alternating-current Elevators. By W. N. Dickinson, Jr..... 501
Alternating-current Generators, Compounding, Steinmetz's Arrangement for..... *352
Alternating-current Generators, Protection of, Against Reversal of Energy. (Leonard Wilson's Patent)..... *136
Alternating-current Meter, Ferranti-Hamilton's..... *54
Alternating-current Motor, Lamme..... *116
Alternating-current Motors, Self-starters for..... *383
Alternating-current Overload and Reverse-current Relay..... *553
Alternating-current Services, Grounding Secondary. By Sidney Hosmer..... 525
Alternating-current Signal Circuits in the New York Subway. By J. M. Waldron..... *395
Alternating-current Traction in Heavy Railroading..... 238, *298
Alternating-current Wave Forms, Oscillographs for the Study of..... *97, *218
"Alternating Currents." By Alfred Hay. (Book Review)..... 241
Alternating Currents of Low Frequency, Stanley's System of Transmitting and Utilizing... *396
Alternating Currents. (See also Central Station, Generators, High Potential, Polyphase, Power Development, Rotary, Single Phase, Two-phase, Three-phase, Surging, Transformer, etc.)
Alternator, A Self-exciting. By E. F. Alexanderson..... *221
Alternators and Gas Engines, Large, for Johannesburg, South Africa..... 278
Alternators, Self-synchronizing of. By Morgan Brooks and M. K. Akers..... 474, 476
Alternators. (See also Generator, Rotary, Turbo-alternator, etc.)
Aluminum Works at Niagara Falls, Large New.. 49
Amateur's First Dynamo, An. By T. H. Reardon. 528
American Association for the Advancement of Science. (Annual meeting in New Orleans).18, 34
American Electrical Business, Competition in the. (Editorial)..... 236
American Electrochemical Society, Ithaca, Convention of..... 379
American Institute of Electrical Engineers, The. (Editorial)..... 420
American Institute of Electrical Engineers, Annual Meeting of..... 422
American Institute of Electrical Engineers, Chicago Meetings of the..... 52, 177, 243
American Institute of Electrical Engineers, Cincinnati Branch of the..... 139
American Institute of Electrical Engineers, Election of Officers of..... 147, 159, 257, *278, 399, 422
American Institute of Electrical Engineers Invited to Visit Great Britain and Italy..... 99, 193, 233, 303, 356, 512
American Institute of Electrical Engineers' Library Receives Fund from International Electrical Congress..... 164, 325
American Institute of Electrical Engineers, Milwaukee Convention of..... 423, 447, *474
American Institute of Electrical Engineers, New York Meetings of the..... 99, 177, 257, 358, 422
American Institute of Electrical Engineers, Pittsburg Meetings of..... 199
American Pacific Cable Is Completed..... 264
American Railway Engineering and Maintenance of Way Association, Chicago Convention of... 257
American Society of Mechanical Engineers, Chattanooga Convention of..... 383
American Street and Interurban Railway Association and Affiliated Organizations..... 6, 213, 257, 423, 534, 535
American Telephone and Telegraph Company, Annual Report of..... 264
Ames, W. W., Death of..... 220
Anaconda, Large Induction Motors for..... 124
Anderson, S. C., Single-phase Railway Equipment for..... 450
Andrews, Leonard. (The Long-flame Arc Lamp). 448
Appleton Wis., Electrical Conditions in..... 320
Appleyard Properties Sold..... 178, 206
Arc-lamp Post Designs, Art Institute..... *213
Arc Lamps, Flame. (See Flame and Flaming.)
Arc Light, Submarine..... *426
Arc Light on Candlemas Day. (McCutcheon's Cartoon)..... *122
Arc Lighting. By R. H. Henderson..... *402
Arc Welding Apparatus, Improved..... *469
Arctic Regions, Electric Lighting in the..... 419
Argentine Republic as a Market for Electrical Goods..... 202, 328
Armstrong's, A. H., Method for the Control of Induction Motors for Railway Purposes..... *152
Arnold, B. J., Elected President of the Western Society..... 19
Arnold-Carroll Report on Electric-light Rates in Chicago..... 238
Arnold Company, The, New Offices of..... *360
Art Institute, Arc-lamp Post Designs at..... *212
Art and Utility Combined in Italian Hydro-electric Plant..... *331
Artillery, Electricity an Important Adjunct of. (Editorial)..... 470
Ashcroft, E. A. (A New Process for the Manufacture of Sodium)..... 380
Ashtabula, O., Municipal-ownership Situation.. 266
Atlantic Cable, All-British, Proposed..... 523
Atlantic City in June..... *445
Atmosphere, The Production of Nitrogen from the..... *197
Auditorium Electric-light Plant in Chicago. (Editorial)..... 36
Aurora, Elgin and Chicago Electric Railway to Extend Express Business..... 555
Aurora, Elgin and Chicago Railway Company, Electric-light Rates of..... 545
Austin (Texas) Dam, Rebuilding of the..... 325
Australian Railroads to be Electrified..... 124
Automatic Telephone Exchange for Skibo Castle.*526
Automatic Telephone System, Bell, in Colorado.. 225
Automatic Telephone System, Chicago, Extensions to..... 305
Automobile, Electric, Grace and Distinction of. (Editorial)..... 138, 316
Automobile Omnibuses, Electric, Proposed, in London..... 386, 406, 480
Automobile Shows. (See Boston, Chicago, New York, etc.)
Automobile Truck, Studebaker Electric..... *181
Automobiles (Notes)..... 111, 188, 228, 248, 410
Automobiles in Chicago, Number of..... 313
Automobiles, Electric, Are Safe. (Editorial)..... 80
Automobiles, Electric, Shown at Chicago Show..*136
Automobiles, Special Roads for..... 245
Auxiliary Telephone Circuits. By Charles H. Coar *62

B

Backus, Edward, Death of..... 279
Badt, F. B., Recovery of..... 307
Baker Street and Waterloo Underground Railway of London..... 205, 265, *312
Bakery, The Central Station and the..... 260, 548
Ballistic Work, D'Arsonval Galvanometer for, Adjustment of the..... 215
Baltimore, New Bell Telephone Exchange in..... *9
Baltimore & New Consolidated Company's Power Plant at..... 363
Baltimore-Washington Electric Railway..... 347, 368
Bannister, Lemuel, Death of..... 313
Barrett, George A. (The Proper Handling of Consumers' Meters)..... 114
Barrows' "Pattern Making." (Book Review)..... 142
Barstow, W. S. (Mercury-arc Rectifier System with Magnetic Lamps for Street Illumination)..... 471, 472
Bartholomew, W. S., on Air Brakes for Electric Cars..... 322
Battery, Dry, Recharging..... 189
Battery, Storage. (See Storage Battery.)
Batteries, Primary..... 459
Baxter's "Electricity." (Book Review)..... 142
Beaumont's "Steam-engine Indicator." (Book Review)..... 241
Beauty Lamp Posts May be Things of. (Editorial)..... 216
Beck Flaming Lamp Company, Incorporation of. 306
Behr Mono-rail Project in England Abandoned. 165
Behrend, B. A., Predicts 25,000-Kilowatt Units.. 127
Belgium, Public Laboratory of Electricity in.... 454
Bell Automatic Telephone System in Colorado.. 225
Bell, Louis. (Some Physiological Factors in Illumination and Photometry)..... *504
Bell Telephone Company of Canada. (See Canadian Bell.)
Bell Telephone Contract Agents, Annual Meeting of..... 405
Bell Telephone Finances..... 165
Bell Telephone Output..... 88, 184, 245, 428, 544
Bell Telephone. (See also American Telephone and Telegraph Company.)
Bell's, Louis, "Electric Power Transmission." (Book Review)..... 222
Benjamin Two-part Lamp Guard..... *163
Benson, A..... *24
Benzol, Alcohol and Gasoline versus Steam for Motor Cars in Europe..... *489
Berlin, Moabit Station in..... 14
Berlin Street-railway Affairs..... 129
Berthoud-Thoune Electric Railway in Switzerland. *14
Binghamton Idea, A..... 161
Bissell, Professor, on Depreciation of Electrical Properties..... 340
Black River Power Transmission..... 381
Blast-furnace Gas-engine Development in Pittsburg District..... 426
Blindness, Apparent, Due to Alleged Electrical Shock..... 419
Blood, William H., Jr..... *443
Blood, William H., Jr., Address of, as President of National Electric Light Association..... 471
Boat, Trolley, to Disperse Floating Ice at Niagara Falls Power House..... *95
Boatz, German Method of Electrically Towing.. 427
Bohemia, Three-conductor Direct-current Railway in. By C. Smith..... *31
Boiler Economy, Hallberg on..... 472, *473
Boiler Economy, Stott on..... *101
Book Reviews..... 142, 222, 241, 385, 450, 547
Books Received..... 38, 108, 178, 222, 241, 320, 423, 450, 479, 505, 531
Boston Automobile Show..... 246
Boston Edison Company's, The New Building of the *445
Boston Harbor, Low Tide in, Affects Power-house Condensers..... 368
Boston, Municipal Ownership of Electric-light Plant Proposed in..... 109, 145, 167, 206, 538
Boston Section of Illuminating Engineering Society..... 366
Bower, L. F..... 147, *327
Bradley, George L., Death of..... 279
Brailey Syndicate Gets Federal Telephone Properties..... 455, 479
Brakes, Air, for Electric Cars..... 322
Brakes Discussed by Central Electric Railway Association..... 255
Brazil, Electrical Opportunities in..... 400
Breen, Joseph L., Death of..... 279
Brembo River Power Development in Italy..... *331
Bremner Steamship, Space Telegraphy on..... *353
Brewery, Pabst, Power Plant..... 124, 401
Bridge, Transporter, Widnes-Runcorn Electrically Operated..... *12
Brill, G. M., Death of..... 279
Bristol Portable Recording Gauges..... *363
British, All, Atlantic Cable Proposed..... 523
British Pacific Cable..... 12
Brockway's "Electric-railway Accounting." (Book Review)..... 241
Brooklyn, Large Steam Turbines for..... 7, *381
Brooklyn Polytechnic Students Make Train Test.. *337
Brooks, Franklin, Death of..... 220
Brooks, Morgan, and M. K. Akers. (Self-synchronizing of Alternators)..... 474, 476
Brown-Boveri Steam Turbines..... *537
Brownell, E. E. (Electrolysis)..... 280
Buck, H. W., on the Economic Value of Niagara Falls..... 453
Buergenstock Electric Elevator in the Alps. By Dr. Alfred Gradenwitz..... *154
Buffalo, Lockport and Rochester Electric Railway. 541
Buffalo, Municipal Lighting Proposed in.. 233, 365, 396
Building Construction, Motors Should Replace Engines in. (Editorial)..... 470
Bullock (Allis-Chalmers) Works in Cincinnati.... *529
Bunsen's Photometer..... 321
Burdett, E. W., on Municipal Ownership..... 491
Burford, W. D. (Underground Construction in La Crosse, Wis.)..... 180
Burgess, C. F., on Magnetic Properties of Electrolytic Iron..... 474
Burglar Protection and Advertising, Combining... 548
Burglars Don't Like Electric Light..... 261
Burke Smokeless Furnace..... *374
Burlingame's Wireless Printing Telegraph..... 38
Burnett, Douglass. (Some Important Considerations in Electric Illuminating Engineering)..... 320
Burns, John, on an Incognito Visit..... 139
Bushnell, S. Morgan. (The Sale of Electric Light and Power)..... 84
Business Notes..... 28, 49, 68, 91, 111, 131, 149, 169, 189, 209, 229, 249, 268, 289, 309, 329, 348, 371, 390, 411, 433, 460, 484, 513, 535, 559
Business of the Year 1905 in Review..... 20

6989

C

Cable, Atlantic. (See Atlantic Cable.)
Cable Cars to Be Abandoned in Chicago.493, 521, 538
Cable Clamps Used in Turning a Corner...*361
Cable Construction for Long Island Railroad...*104, *466, *540
Cable Laying in Simplon Tunnel... 302
Cable, Pacific. (See Pacific Cable.)
Cable, Panama Canal. (See Panama Canal.)
Cable Practice, Underground, Present, Comments on. By Wallace S. Clark... 359
Cable Roller, Callahan...*531
Cable-testing Wagon, German...*469
Cable and Wire Standardization. (Editorial)... 356
Cables, Submarine, of the World... 237
Cables, Testing, Portable X-ray Apparatus for...*254
Cables, Underground, Maximum Voltage for... 445
Cables and Wires, Rubber-covered, Standardizing. By John Langan... 358
Cahill Electrical Music System. (Editorial)... 236
California Electric Power Consolidation Completed 42
California Electrical Works, Effect of San Francisco Earthquake on...*415
California Gas and Electric Corporation, 9,700-horsepower Hydraulic Turbine for... 104
California Power Development, Notes of... 235
Calumet Electric Street Railway of Chicago Sold 459
Canada, Dominion of. (Correspondence)...26, 46, 65, 89, 109, 145, 166, 185, 205, 245, 265, 305, 367, 386, 406, 429, 456, 480, 511, 532
Canada, Exportation of Electric Current from.406, 480
Canadian Bell Telephone Company, Improvements of...143, 165, 185, 405, 479
Canadian Electric-railway Statistics... 237
Canadian Electrical Association, Niagara Falls Convention of...519, 550
Canadian Government Telephone Inquiry...323, 345
Canadian Niagara Power Company, Power Plant of the...*271
Canadian Pacific, Electric Locomotives on... 145
Canadian Telephone News. (Correspondence)...143, 204, 304, 405, 455, 479, 526
Canadian Views of the Niagara Power Situation...152, 191, 277
Canal Boats, Electrical Towing of... 427
Canal Transportation in Ohio, Electric, Financially Attacked... 164
Car, Gasoline-electric, An Experimental...*117
Car, Gasoline-electric, Strang, on Transcontinental Trip...*199
Car, Gasoline, Lake Shore Railroad's... 368
Car Headlights, Searchlights as... 186
Car, Test, Electric, Educational Value of the. (Institute Discussion)... 475
Car and Truck Builders, Combination of...159, 209
Cars for City Service, Types of...*107
Cars, Electric, Air Brakes for... 322
Cars, Motor, in Europe, Alcohol, Benzol and Gasoline Versus Steam for...*489
Cars, Steel, for New York Subway... 480
Carbons, French, in the United States...*162
Carhart, Henry S. (The Charlottenburg Conference on Electrical Units of Measurement)...*297
Carnegie Estate in Scotland, Automatic Telephones for...*526
Carroll, William. (Possible Municipal Uses of Drainage Canal Power)... 37
Carroll's, William, Reports on Electric-light Costs and Rates in Chicago...198, 238
Carter's "Motive Power and Gearing for Electrical Machinery." (Book Review)... 241
Carty, J. J. (Telephone Engineering)...182, 202, 224
Catawba River Power Development...47, 127, 145, 533
Catalogue, W. N. Matthews & Bro.'s...*222
Catenary Overhead Construction of Warren-Jamestown Single-phase Railway...*158
Caustic Soda, Electrolysis of... 380
Cement Plant, Large Pacific Coast, Hydro-electric Power for... 384
Census Statistics of Electrical Industries. (Editorial)...176, 420
Census Statistics of Electrical Manufactures for 1904... 343
Census Statistics of Telephones and Telegraphs in 1902... 428
Centenary of the Electric Light. (Editorial)... 236
Central America, Telegraph Extension in... 94
Central Electric Company, New Building of the... 131
Central Electric Railway Association, Meetings of...57, 100, 139, 255, 448
Central Pennsylvania Traction Company, New Power Station of...*360
Central-station Advertising...*85, 161, *343, 424, *478, 504, 548
Central-station Advertising Exhibit at Atlantic City Convention... 504
Central Station, The, and the Bakery...260, 548
Central Station, The Bille, at Hamburg, Germany. By Frank C. Perkins...*291
Central-station Company and Consumer... 424
Central-station Design, Modern, as Exemplified in La Crosse, Wis. By C. H. Williams...*171
Central-station Economics, Stott on...*101, *120
Central-station Efficiency, Almert on. (Editorial) 98
Central Station Electrically Decorated Attracts Customers... 424
Central Station in Hanover, Germany. By C. Smith... *55
Central-station Industry in Massachusetts... 449
Central-station Losses, Swinburne on... *42
Central-station Policy in Illuminating Engineering, Douglass Burnett on... 320
Central-station Policy in Relation to Lamp Efficiency. (Editorial)... 542
Central-station Practice, Chicago...*1, 31, *439
Central-station Practice, English. (Editorial)... 542
Central-station Service in the United States, Statistical Table of... 237
Central Station, The Small, Forthcoming Articles on...520, 540
Central Station, Small, How to Make a, Pay. By D. F. McGee... 500
Central Stations and Electrochemical Processes.. 380
Central Stations, Experience of, with Lightning Trouble... 527
Central Stations, Power Output of, Suggestions for Increasing the. By P. H. Korst... 85
Central Stations. (See also Lighting, Power, Rates, Selling Electricity, Sub-stations, etc.)
Central Union Telephone Company, Annual Report of... 283
Century Electric Company's Single-phase Motors.*403
Champaign, Ill., Construction Work in... 139
Charlottenburg Conference, The, on Electrical Units of Measurement. By Henry S. Carhart.*297
Cheney, W. W., Jr... *24
Chicago Automatic Telephone System, Extensions to... 305
Chicago Automobile Show...*136, 248
Chicago Central-station Practice...*1, 31, *439
Chicago City Council, Municipal-ownership Measures of Mayor Dunne Passed by...82, 104
Chicago City Railway Company, New Officers and Annual Report of... 155
Chicago Department Store Plant Fifty Feet Below Street Level...*251
Chicago Drainage Canal. (See Drainage Canal.)
Chicago Edison Company, Annual Report and Other Statistics of...31, 207, 545
Chicago Edison Company, Sub-stations of...*439
Chicago Edison Men Entertained at Hawthorne Plant... 361
Chicago, Electric-light Rates in...139, 156, 157, 177, 198, 217, 238, 257, 383, 425, 493, 518, 541
Chicago Electric-light Rates and Methods of Charging. (Editorial)...156, 316, 520
Chicago the Electrical City. (Editorial)... 98
Chicago Electrical Show...28, *33, *51, *72, 80, 99, 126, 141, *157
Chicago Electrical Show, The. (Editorial)...80, 98
Chicago Elevated-railway Traffic...15, 48, 208, 287, 389, 483
Chicago, Engineers' Club of... 124
Chicago Federal Building, Artistic Lighting Fixtures in...*235
Chicago Freight Tunnels...57, *179, 248, 251, 484
Chicago Gas Inquiry...19, 34, 101, 137, 163
Chicago, Illinois Central Railroad in, Proposed Electrification of...19, 36
Chicago Lighting Statistics... 448
Chicago, Mayor Dunne of, Gives His Views on Municipal Problems... 24
Chicago Municipal Election, Result of... 277
Chicago Municipal Election, Significance of the. (Editorial)... 276
Chicago Pneumatic Tool Company, Annual Report of... 149
Chicago Pneumatic Tool Company's Compressed-air Tools for Submarine Working...*426
Chicago Pneumatic Tool Company's Portable Electric Drills...*552
Chicago South Side Elevated Railroad, Extensions to...108, 327, 432
Chicago Street-railway Municipal-ownership Issue. (Editorial)...80, 138, 196, 216, 276
Chicago Street-railway Service, Betterment of. (Editorial)... 492
Chicago Street-railway Situation...21, 39, 80, 82, 104, 138, 141, 179, 196, 216, 218, 242, 276, 277, 322, 362, 404, 422, 450, 493, 521, 538
Chicago Telephone Company, Affairs and Rates of the...44, 88, 106, 144, 165, 184, 204, 244, 263, 284, 305, 323, 405, 428, 506, 545
Chicago Telephone Company's Annual Report... 88
Chicago, Telephone Exchange in, The Newest Branch...*133
Chicago Union Traction Company, Interesting Damage Suit Against... 419
Chicago and Vicinity Suffer from Sleet Storm.82, 126
Chicopee, Mass., Municipal Ownership Not a Success in... 167
Chieti Electric Railway in Italy...*231
Chile, Electrical Opportunities in... 400
Christensen, Niels A...*507
Chromium, Electric... 380
Churches, Notes on the Lighting of. By E. R. Weeks...*453
Cincinnati Gas and Electric Company's Extensions...325, 327, 556
Cincinnati Light, Heat and Power Company Incorporated... 226
Cincinnati Society of Telephone Research... 107
Cincinnati Telephone Situation...264, 283, 324, 366, 385, 506
Cinder Trap, An Efficient... 454
Ciphers, Telegraph, by the Billion... 243
Circuit-breaker, New, of Switchboard Equipment Company...*362
Circuit-breaker, Westinghouse High-voltage... *60
Circuit-breaking Apparatus, High-potential...*304
Clark, Wallace S. (Comments on Present Underground Cable Practice)... 359
Clermont-Ferrand (France) Hydro-electric Plant...13, *15
Cleveland, Block Lighting Proposed in... 311
Cleveland, Niagara Power for... 124
Cleveland Telephone Interests..143, 224, 366, 455, 479
Clifford, Prof. H E., on New Illuminants... 491
Climax Tube for Soldering Flux...*104
Clyde Valley Power Plant near Glasgow. By Frank C. Perkins... *71
Coal, Exports of, from the United States in 1905. 235
Coal-handling Plant of Long Island City Power Station...*273, 274
Coaling Warships, Floating Fuel Depot for, Electrically Operated. By D. A. Willey... *93
Coar, Charles H. (Auxiliary Telephone Circuits) *62
Coar, Charles H. (The Prevention of Pole Rot). 317
Coast Defenses, Electricity and. (Editorial)... 470
Cobalt in North Carolina... 512
Cold-storage Plant, Large, Features of Engineering Interest in a...*413
Colleges and Educational Institutions at Electrical Show. (Editorial)... 98
Collins, A. F., Wireless Telephony of...*292
Colloids, Migration and Flocculation of... 379
Colombia, Electrical Concessions in... 506
Columbiana, Ohio, Peculiar Lighting Controversy in... 238
Commercial Telegraphers' Union of America, Annual Meeting of... 404
Commonwealth Electric Company of Chicago, Annual Report and Other Statistics of...31, 545
Commonwealth Electric Company, Chicago, Fisk Street Station of the. (With supplement)..*1, *554
Commonwealth Electric Company of Chicago, Sub-stations of...*439
Commutation, Motor Field, Improvement in...*272
Compound and Shunt-wound Synchronous Converters for Railway Work. By W. L. Waters...474, 477
Compounding Alternating-current Generators, Steinmetz's Arrangement for...*352
Compressed Air and Arc Light, Submarine Working by...*426
Concrete Power House for the Seattle Electric Company... 493
Condenser, Electric, Damping Effect of. (Editorial)... 492
Condensers, Steam, in Long Island City Power Station...*294
Condensers, Steam, Power-house, Low Tide in Boston Harbor Affects... 368
Condensing Plants, Steam, for Small Stations.. 335
Connectome, Dale Company's... *60
Consolidated Gas, Electric Light and Power Company of Baltimore, New Power Plant of... 363
Construction, Line, in Small Cities... 201
Construction, Line, Telephone. By S. P. Grace..*354
Construction, Overhead Line. By Paul Spencer...472, *521
Construction, Overhead and Underground, for Long Island Railroad...*464, *540
Construction, Underground, in La Crosse, Wis. By W. D. Burford...180, 262
Construction Work in the East and in the West. (Editorial)... 36
Construction Work, Some Things to Avoid in.. 140
Construction Work, Telephone. (Editorial)... 356
Construction. (See also Catenary, Overhead, Underground, Wiring, etc.)
Controller, Two-speed, for Electric Light and Power Circuits...*312
Cooking, Electric, Cost of... 261
Cooking, Electric, in the Household... 541
Cooking by Electricity, Lectures on... 240
Cooley, Lyman E. (The Ownership of Public Utilities)... 200
Coolidge, Marshall H...*58
Cooper, Leon H., Death of... 279
Co-operation, Electrical, Endorsed by National Electric Light Association... 490
Co-operation in Stimulating the Use of Current-consuming Devices. By J. Robert Crouse... 84
Co-operative Development...161, 260
Copper, Export Duty on, Suggested. (Editorial)...98, 138
Copper Market...179, 278
Copper Production in the United States in 1905.. 366
Copper Wire, Hard-drawn. By T. B. Doolittle.. 61
Cornell University, Electrical Engineers at, New Quarters for...*414
Corrosion of Iron by Acids... 380
Cotton-mill Work, New Electrical Equipment for. 550
Council Bluffs, Iowa, Construction Work in, Standard of... 483
Council Bluffs, Iowa, New Telephone Exchange in... 385
Crane, Electric, at Southampton Docks... *12
Crocker-Wheeler Electric Hoists...*122
Crocker-Wheeler Officials, Convention of...*123
Cross-arms, Spencer on... 522
Crouse, J. Robert. (Co-operation in Stimulating the Use of Current-consuming Devices)...84, 260
Curie, Mrs., Succeeds Her Deceased Husband in Professorship... 408
Curie, Professor, Death of...336, *337
Curtis Steam Turbine, Tests of...365, *554
Cutler-Hammer Self Starters for Alternating-current Motors...*383

D

Dale Company's Connectome... *60
Dalrymple Report, The...141, 216, 218
Damage Suit, Alleged Blindness from Electricity Figures in a... 419
Daniel, Frank, on Electrical Construction and Inspection. (Editorial)... 36
Danville, Ill., Construction Work in... 139
D'Arsonval Galvanometer for Ballistic Work, Adjustment of the... 215
Davenport, Rock Island and Moline, Electrical Properties in, Merger of... 302
David, C. (Oscillographic Researches on Surging in High-tension Lines)... *43
Davis, Albert G., Resonant-circuit Telephony Invention of...*165
Death Roll of 1905... 18
December, 1905, Electrical Exports for... 121
De Cew Falls Power Plant, Additions to. By Orrin E. Dunlap...*115
Decorative Lighting in Denver...*548
De Courcy, A. (Electrical Progress of 1905 on the Continent)... *13
De Courcy, A. (Hydro-electric Station of Plan du Var)...13, *14, *192
De Forest, Lee, Marriage of... 168
Delaware and Hudson Railroad's Gasoline-electric Car...*117
Denver Central-entrance Car...*107
Denver, the City of Lights...261, *548
Denver, Electric "Welcome" Arch to Greet the Elks at...*548
Denver, Municipal Ownership Defeated in... 443
Depreciation of Electrical Properties... 340
Detroit Edison Company's Delray Power House.. *8
Detroit, Electrical Conditions in, Underwriters' Report on... 300
Detroit, Electrolysis in, Precautions Against... 353
Detroit River Tunnel, Proposed...164, 484
Detroit, Telephone Matters in...126, 323, 428
Devonport, England, Dockyard, Electricity for... 507
Dickinson, W. N., Jr. (Alternating-current Elevators)... 501
Dielectric Capacities, Substances of Different, Electrical Separation of...*192
Direct Current Versus Alternating Current for Railways. (Editorial)... 36
Direct-current Motor Design as Influenced by the Inter-pole. (Institute Discussion)... 447
Direct-current Power Transmission...13, 348
Direct-current Versus Single-phase Traction in England...139, 197
Direct-current, Three-conductor Railway in Bohemia. By C. Smith... *31
Distribution, Economical, J. A. Innes on... 339
Distribution Scheme of Great Northern Power Company in Duluth, Minn... 463
Distribution, Secondary, Spencer on... 522
Distribution, Steinmetz's Long-distance System of *95
Dockyard, British, Electricity for a... 507
D'Olier Air Deflector for Electric Fan...*425
Donohoe, F. E., Removal of... 187
Doolittle, T. B. (Hard-drawn Copper Wire)... 61
Doremus, R. O., Death of... 267
Dow, Alex, on Lightning Protection... 527
Drafting Rooms, New Wrinkles in... 395
Drainage Canal, Chicago, Power Development, Progress of the...*211
Drainage Canal, Chicago, Power Offered at Lower Rates... 506
Drainage Canal, Chicago, Power, Possible Municipal Uses of...37, 156, 157, 256, 506
Drainage Canal, Chicago, Power, to Be Ready in a Year... 157
Drainage Canal, Chicago, Utilization of the Power of the. (Editorial)...156, 256
Drainage Canal, Chicago, Water Diversion of...296, 313, 398, 450
Drainage Canal, Chicago, Water Diversion of. (Editorial)...296, 398
Drawings, Signs and Symbols in Preparing... 477
Drills, Electric, Duntley Air-cooled Portable, Latest Types of the...*552
Duluth-Edison Electric Company... 129
Duluth, Minn., Great Northern Power Company in, Distribution Scheme of... 463
Dunlap, Orrin E. (Additions to De Cew Falls Power Plant)...*115
Dunlap, Orrin E. (An 800-horsepower Motor for the Operation of a Pulp Mill)...*463
Dunlap, Orrin E. (Generators of 10,000 Horsepower on Vertical and Horizontal Shafts)...*271
Dunlap, Orrin E. (How May Niagara Falls Best Serve the Interests of Mankind?)...*134
Dunlap, Orrin E. (Transmission Line from Niagara Falls to Syracuse)...*151
Dunne, Mayor, Municipal-ownership Measures of, Passed by Chicago City Council...82, 104
Dunne's, Mayor, Views on Pending Municipal Problems... 24
Duntley Air-Cooled Portable Electric Drills, Latest Types of the...*552
Dutch East Indies, Space Telegraphy in the. By Dr. Alfred Gradenwitz...*137
Dynamo, An Amateur's First. By T. H. Reardon 528
Dynamos, Direct-current, Operation of, in Series and Parallel... 262
Dynamos, Shunt, Operation of, in Parallel... 197
Dynamos. (See also Alternator, Generator, Rotary, etc.)
Dynelectron, The... *59

E

Earthquake, San Francisco. (See San Francisco.)
Earthquake, Space-telegraph Apparatus Apparently Foretells ... 365
Eastman's Two-speed Controller ... *312
Eastwood's Improved Arc Welding Apparatus ... *469
Eck's Method of Motor Control ... *253
Eddy Electric Company, Winding up of Receivership of ... 186
Edison Medal, The ... 99
Edison Storage Battery ... 445, 512
Educating the Consumer ... 424
Eduction, Technical. (See Technical Education.)
Educational Value of the Electrical Show. (Editorial) ... 98
Edwards, Clement J., Death of ... 307
Efficiency, Central-station, Almert on. (Editorial) 98
Efficiencies. By James Swinburne ... *42
Egg-eating Hen, Electricity for the ... 322
Eggometer, The ... 130
Eglin, W. C. L. ... *443
Egypt, The Telephone in ... 323
Election Returns, Searchlight "Morse" for Announcing ... 124
Electric Drive. (See Factory Drive, Electric.)
Electric Elevator. (See Elevator.)
Electric Fans. (See Fans.)
Electric Furnace. (See Furnace.)
Electric Heating. (See Cooking and Heating.)
Electric Hoists. (See Hoisting.)
Electric Light, The Centenary of the. (Editorial) 236
Electric-light Fraud in England ... 478
Electric Light and Power Rates. (See Rates.)
Electric Light and Power, The Sale of. By S. Morgan Bushnell ... 84
Electric Lighting. (Notes) ... 27, 48, 67, 90, 111, 129, 147, 168, 187, 207, 227, 247, 267, 286, 308, 327, 347, 370, 389, 409, 431, 459, 482, 511, 534, 557
Electric Lighting. (See also Lighting.)
Electric Locomotive. (See Locomotive.)
Electric Motor. (See Motor.)
Electric Power Stations and Plant Life in London. 399
Electric Power. (See Power, etc.)
Electric Pumps. (See Pumps.)
"Electric-railway Accounting." By W. B. Brockway. (Book Review) ... 241
"Electric-railway Handbook." By A. B. Herrick. (Book Review) ... 222
Electric Railways. (Notes) ... 27, 48, 67, 90, 111, 129, 147, 168, 188, 208, 227, 247, 267, 287, 308, 327, 347, 370, 389, 409, 432, 459, 483, 512, 534, 558
Electric Railways. (See also Railways.)
Electric Service Supplies Company, Formation of 268
Electric Sign. (See Sign.)
Electric Smelting. (See Smelting.)
"Electric Transmission of Waterpower." By Alton D. Adams. (Book Review) ... 450
Electric Welding. (See Welding.)
Electrical Development of the Year 1905, The. (Editorial) ... 16
Electrical Effluvia, Character of, Apparatus for Indicating the ... *376
"Electrical Engineering." By J. H. Alexander. (Book Review) ... 385
Electrical Facilities, Proportion of, to Population. 237
Electrical Industry in Great Britain in 1905 ... *10
Electrical Industries, Census Statistics of. (Editorial) ... 176, 420
Electrical Journals and the New-business Department. (Editorial) ... 80
Electrical Manufactures, Census Statistics of, for 1904 ... 343
Electrical Manufactures, Western Electrician's Statistics of, for 1905 ... 17
Electrical Production of Fuel from Peat ... 454
Electrical Progress of 1905 on the Continent. By A. De Courcy ... *13
Electrical Progress in United States in 1905. By Henry H. Norris. (New Year's Review) ... *6
Electrical Properties Company ... 404
Electrical Salesmen's Association, Annual Meeting of, in Chicago ... *83
Electrical Separation. (See Separation.)
Electrical Shock. (See Shock.)
Electrical Shows. (Editorial) ... 316
Electrical Trades Association of Chicago, Annual Meeting of ... 101
Electrical Units. (See Units.)
Electricians, Massachusetts May License ... 262
"Electricity." By William Baxter, Jr. (Book Review) ... 142
Electricity Cannot Be Adulterated. (Editorial) ... 118
Electricity, Selling. (See Selling Electricity.)
Electrochemical Convention, The. (Editorial) ... 378
Electrochemical Processes as Station Load Equalizers ... 380
"Electrochemistry." By F. G. Wiechmann. (Book Review) ... 450
Electrochemistry. (See also American Electrochemical Society.)
Electro-dynamic Company's Inter-pole Variable-speed Motor ... *41
Electroliers Suggested for St. Louis Street Lighting ... 181
Electrolysis. By E. E. Brownell ... 280
Electrolysis of Buried Pipe ... 48, 280, 353
Electrolysis in Detroit, Precautions Against ... 353
Electrolysis, Possibility of Lead Poisoning from. 535
Electrolytic-tube Furnace, Solid. (Editorial) ... 156
Electrolytic Copper Plant, Electrically Operated. 140
Electrolytic Corrosion of Copper-tin Alloys ... 380
Electrolytic Corrosion of Structural Steel ... 380
Electrolytic Deposits of Metals ... 380
Electrolytic Iron, Magnetic Properties of, Burgess on. (Institute discussion) ... 474
Electrolytic Precipitation of Lead from Acetate Solutions ... 380
Elevator Combination, Alleged, Suit Against ... 229
Elevator, Electric, Buergenstock, in the Alps. By Dr. Alfred Gradenwitz ... *154
Elevator, Hydro-electric, in Tudor Apartment Building, Chicago ... *155
Elevators, Alternating-current. By W. N. Dickinson, Jr. ... 501
Elevators, Automatic Electric ... 261
Elevators, Electric, and Power Plant in Majestic Theater Building, Chicago ... *373
Elk River Power Development near Minneapolis. 202
Elliott, Robert L., Marriage of ... 147
Emmet's Steam-turbine Improvements ... 493
Emmet's System for Regulating Turbo-generators. *272
Empty Houses Lighted by Electricity to Attract Purchasers ... 342
Engine Economy, Stott on ... *102
Engine, Gas. (See Gas Engine.)
Engine Indicator and Overload Alarm, Shreffler. *103
Engine, Steam, Horizontal-vertical, How the Idea of the, Was Evolved ... 281
Engines, Some Large Allis-Chalmers ... *140
Engines, Subway, Interborough Company's Test of ... 123
Engines Under Test Supplying Power for Factory Purposes ... *508
Engineers' Club of Chicago ... 124
"Engineer's Handbook." By Norman H. Schneider. (Book Review) ... 142
England, Electric-light Fraud in ... 478
England, Third Rail versus Single Phase in .. 139, 197
England, Wright Demand System in .. 265, 303, 362
England. (See also Great Britain.)
English Central-station Practice. (Editorial) ... 543
Erie Railroad Electrification ... 124, 139, 286, 287, 406, 509, 533
Escanaba, Mich., Municipal Ownership in ... 247
Europe, Continent of, Electrical Progress of 1905 on the. By A. De Courcy ... *13
Europe, Motor Cars in, Alcohol, Benzol and Gasoline versus Steam for ... *489
Europe, Municipal Operation in, Disappointing .. 321
European Telephone Service, H. L. Webb on .. 305
Evansville, Ind., Merger of Electrical Properties in ... 347
Evansville, Ind., Telephone Situation ... 45, 87, 126, 144, 164, 184
Export Duty on Copper Suggested. (Editorial) .98, 128
Exports, Electrical, for 1905 ... 18, 121
Exports, Electrical, by Months .. 18, 121, 191, 343, 358
Exports, Electrical, of Germany and the United States ... 178
Exports, Electrical, of the United States. (Editorial) ... 118
Exportation of Electric Current from Canada. 406, 480
Express Business, Aurora, Elgin and Chicago Electric Railway to Extend ... 555
Express Service, Trolley, in New England .. 293, 346
Express Service. (See also Parcel Delivery.)

F

Factory Drive, Electric. (Various Installations.) *39, 86, 124, *175, *255, 302, *311, 384, *451, *463, 550
Fairman's "Telephone Wiring." (Book Review). 241
False Teeth and Telephonic Conversation. (Editorial) ... 195
Fan, Electric, Air Deflector for ... *425
Fan Motor, Western Electric ... *219
Fan Motors, General Electric, for 1906 ... *301
Fans, Electric, Discourage Flies ... 177
Fans, Electric, Star ... *241
Fans, Electric, Westinghouse Types of, for 1906 .. *22
Fans, Electric, Winter Use of. (Editorial) ... 56
Fargo, N. D., Central-station Decoration in ... 424
Farm Values in Indiana Increased by Electric Railways ... 47, 326
Farrand, Dudley ... *443
February, 1906, Electrical Exports for ... 343
Federal Building, Chicago. (See Chicago.)
Federal Telephone Properties, Brailey Syndicate Gets ... 455, 479, 544
Feiker, F. M. (Electricity in a Large Paper Mill) ... *39
Ferranti-Hamilton Alternating-current Meter ... *51
Ferris, William J. ... 128
Ferris, W. W. (Proper Handling of New-business Department) ... 342
Field, Marshall, Death of ... 67
Field, Marshall, Death of. (Editorial) ... 56
Fife Electric Power Transmission in Scotland ... *10
Filament, Metallic. (See Metallic.)
Filaments, Osmium Lamp, Support for ... *254
Finzi, Dr., and the Westinghouse Interests ... 329
Fire Hazard of Electricity ... 499
Fire, Ordeal of, Electric Motor Passes ... *509
Fire Pumps, Electric High-pressure, for New York City ... 116
Fire, San Francisco, Causes and Effects of ... 422
Fires, Electricity Blamed for More, Than It Really Causes ... 197
Firemen, Searchlights to Aid ... 122
Firth-Sterling Steel Company's Projectile Shop, Electrical Equipment of ... *451
Fisk Street Station of the Commonwealth Electric Company, Chicago. (With supplement). *1, *554
Fisk Street Station, Miss Monroe's Sonnet on ... 6
Fixtures, Artistic Lighting, in Chicago Federal Building ... *235
Fixtures, Lighting, Location and Care of ... 315
Flame Arc Lamp, The. By Leonard Andrews ... 448
Flame Arc Lamps. (Editorial) ... 470, 492
Flame Arc Lamps at Chicago Electrical Show. 51, *72
Flame Arcs Discussed by Illuminating Engineers. 217
Flaming Carbon Arc Lamp, The. By L. B. Marks ... 471, *502
Flat, Not How, but How Steep ... 122
Flies, Electric Fans Discourage ... 177
Flywheel Accident, Mansfield (O.) ... *393
Flywheel Accident in Pontiac, Ill. ... 129
Flywheel Accidents. (Editorial) ... 398
Fond du Lac, Wis., Electrical Conditions in ... 320
Fond du Lac, Wis., Electrical Show ... *318, 425
Foreign Trip of Institute Members. (Editorial) .. 356
Forest Preservation in Its Electrical Aspects ... 426
Forestry as Affected by Electricity ... 65
Foster, George B., Promotion of ... 511
France, "White Coal" in ... 297
Franklin Bicentenary, The ... *81, 366
Franklin Celebration in Philadelphia ... 318, 344
Franklin Day at Chicago Electrical Show ... 52, *81
Franklin as a Man of Science. (Editorial) ... 378
Franklin Statue Unveiled in Paris ... 366
Franklin's Historic Electric Generator ... *438
Fraud, Electric-light, in England ... 478
Free Alcohol. (See Alcohol.)
Freight Handled by Indianapolis Electric Railways ... 167
Freight Tunnels, Chicago. (See Chicago Freight Tunnels.)
French Battery Company ... *162
Frueauff, Frank W. (Business-getting Methods). 549
Fuel Economy. By J. H. Hallberg ... 472, *473
Furnace, Burke Smokeless ... *374
Furnace, Electric, Design, Collens on ... 379
Furnace, Electric, Stassano ... 410
Furnace, Electric Vacuum, Arsem on ... 380
Furnace, Solid Electrolyte-tube. (Editorial) ... 156
Furniture Factory, Large, Motor Drive in a ... 302
Fuse Holder, High-potential, New Type of ... *404
Future, The Hope of the. (Editorial) ... 197

G

Galesburg Case. (Telephone Patent Litigation) .. *105
Galvanometer, D'Arsonval, Adjustment of the, for Ballistic Work ... 215
Garbage-burning Plant in Zurich ... 14
Garbage-burning. (See also Rubbish Incinerating.)
Gary, Ind., The New City of ... 369
Gas Competition in England ... 555
Gas-engine Development, Blast-furnace, in Pittsburg District ... 426
Gas Engine, 1,800-horsepower, Direct-connected to Alternator ... *122
Gas-engine Economy, Stott on ... *103, 120
Gas-engine Plant, Electric (Producer) in Greeley, Colo. ... 478
Gas-engine Power. (New Year's Review) ... 8
Gas Engine, The, as a Prime Mover ... 242
Gas Engines and Alternators, Large, for Johannesburg, South Africa ... 278
Gas Engines Operating Warren-Jamestown Single-phase Railway ... *158
Gas Engines Used in Chieti, Italy, Electric-railway Station ... *232
Gas Mantles Discussed by Illuminating Engineers 217
Gas Power Plant, Producer, in Worcester ... 478
Gas, Price of, in Chicago ... 19, 34, 101, 137, 163
Gas, Price of, in New York ... 46, 177, 266
Gasoline, Alcohol and Benzol Versus Steam for Motor Cars in Europe ... *489
Gasoline Blow Torch, Zeidler ... *509
Gasoline Car, Lake Shore Railroad's ... 368
Gasoline-electric Car, An Experimental ... *117
Gasoline-electric Car, Strang, on Transcontinental Trip ... *199
Gasoline-electric Cars for New York Central Railroad ... 306
Gasoline-electric Railway Project for Indiana ... 329
Gauges, Bristol Portable Recording ... *363
Gear, H. B., on Overhead Versus Underground Lines ... 201
Geary Street Railway in San Francisco ... 557
General Electric Cable for Long Island Railroad. *104
General Electric Company, Annual Report of the 382
General Electric Company's Annual Report as Showing Developments in the Art. (Editorial) .. 378
General Electric Fan Motors for 1906 ... *301
General Electric High-potential Fuse-holder ... *404
General Electric Motors for Small Machine Tools. *361
General Electric Oscillograph ... *218
General Electric Salesmen's Meeting in Chicago .. 55
General Electric Single-phase Equipment for Railways ... *201, 240
General Electric Small Riveted-frame Induction Motors ... *553
General Electric Tantalum Incandescent Lamps ... *554
Generator, Stanley-G. I. Revolving-field Inductor. *163
Generators, Alternating-current, Protection of, Against Reversal of Energy. (Leonard Wilson's Patent) ... *136
Generators, Alternating-current, Steinmetz's Arrangement for Compounding ... *352
Generators, Large, Operating at 18,000 Volts ... 467
Generators of 10,000 Horsepower on Vertical and Horizontal Shafts. By Orrin E. Dunlap ... *271
Generators. (See also Alternator, Dynamo, Rotary, Turbo-generator, etc.)
Gerard's, Leon, Apparatus for Indicating the Character of Electrical Effluvia ... *376
German Central Station (Hamburg), Large ... *291
German Electrical Testing Wagon ... *469
German Method of Electrically Towing Boats ... 427
German Mine Operation by Electric Power ... *233
German Patent Regulations. (Editorial) ... 470
German Tariff, The New. (Editorial) ... 176
Germany, Technical Education in, Overdone ... 142
Germany and the United States, Electrical Exports of ... 178
Gernaert's Design for High Buildings ... 421
Gherardi, B., on Telephone Engineering ... 223
Gilchrist, John F., Promotion of ... 27
Gilpin's Method of Motor Control ... *253
Glaciers on Mount Hood, Proposed Power Development from the ... 82
Glasgow's Municipal Debt. (Editorial) ... 196
Glass Flooring for Switchboard Structures ... 399
Gongs, Alarm, for Patrol Boxes ... 222
Gonzenbach, Ernest. (The Economy of Combined Railway and Lighting Plants) ... *96
Government Ownership. (See Municipal Ownership.)
Grace, S. P. (The Telephone Line) ... *354
Gradenwitz, Dr. Alfred. (Buergenstock Electric Elevator in the Alps) ... *154
Gradenwitz, Dr. Alfred. (Electric Railroading Under Difficulties) ... *231
Gradenwitz, Dr. Alfred. (Electrical Operation in Silk Factories) ... *311
Gradenwitz, Dr. Alfred. (High-tension Single-phase Traction Experiments on the Seebach-Wettingen Line) ... *515
Gradenwitz, Dr. Alfred. (Space Telegraphy in the Dutch East Indies) ... *137
Gradenwitz, Dr. Alfred. (Space Telegraphy on Seagoing Steamships) ... *353
Grand Rapids, Mich., Cheaper to Buy Current in .. 124
Grand Rapids, Mich., Electrical Improvements in. 369
Grand Rapids, Mich., Municipal Arc-lighting Figures in ... 430
Grand Rapids, Wis., Overhead Wiring Conditions in ... 271
Grand Trunk Railroad Telephone System ... 204
Grayne, R. G. (Cold Bending of Pipes for Electrical Wires) ... *94
Grayne, R. G. (Trials and Dangers of the Lineman) ... *321
Great Britain. (Correspondence) ... 26, 46, 64, 88, 108, 126, 144, 166, 185, 205, 225, 245, 265, 284, 305, 324, 346, 367, 386, 406, 429, 456, 480, 509, 531, 555
Great Britain, Electrical Industry in, in 1905 ... *10
Great Britain, Free Trade Versus "Fair Trade" in. (Editorial) ... 98, 138
Great Britain, Street Railways in ... 108
Great Britain, Telephony in. (See Telephony.)
Great Britain. (See also England.)
Great Northern Power Company in Duluth, Minn., Distribution System of ... 463
Greeley, Colo., Producer-gas Electric Plant in ... 478
Green Bay, Wis., Electrical Conditions in ... 320
Grounded Secondaries. (Iowa Convention) ... 339
Grounding Secondary Alternating-current Services. By Sidney Hosmer ... 525
Ground-wire Clamp for Telephone and Telegraph Work ... *303
Guns, Electrical Mechanism for Firing ... *252
Guy Anchor, New Stombaugh ... *201

H

Hair-drying Machine, Electric ... 371
Hallberg, J. Henry. (Fuel Economy) ... 472, *473
Hamburg, Germany, The Bille Central Station at. By Frank C. Perkins ... *291
Hammer, Electric ... 332
Hanover, Germany, Central Station in. By C. Smith ... *55
Harrisburg, Pa., New Traction Facilities for ... *360
Harrison's "Wiring Diagrams and Switchboards." (Book Review) ... 142
Hawaiian Hydro-electric Irrigating Plant ... 62
Hawthorne Plant of Western Electric Company, Chicago Edison Men Entertained at ... 361
Hawthorne Shops of the Western Electric Company. By H. R. King ... *417
Hay's "Alternating Currents." (Book Review) ... 241
Hazing, Electrical, Should Be Discountenanced. (Editorial) ... 276
H. C. K. Sealing Press ... *427
Heat, Electric, for the Laboratory ... 424
Heating, Electric, Ayer and Loewenthal on ... 472
Heating and Lighting Plant at Parkville, Mo ... *23
Heating Pad, Electric ... 260
Hen, Egg-eating, Electricity for the ... 322
Henderson, R. H. (Arc Lighting) ... *402
Hering, Carl ... *379, 381
Herrick's "Practical Electric-railway Handbook." (Book Review) ... 222
Hewitt, Cooper, Mercury Vapor Lamp ... 425
Hewlett, E. M. (Modern Switchboard Practice with Particular Reference to Automatic Devices) ... *546
Hewlett's High-potential Circuit-breaking Apparatus ... *304
High-potential Circuit-breaking Apparatus ... *304

High-potential Generators for Los Angeles........ 467
High-tension Line Maintenance, Practical Points on 546
High-tension Lines, Surging in, Oscillographic Researches on. By C. David.... *43
High-tension Wires Crossing Other Wires, Possible Danger from.... 187
Highways, Telephone Lines on.... 224
Hine, William S.... *286
Hogan, J. J., Engineering Club.... 157
Hoge, J. B., Address of, as President of the National-Interstate Telephone Association.... 543
Hohenfuerth Hydro-electric Plant in Bohemia..13, *15
Hoisting, Electric, in Coal Mines.....305, 324, 346
Hoisting Machinery, Electric (Crocker-Wheeler)..*122
Holophane New Pagoda "Reflecting Arc"....*450
Holophane Reflector, New.... *86
Horticulture, Electricity in.....135, 520
Hosmer, Sidney. (Grounding Secondary Alternating-current Services).... 525
Houses, Empty, Lighted by Electricity to Attract Purchasers.... 342
Hovey, William A., Death of.... 181
Humboldt Exchange of Chicago Telephone Company.... *133
Hydro-electric Development in France.... 297
Hydro-electric Development, Milan-Paderno.... *488
Hydro-electric Development in Switzerland.... 483
Hydro-electric Installations, Influence of Load Factor on.... *258
Hydro-electric Installation on Jhelum River, India 43
Hydro-electric Irrigating Plant in Hawaii.... 62
Hydro-electric Plant for Iron Mine at Marquette, Mich.... 58
Hydro-electric Plant, Italian, Art and Utility Combined in.... *331
Hydro-electric Power for Large Pacific Coast Cement Plant.... 384
Hydro-electric Station of Plan du Var, France, by A. De Courcy.....13, *14, *192
Hydro-electric. (See also Power Development, Power Generation or Power Transmission, Waterpower, etc.)
Hygiene of Rural Electric Railways.... 451
Hylo Incandescent Lamp Poster.... *478

I

Ice Cream Freezing, Electric Power in.... 548
Ice, Floating, at Niagara Falls Power House, Trolley Boat to Disperse.... *95
Ice on Third Rail, Prevention of.... 281
Illinois. (Correspondence) 267, 286, 326, 369, 388, 407, 431, 457, 481, 556
Illinois Central Railroad Electrification May be Hastened.....19, 36
Illinois Central Railroad Telephones.... 144
Illinois Independent Telephone Association, Meetings of.....44, 244, 305, 405, 544
Illinois Manufacturers' Association and Chicago Telephone Rates.....284, 428
Illinois Towns, A Central Plant for.... 488
Illinois Traction System.....148, *174, 208, 240, 326, 388, 534
Illuminants, Artificial, Swinburne on.... 42
Illuminants, New, H. E. Clifford on.... 491
Illuminating Engineering, Electric, Some Important Considerations in. By Douglass Burnett.. 320
Illuminating Engineering, The Problems of.... 162
Illuminating Engineering Society, Growth of.... 554
Illuminating Engineering Society, Meetings of the 162, 217, 315, 320, 366, 429, 488
Illumination, Novel, by Nernst Lamps in Pittsburg Railroad Station.... 208
Illumination and Photometry, Some Physiological Factors in. By Dr. Louis Bell.... *504
Incandescent Lamp, Is the Carbon-filament, Doomed? (Editorial).... 446
Incandescent Lamp, Swinburne on the.... 452
Incandescent Lamps, Willcox on.... 494
Independent Telephone Exchange, The First.... 284
Independent Telephone Interests Win in Important Patent Litigation.... 87
Independent Telephone Situation, The. (Editorial).... 542
Independent Telephony in Western Massachusetts. 225
India, Electrical Industry in....43, 386
Indiana. (Correspondence).....47, 65, 90, 110, 128, 146, 167, 186, 206, 226, 246, 266, 288, 307, 326, 347, 369, 388, 407, 431, 457, 481, 510, 532, 556
Indiana Engineering Association, Indianapolis Convention of.... 83
Indiana Independent Telephone Association, Meetings of..45, 106, 126, 204, 303, 385, 386, 427, 506
Indiana and Ohio Interurban Railway Associations, Merger of.....23, 57, 100
Indiana Railways, Changes in Personnel of.... 519
Indiana Telephone Items. (Correspondence) 45, 64, 87, 106, 125, 144, 164, 184, 204, 224, 243, 264, 283, 304, 324, 366, 385, 404, 427, 455, 479, 506, 526, 545
Indiana Traction Men, New Year's Dinner in Indianapolis to.... 41
Indianapolis, Power Center for Small Users in.. 404
Indianapolis Telephone Affairs....45, 64, 87, 164, 204, 304, 366, 385, 455, 506
Induction Coil, Invention of the.... 328
Induction Motor Explained.... 321
Induction Motor Operating Hydraulic Passenger Elevator.... *155
Induction Motor, Polyphase, A New Type of.... *551
Induction Motor, Repulsion. (Institute discussion).... 447
Induction Motors Driving Pumps of Schenectady Waterworks.... *351
Induction Motors, Large, for Anaconda.... 124
Induction Motors for Railway Purposes, Armstrong's Method of Control of.... *152
Induction Motors, Small Riveted-frame (General Electric).... *553
Induction Motors, Variable-speed Operation of.. *234
Industrial Buildings. (Editorial).... 118
Ines, J. A. (Line Losses and Economical Distribution).... 339
Inspection, Electrical. (See Construction Work.)
Instruments, Electric, Graphic Recording, New Westinghouse.... *259
Instruments, Measuring, of International Electric Meter Company.... *24
Instruments, Switchboard, New Permanent-magnet.... *450
Instruments. (See also Galvanometer, Gauges, Meter, Voltmeter, etc.)
Insulated Wire and Storage Batteries Discussed by Railway Signal Association.... 54
Insulated Wiring and Underground Cables Discussed by the Institute.... 358
Insulation, Protective, of Workmen, Rubber Shoes and Gloves for.... 142
Insulation, Thin.... 303
Insulator Pin, All-steel.... *140
Insulator Pin, W. N. Smith's.... *529
Insurance, Co-operative, for Electric Railway and Lighting Properties.... 61
Insurance Requirements for a Standard Electric Light and Power Station.... 365
Interborough Rapid Transit Company's Test of Subway Engines.... 123
International Brotherhood of Electrical Workers 35, 169, 248
International Congress of Inventors.... 422
International Electric Meter Company—Its Personnel and Products.... *24
International Electrical Congress, Final Financial Report of.....164, 325
International Electrical Units.....257, 297
International Waterways Commission, Report of 222, 259, 277, 385
Inter-pole, Direct-current Motor Design as Influenced by the. (Institute discussion).... 447
Inter-pole Variable-speed Motor for Machine-tool Work.... *41
Interstate Electric Railway Association, Joliet Meeting of.... 117
Interurban Competition in Iowa.... 243
Interurban Railway Development in Central Illinois.... *174
Interurban Railway Merger in Massachusetts.... 127
Interurban Railway in Switzerland, St. Gallen-Trogen. By Franz Koester.... *113
Interurban Railway, Winona, Ind., Equipment for. 477
Interurban Roads Benefit Farming Communities 47, 336
Interurban Roads Make Towns Grow.... 159
Inventing, The Art of. (Institute discussion).. 475
Inventors, Of Interest to.... 422
Iowa Central-station Statistics.... 334
Iowa Cities Oppose Municipal Ownership.... 257
Iowa Electrical Association, Des Moines Convention of.....322, *334
Iowa Street and Interurban Railway Association, Des Moines Convention of.... 340
Iowa Telephone Association, Des Moines Convention of.... 244
Ipswich, England, Municipal Electrical Enterprise at.... 424
Iron, Electrolytic, Magnetic Properties of. (Institute discussion).... 474
Iron Wires Substituted for Copper in Telegraph Work.... 454
Irrigating Large Sugar Plantation, Electricity for 62
Isolated Plant, Large, in Pittsburg.... *528
Isolated Plant, The Largest. (Editorial).... 36
Italian Hydro-electric Plant, Art and Utility Combined in.... *331
Italy, Chieti Electric Railway in.... *231

J

Jackson, Julian S.... *24
Jackson's Electrically Operated Tunnel Excavator 182
Jacksonville, Ill., Construction Work in.... 139
Jamestown (Va.) Exposition.....309, 422
Jamestown (N. Y.) and Warren Single-phase Railway.... *158
January, 1906, Electrical Exports for.... 191
Japan, Largest Power Station in.... 278
Jewett, Frank N.... *110
Jhelum River Power Installation in India....43, 386
Johannesburg, Large Gas-driven Alternators for. 278
Johns-Manville Pure Copper Trolley Wheel.... *123

K

Kafer, John C., Death of.... 279
Kakabeka Falls Power Development near Port William, Ont.... 205
Kaukauna, Wis., Electrical Conditions in.... 320
Kennelly, A. E., on Cable Testing.... 360
Kennelly, A. E., on Self-exciting Alternators.... 221
King, H. R. (The Hawthorne Shops of the Western Electric Company).... *417
King, Terry T. (The "Preservation" of Niagara Falls).... 159
Kingston, Ont., Municipal Light Plant in....145, 386
Kingsway Subway in London.....*11, 64, 225
Kinraide's Ultra-violet Lamp with Heat-radiating Qualities.... *376
Kirk, E. B.... *79
Kitsee's Sectionalized Inductive Conductor for Telephone Lines.... *397
Knife Switch, A Curious Home-made.... *414
Koester, Franz. (St. Gallen-Trogen Interurban Railway in Switzerland).... *113
Korst, P. H. (Suggestions for Increasing the Power Output of Central Stations).... 85
Kuzel Metallic-filament Lamp.....179, 352, 452

L

Laboratory of Electricity, Public, in Belgium.... 454
Laboratories, Electrical Engineering and Railway, at Worcester Polytechnic Institute.... *444
Laboratories, New York Electrical Testing.... 111
Lackawanna Steel Mills near Buffalo, Electrical Equipment of.... 535
La Crosse, Wis., Central-station Advertising in..*343
La Crosse, Wis., Hogan Engineering Club of.... 157
La Crosse, Wis., Modern Central-station Design, as Exemplified in. By C. H. Williams.... *171
La Crosse, Wis., Underground Construction in. By W. D. Burford.....180, 262
La Crosse Wis., Waterpower Company.... 381
Lake Shore Railroad's Gasoline Car.... 368
Lamme Alternating-current Motor.... 225
Lamme on Alternating-current Traction.... 238
Lamme, Scott and Conrad's Automatic Control of Rotary Converters.... *53
Lamme's Variable-speed Operation of Induction Motors.... *234
Lamp Efficiency, Central-station Policy in Relation to. (Editorial).... 542
Lamp Guard, Benjamin Two-part.... *163
Lamp Guard, Hold-fast.... *40
Lamp Posts. (See Arc-lamp Posts.)
Lamp Suspension, Spencer on.... 523
Lamps. (See Arc, Illuminants, Incandescent, Metallic-filament, Magnetite, Mercury-vapor, Nernst, Osmium, Tantalum, Ultra-violet, Wolfram, Zirconium, etc.)
Landau, Alfred.... *162
Langan, John. (Standardizing Rubber-covered Wires and Cables).... 358
Langley, Prof. S. P., Death of.... 207
Lansing, Mich., Electric Railways Centered in.. 41
Laundry, Electrically Operated, in San Francisco. 66
Lawn Party, The Electric. (Editorial).... 176
Layman, W. A., on the Single-phase Motor in Central-station Work. (Institute discussion).. 177
Lea, John M.... *24
Lead, Electrolytic Precipitation of, from Acetate Solutions.... 380
Lead Poisoning, Possibility of, from Electrolysis. 535
Lexicon, An Electrical.... 202
Lighting Controversy, Peculiar, in Columbiana, Ohio.... 238
Lighting, Electric, of Churches. By E. R. Weeks.... *453
Lighting, Electric, in the Far North.... 419
Lighting, Electric, and Heating Plant at Parkville, Mo.... *23
Lighting, Electric. (New Year's Review)...9, 11, 15
Lighting, Electric, in New York State.... 237
Lighting (Electric) Outfit, Richardson.... *21
Lighting, Electric, and Power Station, Standard, Underwriters' Requirements for a.... 365
Lighting, Electric, and Railway Plants, Combined, The Economy of. By Ernest Gonzenbach.... *96
Lighting, Electric, Train. (See Train Lighting.)
Lighting, Electric. (See also Arc, Central Station, Decorative Lighting, Fixture, Illuminants, Incandescent, Illuminating, etc., Isolated Plant, Lamps, Reflector, Signs, Street Lighting, Tube Lighting, etc.)
Lightning Arresters, High-tension, for Long Island Railroad.... 540
Lightning Flash, Duration of a.... 478
Lightning, Protection from. (Editorial).... 256
Lightning, Protection from. (Institute discussion) 447
Lightning, Protection from. (N. E. L. A. report). 527
Lincoln, Neb., Telephone Company, Annual Report of.... 527
Lincoln's Variable-speed Motor.... *141
Line Construction. (See Construction, Wiring, etc.)
Line Maintenance, High-tension, Practical Points on.... 546
Lineman, Trials and Dangers of the. By R. G. Graves.... *321
Lloyd, E. W., Promotion of.... 67
Load Factor, Influence of, on Hydro-electric Installations.... *258
Load Factor and Investment in Power Plants, Stott on.... 120
Lockwood, T. D., on Telephone Engineering.... 222
Locomotive, Electric, New York Central.... ....*6, 7, 144, *528
Locomotive, Electric, One Advantage of the. (Editorial).... 296
Locomotive, Electric, for Simplon Tunnel.... *153
Locomotive Engine, A New Definition of.... 377
Locomotive, Oerlikon Single-phase.....49, *515
Locomotive, Single-phase, 20,000-volt, for the Swedish Railways. By C. Smith.... *191
Locomotives, A. C.-D. C., for New York, New Haven and Hartford Railroad.... *298
Locomotives, Electric, on Canadian Pacific.... 145
Locomotives, Single-phase, for Sarnia Tunnel..32, 59
Locomotives, Steam and Electric, Comparison of Large.... 178
Logue, William S., Death of.... 388
London, Brighton and South Coast Railroad in England, Single Phase for......26, 46, 225, 228, 386
London, Electric Power Stations and Plant Life in.... 399
London Electric Power Supply Projects....26, 46, 126, 245, 303, 305, 324, 346, 386, 406, 429, 480, *541
London "Electrobus".....386, 406, 480
London, Kingsway Subway in.....*11, 64, 225
London, Olympia Electrical Exhibition of, Results of.... 309
London Outer Circle Railway.... 456
London, Telephone Conditions in. (Editorial).... 56
London Underground (Tube) Electric Railways 10, 19, 41, 64, 205, 265, *312
Long-flame Arc. (See Flame Arc.)
Long Island Railroad, Electrical Equipment of the *7, *104, *273, 276, *293, *313, *464, *516, *539
Los Angeles, Large High-voltage Generators for. 467
Louisville Lighting Company's Affairs and Rates. 306
Louisville and Nashville Railroad Shops, Electrical Equipment of. By A. G. Wessling.... *175
Low-frequency Currents, Stanley's System of Transmitting and Utilizing.... *396
Luminous Arc. (See Flame Arc.)
Lyons Domestic Electricity Exposition.... 278

M

McCormick, Bradley. (Comparison of Two-phase and Three-phase Motors).... *523
McCutcheon's Candlemas Day Cartoon.... *122
McGee, D. F. (How to Make a Small Electric Plant Pay).... 500
Mackay Companies Prosperous.... 202
MacMillan, George D., Death of.... 147
MacMullan, R. H., Illness and Death of.....307, 343
McQuarrie, J. L. (Telephone Engineering as a Profession).... 243
"Machine Shop." By O. E. Perrigo. (Book Review).... 241
Machine Tools, Electrical Equipment of, in a Large Projectile Shop.... *451
Machine Tools, Horsepower Required by.... 454
Machine Tools, Small Electric, Some New.... *361
Magnesium, New Method of Obtaining. (Editorial).... 398
Magnesium Oxide, Fused, Goodwin and Mailey on. 379
Magnetic Properties of Electrolytic Iron, Burgess on. (Institute discussion).... 474
Magnetic Wells.... 57
Magnetite Lamps with Mercury-arc Rectifier System for Street Illumination. By W. S. Barstow.....471, 472
Mail-conveying System, Underground, in Chicago, Test of.... *179
Maine Independent Telephone Association, Organization of.... 544
Maintenance, Line, High-tension, Practical Points on.... 546
Majestic Theater Building, Chicago, Electric Light and Power Plant in.....49, *373
Mall, W. A., on Condensers in Small Stations.. 335
Manchester, England, Street Railways, Carriage of Packages by.... 166
Mandel Bros.' Private Electric Light and Power Plant.... *251
Manila, Electric Railways in.... 129
Manila, Modern Telephone Exchange for.... 45
Mansfield (O.) Flywheel Accident.... *393
March, 1906, Electrical Exports for.... 358
Marconi Company's Report.... 300
Marconi, William. (Controlling the Direction of Space-telegraph Signals).....295, 381, *394
Marinette, Wis., Electrical Conditions in.... 320
Marks, L. B. (The Flaming Carbon Arc Lamp) 471, *502
Marks, L. B. (The Problems of Illuminating Engineering).... 162
Maryland, Motive Power Statistics of.... 142
Massachusetts, Central-station Industry of.... 449
Massachusetts, Interurban Railway Merger in.. 127
Massachusetts May License Electricians.... 262
Massachusetts Steam and Electric Railway Merger Bill.... 521
Massachusetts, Western, Independent Telephony in.... 225
Massena Power Plant on St. Lawrence River Reported Sold.... 208
Massie Space-telegraph System.... *35
Matthews, W. N., and Bro.'s Cable Clamps (Kearney).... *361
Matthews, W. N., & Bro.'s Catalogue.... *222
Matthews, W. N., & Bro.'s Hold-fast Lamp Guard.... *40
Matthews, W. N., & Bro.'s New Stombaugh Guy Anchor.... *201
Matthews, W. N., & Bro.'s New Style of Cable Roller.... *531
Maunsell, C. R., Resignation of.... 308
Maximum Demand Systems in England and the United States. By J. S. C.... 362
Mechanical Refrigeration, Meyer on.... 472
Menasha, Wis., Electrical Conditions in.... 320

Mercein, Thomas R. ... *33
Mercury-arc Rectifier Operating in Multiple with Motor-generator ... 195
Mercury-arc Rectifier System with Magnetite Lamps for Street Illumination. By W. S. Barstow ... 471, 472
Mercury-arc Rectifier for Telephone Work ... *113
Mercury-vapor Apparatus, P. H. Thomas on (Institute discussion) ... 175, 542
Mercury-vapor Lamp, The ... 125, 456, 542
Mercury-vapor Lamp, The Schott Improved ... 15
Meridian, Miss., Home Telephone Company, Modern Plant of the ... *518
Merrick, J. V., Death of ... 279
Merrill, W. H., Jr., on Fire Hazard of Electricity. 190
Mershon, R. D., on Reverse-relay Construction ... 329
Metallic-filament Incandescent Lamps. (Editorial) 116
Metallic-filament Lamp, Kuzel ... 179, 352, 452
Metallic-filament Lamps, Clifford on ... 191
Metallic Lamp Filaments. By J. Swinburne ... 452
Meter, Ferranti-Hamilton Alternating-current ... *54
Meter Testing, Public, in New York ... 425
"Meters." By H. G. Solomon. (Book Review).. 385
Meters, Consumers', The Proper Handling of. By George A. Barrett ... 114
Meters, Electric, The Care and Maintenance of. By A. W. Zahm ... 381
Meters, Selection of. (Editorial) ... 176
Meters, Service ... 491
Meters. (See also Instruments.)
Metric System, The ... 218, 381
Metric Weights and Measures. (Editorial) ..256, 296
Metropolitan Elevated Road, Affairs of..161, 188, 287
Mexican Mines, Electric Power a Boon to ... 541
Mexico. (Correspondence) ... 66, 128, 186, 325, 511
Mexico, Space Telegraphy in ... 308
Michigan. (Correspondence) ... 65, 89, 110, 146, 167, 187, 206, 227, 247, 266, 285, 326, 369, 387, 407, 430, 481, 510, 557
Michigan Independent Telephone Association, Ann Arbor Convention of ... 263
Michigan State Telephone Company, Earnings of. 105
Michigan Telephone Matters. (Correspondence) ... 87, 143, 211, 283, 366
Michigan Traction Consolidation ... 41
Milan Exposition and the Electrical Undertakings of the City. By Frank C. Perkins ... *187
Milan Exposition, Opening of ... 401
Military Methods, Importance of Electricity in. (Editorial) ... 470
Milne, James A ... *147
Milwaukee Electric Railway and Lighting Company, Public Service Building of ... *468
Milwaukee Electric Railway and Lighting Company, Single-phase Equipment for ... *201
Milwaukee, Municipal Electric-light Plant for, Proposed ... 358, 511, 534
Milwaukee Telephone Situation ... 282
Mine Operation from Central Power Stations....*233
Mines, Coal, Electric Hoisting in ... 305, 324, 346
Mines, Mexican, Electric Power a Boon to ... 541
Mines, Use of Electricity in. (Editorial) ... 118
Minneapolis Electric-light Rates ... 558
Minneapolis, Elk River Power Development near. 202
Minneapolis Merchants Believe in Light ... 343
Minneapolis, Proposed Electrical Treatment of Water in. (Editorial) ... 176
Minneapolis, Telephone Amalgamation in ... 405
Minneapolis, Wire Ordinance in, Proposed...193, 287
Miscellaneous Notes ... 28, 48, 68, 91, 130, 148, 169, 189, 208, 228, 248, 268, 288, 308, 328, 348, 371, 410, 432, 460, 484, 512, 535
Mississippi River Power Utilized at Sauk Rapids, Minn ... 86
Mississippi Wire Glass Company's Product ... 484
Mitchell, C. E., Resignation of, from Western Electric Company ... 47
Mobile Electric Light Company Reported Sold... 347
Molybdenum, A New Silicide of ... 379
Monroe, Harriet. (Sonnet on a Power Plant).... 6
Monroe, Mich., Municipal Plant at, Shut Down. 52
Montreal, Electrical Extensions in ... 205, 370, 389
Montreal Electrical Show ... 473
Moore System of Electric Tube Lighting ... *219, 494
Mortuary Record of 1905 ... 18
"Motive Power and Gearing for Electrical Machinery." By E. T. Carter. (Book Review).... 241
Motor Control, Eck's Method of ... *253
Motor Control, Gilpin's Method of ... *253
Motor Design. (Institute discussion) ... 447
Motor, An 800-horsepower, for the Operation of a Pulp Mill. By Orrin E. Dunlap ... *463
Motor, The Electric. (New Year's Review) ... 8
Motor, Electric, Passes Ordeal of Fire ... *509
Motor Field Commutation, Improvement in ... *272
Motor, Induction. (See Induction.)
Motor, Inter-pole Variable Speed, for Machine-tool Work ... *41
Motor, Lamme Alternating-current ... *116
Motor, Lincoln Variable-speed ... *141
Motor, Railway, Allis-Chalmers ... *86
Motor, Single-phase, Advance ... *239
Motor, Westinghouse Single-phase Compensated. *59
Motor, Westinghouse Variable-speed, with Auxiliary Poles ... *163
Motors, Alternating-current, Self Starters for....*383
Motors, Fan. (See Fan.)
Motors, General Electric, for Small Machine Tools.*361
Motors for Hire. (Editorial) ... 236
Motors, Polyphase, Starting of ... 454
Motors, Purchasing in Too Small Sizes ... 424
Motors Should Replace Engines in Building Construction. (Editorial) ... 470
Motors, Two-phase and Three-phase, Comparison of. By Bradley McCormick ... *523
Motors, Westinghouse, Small ... *219
Motor-generator, Mercury-arc Rectifier Operating in Multiple with ... 195
Mount Hood, Glaciers on, Proposed Power Development of the ... 82
Mount Vesuvius Eruption and Abandonment of Electric Railway. By Frank C. Perkins ... *332
Mueller-certificate Ordinances of Chicago City Council ... 82, 104, 450
Muncie, Ind., Quits the Lighting Business ... 443
Municipal Accounting a Minus Quantity ... 157
Municipal Arc-lighting Figures in Grand Rapids, Mich. ... 430
Municipal Art League Prize Designs for Arc-Lamp Posts ... *213
Municipal Electrical Enterprise at Ipswich ... 424
Municipal Light Plant in Kingston, Ont ... 145, 386
Municipal Light Plant in New York City, Will Not Build ... 140
Municipal Lighting Proposed in Buffalo..233, 365, 396
Municipal Operation in Europe Disappointing ... 321
Municipal Ownership in Ashtabula, O ... 266
Municipal Ownership, E. W. Burdett on ... 491
Municipal Ownership Defeated in Denver ... 443
Municipal Ownership of Electric-light Plant Proposed in Boston ... 109, 145, 167, 306, 538
Municipal Ownership in Escanaba, Mich ... 247
Municipal Ownership, Iowa Cities Oppose ... 257
Municipal-ownership Issue in Chicago. (See Chicago.)
Municipal Ownership, National Civic Federation's Investigation of ... 68, 242, 460, 512, 531
Municipal Ownership Not a Success in Chicopee, Mass. ... 167
Municipal Ownership Piles up Debt. (Editorial).. 196
Municipal Ownership Setback in New Jersey. (Editorial) [illegible]
Municipal Ownership, [illegible]
Municipal Ownership in Toronto [illegible]
Municipal Ownership in Yonkers, N. Y. [illegible]
Municipal Plant at Monroe, Mich. [illegible]
Municipal Problem [illegible]
Municipal Street Railways in [illegible] Lose Money [illegible]
Municipal Water Plant Too Expensive [illegible]
Municipal. (See also Public [illegible])
Munising, Mich., Paper Mill Electric [illegible]
Munger Winch System [illegible]
Music, Electrical, Cahill System. (Editorial) [illegible]
Myth, A Fleeting [illegible]

N

National Brake and Electric Company ... 290
National Civic Federation's Investigation of Municipal Ownership ... 68, [illegible], 460, 512, 531
National Electric Company's Assets Sold ... [illegible]
National Electric Light Association, Atlantic City Convention of. (Editorial) ... 416, 470, 492
National Electric Light Association, Atlantic City Convention of, Preparation for ... *331, 391, *412
National Electric Light Association, Atlantic City Convention of, Proceedings of ... 471, *490
National Electric Light Association, One Phase of the Work of the. (Editorial) ... 530
National Electrical Code, Changes and Additions in the ... 119
National Electrical Contractors' Association, Cleveland Convention of, Arrangements for ... 423, 521
National Fire Protection Association, Annual Meeting of, in Chicago ... 418, 481
National-Interstate Telephone Association, Chicago Convention of ... 543
National-Interstate Telephone Association, Work of the ... 165, 211, 526
National Physical Laboratory of Great Britain .46, 321
National X-ray Reflector Company's "Poke Bonnet" Reflector ... *21, *60
Nebraska Independent Telephone Association, Lincoln Convention of ... 106
Nelson, B. C., Municipal Street Railway Loses Money ... 86
Nernst Lamp Illumination in Pittsburg Railroad Station ... 208
Nernst Lamp, Swinburne on the ... 452
Nevada Consolidated Copper Company, Electrically Operated Plant of ... 140
New Business Department, Electrical Journals and the. (Editorial) ... 50
New-business Department, Prize Competition for Papers on ... 197, 488
New-business Department, Proper Handling of the. (Papers by John S. Allen and Harold Almert, with discussion, at Northwestern Convention.).. 160
New-business Department, Proper Handling of. By W. W. Ferris ... 342
New-business Getting Discussed at N. E. L. A. Convention ... 490, 518, 519
New-business-getting Methods. By Frank W. Frueauff ... 519
New Business, Getting and Retaining, George B. Tripp on ... 518
New-business Notes ... 261
New-business Suggestions. (See also Selling Electricity.)
New England. (Correspondence) ... 109, 127, 145, 166, 186, 205, 226, 245, 266, 284, 306, 324, 346, 367, 386, 406, 429, 456, 480, 509, 532, 556
New England Street Railway Club ... 263
New England Telephone Company's Report ... 405
New England Telephone News. (Correspondence). 107
New Orleans, Building and Electrical Boom in... 547
New York. (Correspondence) ... 26, 46, 65, 89, 108, 127, 144, 166, 185, 205, 226, 246, 265, 284, 306, 324, 346, 368, 387, 406, 429, 456, 480, 509, 532, 555
New York Automobile Shows ... 53
New York Central Railroad's Electrical Equipment ... *6, 7, 144, 368, *469, *528
New York Central Railroad's Gasoline-electric Cars 306
New York City, Central-station Advertising in..*343
New York City, Co-operation Meeting in ... 260
New York City Electric Light and Power Rates.. ... 65, 127, 140, 368
New York City, Municipal Light Plant in, Will Not Build ... 140
New York City, The Pennsylvania Railroad's Improvements in ... *7, *273, 276, *293, *313, *416, *464, *516, *539
New York City, Possible Telephone Competition in ... 144, 324, 346, 387, 457, 480, 509
New York City Street-railway Statistics ... 285, 406
New York City, Telephone Rates in ... 180
New York City Traction Merger.26, 46, 108, 127, 185, 205
New York City, Williamsburgh Bridge in, Rubbish Incinerating Plant for Lighting ... *215
New York Edison Motor Load ... 65, 161
New York Edison Waterside Station ... 9
New York Electrical Club ... 368
New York Electrical Society, Annual Meeting of..538
New York Electrical Testing Laboratories ... 111
New York Gas Inquiry ... 46, 177, 266
New York, New Haven and Hartford Railroad's Alternating-current Equipment ... 238, 284, *298
New York Railroad Club's Discussion on Alternating-current Traction ... 238
New York State, Electric Lighting in ... 237
New York Subway, Alternating-current Signal Circuits in. By J. M. Waldron ... *395
New York Subway Engines, Test of ... 123
New York Subway, Fire in the ... 480
New York Subway, Quality of Air in ... 205, 246, 555
New Zealand, Use of Electricity in ... 49
Niagara Falls, Economic Value of, H. W. Buck on ... 453
Niagara Falls, How May, Best Serve the Interests of Mankind? By Orrin E. Dunlap ... *131
Niagara Falls, Long-distance Power Transmission from ... *135, *151
Niagara Falls Power Development ... *8, 53, 118, 124, *135, *151, 191, *271, 401, 423, 426
Niagara Falls Power House, Floating Ice at, Trolley Boat to Disperse ... *95
Niagara Falls, The "Preservation" of ... 48, 93, *134, 152, 159, 191, 222, 259, 277, 296, 313, 385, 423, 426, 453
Niagara Falls, The "Preservation" of. By Terry T. King ... 159
Niagara Falls, The "Preservation" of. (Editorial) 178
Niagara Falls Pulp Mill, An 800-horsepower Motor for the Operation of a. By Orrin E. Dunlap.*463
Niagara Falls, Transmission Line from, to Syracuse. By Orrin E. Dunlap ... *151
Niagara Power, Cheaper, New York Cities Want.. 476
Niagara Power Transmission. (Editorial) ... 118
Niagara's "White Coal" ... 277
Nickel-plating Industry, The Development of the. 380
Niesz, H. E ... *33, *157
Nitrogen, The Production of, from the Atmosphere.*197
Noise, Unnecessary, in Steel-building Construction. (Editorial) ... 470
[illegible] Henry H. [illegible]
[illegible]
Northwestern [illegible] (Correspondence) [illegible]
November [illegible], Electrical Exports for [illegible]

O

Oerlikon Single-phase Locomotive [illegible]
Ohio. (Correspondence) [illegible]
Ohio Independent Telephone Association, Columbus Convention of [illegible]
Ohio Independent Telephone Situation [illegible]
Ohio and Indiana Interurban Railway Association, Merger of ... 7, [illegible]
Ohio, Michigan and Indiana Long [illegible]
Ohio Passenger Rates Affected by Electric Competition. (Editorial) [illegible]
Oil Switch, Westinghouse [illegible]
Ohio Telephone Notes. (Correspondence) ... 45, 64, 87, 106, [illegible], 221, 243, 261, 283, 324, [illegible]
Olds Gas Power Company's Factory, Engines Under Test Supply Power for [illegible]
Oliver Estate, Large Isolated Plant of, in Pittsburg [illegible]
Ontario Legislature, Government Power Bill Before the [illegible]
Ontario Power Company at Niagara Falls, Power Plant of the [illegible]
Ontario Power-development Investigation [illegible]
Oregon Independent Telephone Association, Formation of the [illegible]
Oregon and Washington, The Telephone in. (Correspondence) [illegible]
Osborne, L. A. ... *[illegible]
Oscillograph for the Study of Alternating-current Wave Forms ... [illegible]
Oscillographic Researches on Surging in High-tension Lines. By C. David ... *[illegible]
Osmium Lamp Filaments, Support for ... *[illegible]
Osmium Lamp, Swinburne on the ... [illegible]
Ottawa, Ont., Street-railway Report ... [illegible]
Overhead Construction, Catenary, of Warren-Jamestown Single-phase Railway ... *[illegible]
Overhead Construction for Seebach-Wettingen Single-phase Traction Experiments ... *515
Overhead Line Construction. By Paul Spencer. ... 172, *[illegible]
Overhead versus Underground Lines ... [illegible]
Overhead Wiring Conditions in Grand Rapids, Wis. ... 271
Overhead Work. (See also Construction.)
Overshiner, E. B. ... *33
Oxone ... 300, 380

P

Pabst Brewery, Power Plant ... 124, 401
Pacific Cable, American, Is Completed ... 364
Pacific Cable, British ... 12
Pacific Gas and Electric Company ... 42, 193
Pacific Slope. (Correspondence) ... 26, 47, 66, 90, 110, 128, 147, 167, 187, 207, 247, 286, 307, 326, 388, 408, 431, 458, 482, 511, 533, 557
Pacific Slope, The Telephone on the. (Correspondence) ... 125, 283
Paderno, Italy, Hydro-electric Plant ... *488
Panama Canal, Cable to, Proposed ... 97
Panama Canal Zone, Electrical Plants for ... 257, *277, 389, 426, 450
Paper-box and Bag Factory, Electrical Equipment of ... *255
Paper Mill, Large, Electricity in a. By F. M. Feiker ... *29
Parallel Operation of Compound-wound Dynamos. 262
Parallel Operation of Shunt-wound Dynamos.... 197
Parcel Delivery by Street Railways of Manchester, England ... 166
Parcel Delivery. (See also Express Service.)
Paris, Large Steam-turbine Power Stations for ... 259, *537
Paris Lighting Situation, The ... [illegible]
Paris Metropolitan Railway ... *[illegible]
Parkville, Mo., Heating and Lighting Plant at.. *[illegible]
Parr, G. D. A., on Deterioration in Storage Batteries ... *119
Partridge, James, Death of ... 220
Party-line Selective Telephone System, Step-by-step ... *124
Pass & Seymour Sign Receptacle ... *[illegible]
Passenger Rates in Ohio Lowered by Electric Competition. (Editorial) ... 196
Passenger Station, New, of the Pennsylvania Railroad in New York City ... *416
Patent Litigation ... 87, *105
Patent Record, Illustrated Electrical ... 28, 49, 69, 91, 111, 131, 149, 169, 189, 209, 229, 249, 269, 289, 309, 329, 349, 371, 391, 411, 433, 461, 485, 512, 535, 559, 560
Patent Regulations, German. (Editorial) ... 479
"Pattern Making." By F. W. Barrows. (Book Review) ... 142
Peat, Electrical Production of Fuel from ... 451
Penington, T. C. ... *153
Penn Iron Mining Company's Hydro-electric Plant near Marquette, Mich ... 58
Pennsylvania Railroad's, The, Improvements in New York City ... *7, *273, 276, *293, *313, *416, *464, *516, *539
Perkins, Frank C. (The Bille Central Station at Hamburg, Germany) ... *291
Perkins, Frank C. (The Exposition in Milan and the Electrical Undertakings of the City) ... *487
Perkins, Frank C. (Mount Vesuvius Eruption and Abandonment of Electric Railway) ... *332
Perkins, Frank C. (New Simplon Tunnel Electrical Equipment) ... *153
Perkins, Frank C. (A 60,000-kilowatt Steam-turbine Plant at St. Denis, France) ... *537
Perkins, Frank C. (Steam-turbine Power Station in the Clyde Valley near Glasgow) ... *71
Perrigo's "Modern Machine Shop." (Book Review) ... 241
Perry, Prof. John, Accident to ... 409

Personal Notes....................27, 47, 66, 90, 110, 128, 147, 168, 187, 207, 227, 247, 267, 286, 307, 327, 347, 369, 388, 408, 431, 458, 482, 511, 533, 557
Peru Electric Manufacturing Company's Fuseless Rosettes *86
Peru, Electrical Opportunities in.................. 401
Philadelphia Electric Company, System of......*435
Philadelphia, Electrical Conditions in........303, 352
Philadelphia, Electrical Development in. By Frank H. Taylor..............................*435
Philadelphia, Franklin Celebration in.........318, 341
Philadelphia Rapid Transit Company.........*7, *136
Philadelphia Subway, The New...............43, *437
Philadelphia Telephone Service.................... 438
Phin's "Seven Follies of Science." (Book Review).. 547
Photometer, Bunsen's............................. 321
Photometric Measurements of the Mercury-vapor Lamp. (Editorial)............................ 542
Photometry and Illumination, Some Physiological Factors in. By Dr. Louis Bell...............*504
Physiological Factors, Some, in Illumination and Photometry. By Dr. Louis Bell...............*504
Pierce, Mrs. R. H., Death of...................... 308
Pignolet Switchboard Instruments...............*150
Pipes, Cold Bending of, for Electrical Wires. By R. G. Grayne.............................. *94
Piping in Long Island City Power Station...... 294
Pittsburg Isolated Plant, Large..................*528
Plan du Var (France) Hydro-electric Station.......................................13, *14, *192
Plant Life, Electric Power Stations and, in London 399
Plate Warmers, Electric........................... 342
Pole Line Construction, Spencer on..............*521
Pole Line and Equipment for Long Island Railroad *467
Pole Rot, The Prevention of. By Charles H. Cear 317
Police Patrol Boxes, Alarm Gongs for.......... 222
Polyphase Induction Motor, A New Type of....*551
Polyphase Motors, Starting of.................... 174
Poole's "Wiring Handbook." (Book Review).... 241
Popoff, Prof. Alexander, Death of................ 220
Pontiac, Ill., Flywheel Accident in............... 129
Portland (Ore.) General Electric Company, Advertising of..................................... *85
Port William, Ont., Kakabeka Falls Power Development near.................................. 205
Poster Advertising of Incandescent Lamps *178
Potomac Electric Company's Power House in Washington, D. C.............................. 200
Power Bill, Government, before the Ontario Legislature 423
Power Center for Small Users in Indianapolis... 404
Power Development, California, Notes of........ 237
Power Development of Chicago Drainage Canal. (See Drainage Canal.)
Power Development, Electric, in and near Winnipeg 521
Power Development, Elk River, near Minneapolis 202
Power-development Investigation, Ontario....401, 423
Power Development at Niagara Falls. (See Niagara Falls.)
Power Development, Proposed, from the Glaciers on Mount Hood.................................. 82
Power Development, St. Croix River............. 177
Power Development, St. Joseph River............ 222
Power Development, Susquehanna River..217, 370, 409
Power Development and Transmission. (See also Hydro-electric, Waterpower, etc.)
Power Distribution of Great Northern Power Company 463
Power, Electric, a Boon to Mexican Mines...... 541
Power Generation and Transmission. (New Year's Review).............................8, 10, 13
Power House and Equipment for Potomac Electric Company of Washington, D. C............. 200
Power Output of Central Stations, Suggestions for Increasing the. By P. H. Korst............ 87
Power Plant, A. By Harriet Monroe. (Sonnet).. 6
Power Plant at Baltimore, New Consolidated Company's.. 363
Power Plant, Clyde Valley, near Glasgow. By Frank C. Perkins................................. *71
Power Plant, De Cew Falls, Additions to. By Orrin E. Dunlap.................................*115
Power Plant Economics. By Henry G. Stott.......................................*101, *120
Power Plant and Electric Elevators in Majestic Theater Building, Chicago.......................*373
Power Required by Machine Tools................ 454
Power-station Design, A Fine Example of. (Editorial)... 276
Power Station, Long Island City..*273, 276, *293, *313
Power (Motive Power) Statistics of Maryland... 142
Power Transmission. (Notes)..67, 130, 168, 188, 228, 268, 287, 308, 328, 348, 370, 389, 409, 432, 483, 512
"Power Transmission." (Book Review).......... 450
"Power Transmission." By Dr. Louis Bell. (Book Review)....................................... 222
Power Transmission, Black River................. 381
Power Transmission, Direct-current............13, 348
Power-transmission Line and Third-rail System of the Long Island Railroad.....................*464
Power Transmission Projects in South Africa.... 108
Power Transmission, Proposed, in Western New York 83
Power Transmission in Wales.................10, *181
Power-transmitting Device, Thomson's............ *35
Power-wise, Are You?.............................. 161
Prindle, E. J., on the Art of Inventing.......... 475
Printing Telegraph, A Wireless.................... 38
Printing Titles on Drawings....................... 395
Prize Competition for Papers on New-business Department..................................197, 488
Producer-gas Power Plant in Worcester.......... 478
Projectile Shop, Machine Tools in a, Electrical Equipment of.....................................*451
Provo Plant, New, of Telluride Power Company.. 483
Public Service Building of Milwaukee Electric Railway and Lighting Company..................*468
Public Utilities, The Ownership of. By Lyman E. Cooley.. 200
Public Utilities, The Ownership of. (Editorial).. 196
Public. (See also Municipal.)
Publications. (Notes)...................27, 48, 68, 90, 111, 130, 148, 168, 188, 208, 228, 268, 288, 308, 328, 348, 370, 389, 409, 432, 459, 483, 512, 534, 558
Pulp Mill, An 800-horsepower Motor for the Operation of a. By Orrin E. Dunlap..............*463
Pulp Mill, Electrically Operated, at Sauk Rapids, Minn.. 86
Pumping Plant, Electric, of the Schenectady Waterworks. By C. T. Wilkinson.................*351
Pumps, Fire, High-pressure Electric, for New York City.. 116
Punga's "Single-phase Commutator Motors." (Book Review)....................................... 385
Pupin, M. I., on Telephone Engineering.......... 223
Pyrometry, Errors in........................381, 479

Q

Questions and Answers..............197, 262, 321, 454

R

Radium, Discovery of, Importance of the. (Editorial) 336
Rae, Frank B., Jr. (Modern Methods of Advertising) 342
Railroad Accidents. (Editorial).................216, 276
Railroad Service, Suburban, of the Illinois Central Should Be Electrified. (Editorial).............. 36
Railroad Shops, Louisville and Nashville, Electrical Equipment of. By A. G. Wessling.............*175
Railroad Signaling. (See Signals and Signaling.)
Railroad Telegraphers, Proposed Licensing of. (Editorial) 336
Railroad Telephones of Illinois Central.......... 144
Railroad Telephones Proposed for Grand Trunk.. 204
Railroading, Electric, Under Difficulties. By Dr. Alfred Gradenwitz *231
Railroading, Electric, A "Missing Link" in, Supplied *19
Railroading, Heavy, Alternating-current Traction in. (New York Railroad Club)................... 238
Railroading, Heavy, Various Applications of Electricity in *6, 7, 124, 139, 145, 178, 185, *191, 197, 225, 238, 259, *273, 276, *293, *298, *313, 386, 406, *461, *515, *516, 532, *539
Railroads, Steam, Electrification of.............. 79
Railway Competition, Electric, Affects Passenger Rates in Ohio. (Editorial)......................... 196
Railway, Electric, Canadian Statistics of......... 237
Railway, Electric, Cars for City Service..........*107
Railway, Electric, Express Service on, in New England 293
Railway, Electric, and Lighting Plants, Combined, The Economy of. By Ernest Gonzenbach........ *96
Railway, Electric, Long, for Canada Proposed.... 263
Railway, Electric, on Mount Vesuvius............*332
Railway, Electric, R. P. Woods on the History of the 83
Railway, Electric, Test by Brooklyn Polytechnic Students *397
Railway, Electric, Three-conductor, Direct-current, in Bohemia. By C. Smith.................. *31
Railway, Electric, Triumphs in San Francisco.... 422
Railway Motor, Allis-Chalmers..................... *86
Railway Properties, Appleyard Electric, Sold...178, 206
Railway Purposes, Induction Motors for, Armstrong's Method of Control of.......................*152
Railway Signal Association. (January Meeting in New York City)...................................... 54
Railway Signal Association (March Meeting in Chicago) 240
Railway, Steam and Electric, Merger Bill, The Massachusetts 521
Railway Telegraph Superintendents Meet in Denver 538
Railway Work, Shunt and Compound-wound Synchronous Converters for. By W. L. Waters.474, 477
Railways, Direct Versus Alternating Current for. (Editorial) 36
Railways, Electric, Rural, Hygiene of.............. 451
Railways, Electric. (See also Interurban Railroading, Single-phase, Street Railway, Third Rail, Traction, Trolley, etc.)
Raleigh, N. C., and Its Three Telephone Systems 204, 304
Rates, Drainage Canal, for Power....156, 157, 256, 398
Rates, Electric-light, Attacked by a Newspaper.... 122
Rates, Electric-light, of Aurora, Elgin and Chicago Railroad Company.............................. 545
Rates, Electric-light, in Chicago.................139, 156, 157, 177, 198, 217, 238, 257, 383, 425, 493, 518, 541
Rates, Electric-light, in Chicago. (Editorial)...156, 316, 520
Rates, Electric-light, in England and the United States 362
Rates, Electric-light, Minneapolis................. 558
Rates for Electric Light and Power in New York City................................65, 127, 140, 368
Rates, Electric-light, Regulation of, in Iowa...... 340
Rates, Electric-light, in Seattle.................... 129
Rates, Electric-light, Wright Demand System and the. (Editorial) 356
Rates, Electric-light. (See also Wright Demand System.)
Rates, Electric-power, in Winnipeg................ 425
Rates, Telephone, in Chicago...........................144, 165, 184, 244, 263, 284, 323, 428
Rates, Telephone, in England...................... 244
Rates, Telephone, in Indianapolis.......................45, 164, 204, 304, 366, 385, 455, 506
Rates, Telephone, in New York City.............. 480
Rates, Telephone, in Toledo........................ 45
Rates, Telephone, in Wisconsin, New Law Regulating 125
Rates, Telephone, World-wide, Disclosed by Canadian Inquiry 323, 345
Reardon, T. H. (An Amateur's First Dynamo).. 528
"Reasons Why" for the Merchant.................. 525
Reduction of Metal Sulphides O. W. Brown on... 379
"Reflecting Arc," New Pagoda......................*450
Reflector, Holophane, New.......................... *86
Reflector, "Poke Bonnet," for Window Lighting.......................................*21, *60
Refrigerating and Cold-storage Plant, Large, in Chicago *413
Refrigeration, Mechanical, Meyer on.............. 472
Refrigeration. (See also Ice Cream Freezing.)
Refuse Destruction. (See Garbage Burning.)
Relay, Overload and Reverse-current, Alternating-current *553
Relay, Reverse, Construction, Mershon on........ 399
Repulsion Induction Motor. (Institute discussion). 447
Resonant-circuit Telephony. (A. G. Davis' Patent) *165
Reversal of Energy in Generators, Wilson's Protection Against *136
Reverse-current Relay, Overload and, Alternating-current *553
Reverse-relay Construction, Mershon on.......... 399
Reynolds, Edwin, and the Horizontal-vertical Engine 281
Rice, E. W., Jr., Candidacy of..................159, *278
Richardson Lighting Outfit......................... *21
Richmond (Va.) and Chesapeake Bay Railroad, Single-phase Equipment for....................... 527
Richmond, Ind., Municipal Lighting Plant in.326, 388
Rochester Division of Erie Railroad, Electrification of 509, 538
Rock Island Battery Company's Fire.............. 61
Rock Island, Moline and Davenport, Merger of Electrical Properties in 302
Rocky Mountain States. (Correspondence)....408, 533
Roosevelt, President, Recommends Legislation to Preserve Niagara Falls.............................. 259
Rope-tightening Device, Electrical, for Telpher System *531
Rosettes, Fuseless, New Line of................... *86
Rosewater's Recollections 364
Rotary-converter Sub-stations of the Long Island Railroad *516, *539
Rotary Converters, The Automatic Control of..... *53
Rotary Converters, Shunt and Compound-wound. (Institute discussion) 474, 477
Roussel's System of Typewriting Telegraphy......*214
Royal Gorge Bridge for Electric Railway Proposed 208
Rubber, Production of.............................. 410
Rubber Shoes or Rubber Gloves?.................. 142
Rubbish Incinerating Plant for Lighting Williamsburgh Bridge in New York City.................*215
Rudd, W. A., Death of.............................. 343
Rushmore, D. B., on Design of Hydro-electric Stations 258
Russia, The Telephone in........................... 345
Rustin, Henry, Death of........................187, *194

S

St. Croix River Power Development.............. 177
St. Denis, France, A 60,000-kilowatt Steam-turbine Plant at. By Frank C. Perkins...........*537
St. Gallen-Trogen Interurban Railway in Switzerland. By Franz Koester.............................*113
St. Joseph, Mich., Railway and Light Property Sold 146
St. Joseph River Power Development............ 222
St. Louis Electrical Contractors' Association.... 130
St. Louis Street Lighting, Electroliers Suggested for 181
St. Paul, Minn., Tollboard Equipment of Tri-state Telephone Company of........................*194
St. Paul, Minn., Wiring Conditions in........35, 287
St. Petersburg, Electric Railways in............. 129
Salomons' "Management of Accumulators." (Book Review)... 450
Salt Lake City Electrical Interests................ 421
Salt Lake City Electrical Show.................... 318
San Francisco Earthquake and Fire. (Editorial)......................................316, 336, 378, 420
San Francisco Earthquake and Fire and Its Effect on Electrical Interests..........*337, *357, *376, *397, 405, *415, 421, 422, 458, 482, 493, 533
San Francisco Gas and Electric Company Absorbed..42, 193
San Francisco, Geary Street Railway in.......... 557
San Francisco, Independent Telephone Company Established in.. 544
San Francisco, Old Edison Plant in, Destroyed by Fire..............................177, 193, 247, 272
San Francisco, A Vivid Short-circuit in.......... 233
Sarco Arc Lamps at Chicago Electrical Show.... 72
Sarnia Tunnel, Single-phase System for..*32, *59, 532
Sauk Rapids, Minn., Electrically Operated Pulp Mill at.. 86
Schenectady Waterworks, Electric Pumping Plant of the. By C. T. Wilkinson.............*351
Schneider's "Engineer's Handbook." (Book Review)... 142
Schott, William H..................................*507
Scott, Charles F., on Cable Testing............... 360
Scott, Charles F., on Self-exciting Alternators.. 221
Scott, Henry T., President of Pacific States Telephone Company.......................107, 144, *283
Scribner Automatic Signaling Patent Not Infringed in Galesburg Case.........................*105
Scribner-McBerty Telephone Patent Defeated.... 87
Sealing Press, A New Form of.....................*427
Searchlight "Morse" for Announcing Election Returns 124
Searchlights to Aid Firemen........................ 122
Searchlights as Car Headlights.................... 186
Searle, R. M., on Location and Care of Lighting Fixtures.. 315
Seasickness Treated by Electric-vibration Chair.. 148
Seattle, Electric-light Rates in.................... 129
Seattle Electric Company, Concrete Power House for the.. 493
Seattle, Electric Signs Must Burn till Midnight in 260
Seebach-Wettingen Line, High-tension Single-phase Traction Experiments on the. By Dr. Alfred Gradenwitz................................*515
Self-synchronizing of Alternators. By Morgan Brooks and M. K. Akers......................474, 476
Selling Electric Light and Power. By S. Morgan Bushnell.. 81
Selling Electricity. (Department)..........................*84, 160, *260, *342, 424, *518
Selling Electricity. (See also New Business, etc.)
Separation, Electrical, of Substances of Different Dielectric Capacities *192
Series and Parallel, Direct-current Generators in, Operation of....................................... 262
"Seven Follies of Science." By John Phin. (Book Review)....................................... 547
Sewalls Falls, N. H., Waterpower Development at. *38
Sewing Machine, Electric Power for the......... 425
Shaler, N. S., Death of............................. 327
Sheldon, Samuel..............................*278, 399
Shepard, B. E. S., on Errors in Pyrometry....... 381
Shepardson, Professor, on Technical Men as Dividend Earners.................................... 339
Shock, Electrical, Alleged, Apparent Blindness Due to... 419
Shopping by Telephone............................. 224
Short-circuit in San Francisco, A Vivid.......... 233
Shreffler Engine Indicator and Overload Alarm..*103
Shunt-wound Dynamos Operated in Parallel.... 197
Shunt-wound Rotary Converters. (Institute discussion).....................................474, 477
Siam, Steam-turbine Installation in............... 303
Siemens, Carl, Death of............................ 279
Sign Business Increased in Fond du Lac by Electrical Show... 425
Sign, Electric, The First........................... 161
Sign, Electric, Large, in Indianapolis............ 455
Sign, Electric, New Use of, to Please Central-station Customers.................................. 261
Signs, Electric. (Editorial)........................ 296
Signs, Electric, Free Installation of.............. 490
Signs, Electric, Must Burn till Midnight in Seattle 260
Signs, Electric, as a Summer Load................ 343
Signs, Labor-saving Receptacle for............... *23
Signs and Symbols in Preparing Drawings...... 477
Signal Circuits in the New York Subway, Alternating-current. By J. M. Waldron..............*395
Signal Service, Universal Space-telegraph Intercepter for... 21
Signals Discussed by Central Electric Railway Association.. 255
Signaling in the Electric Zone of the New York Central Railroad..................................*468
Signaling Problems Presented by Chicago Freight Tunnels 484
Signaling, Railway, in London.................... 126
Signaling System, An Extensive.................. 252
Signaling. (See also Railway Signal Association.)
Silk Factories, Electrical Operation in. By Dr. Alfred Gradenwitz.................................*311
Simplon Tunnel Electrical Equipment, New. By Frank C. Perkins.................................*153
Simplon Tunnel, Electrification of the. (All references)......................48, 61, 80, *153, 302, 535
Simplon Tunnel, Opening of....................... 426
"Single-phase Commutator Motors." By Franklin Punga. (Book Review)........................ 385
Single-phase versus Direct-current Traction in England.......................................139, 197
Single-phase Equipment for Central Illinois Electric Railways.................................. 240
Single-phase Equipment for Milwaukee Electric Railway Company.................................*201
Single-phase Equipment for Richmond and Chesapeake Bay Railroad............................ 527

Single-phase Locomotive, 20,000-volt, for the Swedish Railways. By C. Smith.....*191
Single-phase for London and Brighton Railroad in England.....26, 46, [illegible], [illegible], [illegible]
Single-phase Motor, Advance.....*[illegible]
Single-phase Motor, The, for General Power Purposes. (Institute discussion).....177
Single-phase Motors, Century.....*403
Single-phase Railway Equipment for Anderson, S. C......150
Single-phase Railway, Warren and Jamestown *15[illegible]
Single-phase System in Italy, Westinghouse-Finzi.....329
Single-phase System for Sarnia Tunnel *32, *59
Single-phase Traction. (New Year's Review).....*6, 7, 14
Single-phase Traction Experiments. (High-tension, on the Seebach-Wettingen Line. By Dr. Alfred Gradenwitz.....*51[illegible]
Small Electric Plant, How to Make a, Pay. By D. F. McGee.....509
Smelting, Electric, of Iron at Sault Ste. Marie, Ont.....26, 196
Smelting Iron Ore by Electricity. (Editorial).....196
Smith, C. (Central Light and Power Station in Hanover, Germany).....*[illegible]
Smith, C. (Three-conductor Direct-current Railway in Bohemia).....*31
Smith, C. (Twenty-thousand-volt Single-phase Locomotive for the Swedish Railways).....*191
Smith's Insulator Pin.....*529
Smoke Abatement in England.....26, 106
Societies and Schools. (Notes).....48, 68, 91, 130, 169, 188, 208, 228, 248, 268, 288, 308, 328, 348, 370, 390, 410, 432, 483, 512, 531, 558
Socket Bushing, Knostrain.....*123
Sodium, A New Process for the Manufacture of. By E. A. Ashcroft.....380
Soldering Flux, Convenient Tube for.....*101
Solomon's "Electricity Meters." (Book Review).385
Sons of Jove Increasing Rapidly.....111
South Africa, Power Transmission Projects in..108
South Africa, The Telephone in.....345
South America, Electrical Opportunities in..302, 400
Southeastern States. (Correspondence).....47, 66, 109, 127, 145, 186, 206, 226, 246, 266, 306, 325, 346, 368, 387, 407, 430, 457, 481, 510, 533, 556
Southeastern Telephone Developments. (Correspondence).....64, 125, 164, 213, 304, 367, 405, 428, 455, 506, 544
Southwestern Electrical and Gas Association, Galveston Convention of.....421
Space-telegraph Apparatus Apparently Foretells Earthquake.....365
Space-telegraph Industry, Government Control of, in Great Britain.....245, 324, 480
Space-telegraph Industry, Marconi Company's Report on the.....300
Space-telegraph Intercepter, Universal, for Signal Service.....21
Space-telegraph Messages, Commercial, Rates for 240
Space-telegraph Signals, Controlling the Direction of. By William Marconi.....295, 381, *394
Space-telegraph Stations in Canada.....153, 205
Space-telegraph System, Massie.....*35
Space-telegraph Transmission Better at Night....208
Space Telegraphy. (Notes).....169, 348, 410, 535
Space Telegraphy in the Dutch East Indies. By Dr. Alfred Gradenwitz.....*137
Space Telegraphy, International Co-operation in, Desirable.....292, 363
Space Telegraphy in Mexico.....308
Space Telegraphy, Navy Department's Work with 278
Space Telegraphy. (New Year's Review)....9, 12, 15
Space Telegraphy for North Pole Expedition.....56, 300, 404
Space Telegraphy Proved Useful at San Francisco. (Editorial).....420
Space Telegraphy on the Stage. (Editorial).....80
Space Telegraphy on Seagoing Steamships. By Dr. Alfred Gradenwitz.....*353
Space Telegraphy. (See also Wireless.)
Spencer, Paul. (Overhead Line Construction).....472, *521
Spencer, Theodore, Death of.....126
Sperry, E. A., on Electrochemical Processes for Central Stations.....380
Sprague, Frank J., on Alternating-current Traction.....239
Sprengel, Dr. H. J. P., Death of.....110
Spring, E. C......*255
Springfield, Ill., Construction Work in.....139
Standard Electric Light and Power Station, Underwriters' Requirements for a.....365
Standardization Discussed in England.....185
Standardization of Electrical Machinery. (Editorial).....236
Standardization Rules. (American Institute of Electrical Engineers).....416, 448
Standardization, Wire and Cable. (Editorial).....356
Standardizing Rubber-covered Wires and Cables. By John Langan.....358
Stanley-G. I. Electric Manufacturing Company's Manufacture of Wright Demand Indicators.....*43
Stanley-G. I. Polyphase Induction Motor.....*551
Stanley-G. I. Revolving-field Inductor Generator.*163
Stanley-G. I. Wright Demand Indicator for Transformer Testing.....*478
Stanley's, William, System of Transmitting and Utilizing Low-frequency Currents.....*396
Star Electric Fans.....*241
Station, Passenger, New, of the Pennsylvania Railroad in New York City.....*416
Stationary Engineers Visit Allis-Chalmers Shops at West Allis.....*551
Statistical Table of Electric Service Facilities in the United States.....237
Statistics, Canadian Electric-railway.....237
Statistics, Census, of Electrical Industries. (Editorial).....176, 420
Statistics, Census, of Electrical Manufactures for 1904.....343
Statistics, Census, of Telephones and Telegraphs in 1902.....428
Statistics, Central-station, of Massachusetts.....449
Statistics, Chicago Lighting.....448
Statistics of Electrical Manufactures, Western Electrician's.....17
Statistics, Iowa Central-station.....334
Statistics, Ohio Independent Telephone.....165
"Steam-engine Indicator." By W. W. Beaumont. (Book Review).....241
Steam Engine. (See also Engine.)
Steamship Mauritania, Electrical Equipment of...268
Steamships, Seagoing, Space Telegraphy on. By Dr. Alfred Gradenwitz.....*353
Steam-turbine Accident, Peculiar.....*507
Steam Turbine, Curtis, Tests of.....365, *554
Steam-turbine Design, Recent Improvements in, by Stumpf, Elihu Thomson and W. L. R. Emmet 493
Steam-turbine Economy, Stott on.....*103, 120
Steam Turbine in Europe, Development of the. (New Year's Review).....13
Steam-turbine Plant at St. Denis, France, A 60,000-kilowatt. By Frank C. Perkins.....*537
Steam Turbine and Reciprocating Engine, Combination of, for Freight Steamboats.....432
Steam Turbine, Schultz.....268
Steam Turbines, Allis-Chalmers.....*60, *381
Steam Turbines, Curtis, in Chicago.....*1, *554
Steam Turbines. Practice, [illegible] (Iowa Convention).....[illegible]
Steam Turbines. (See also [illegible])
Steinmetz. [illegible] for [illegible] Generator.....[illegible]
Steinmetz. [illegible] of [illegible].....[illegible]
Steinmetz on Telephone Engineers.....[illegible]
Stewart (Frank H.) [illegible].....[illegible]
Stickle, George W., Death of.....[illegible]
Stombaugh Guy Arrester.....[illegible]
Stone & Webster Properties, [illegible].....[illegible]
Storage-battery [illegible].....[illegible]
Storage Battery, Edison.....[illegible]
Storage Batteries, The Care of [illegible].....[illegible]
Storage Batteries, Deterioration [illegible].....[illegible]
Storage Batteries, Initial Charge [illegible] Complete Discharge of.....[illegible]
Storage Batteries and Insulated Wire [illegible] by Railway Signal Association.....[illegible]
Storage Batteries for Long Island Railroad.....[illegible]
Storer, S. B., on Load Factor of Hydro-electric Plants.....[illegible]
Storm of Sleet Hampers Electrical [illegible] in Chicago.....[illegible]
Stott, Henry G. (Power Plant Economies).....*[illegible]
Strang Gasoline-electric Car on [illegible] Trip.....*[illegible]
Street Lighting, Mercury-arc Rectifier System with Magnetite Lamps for. By W. S. Barstow [illegible]
Street Lighting, St. Louis, Electrolier Suggested for.....181
Street-railway Accidents in Chicago, Frequency of (Editorial).....[illegible]
Street-railway Tracks, Two-part.....[illegible]
Street Railways in Great Britain.....[illegible]
Street Railways. (See also Railways, Electric.)
Stromberg-Carlson Telephone Transmitter, New *[illegible]
Studebaker Electric Automobile Truck.....*181
Stumpf's, Johann, Steam-turbine Improvement.....493
Sturgeon River Power Development.....[illegible]
Submarine Arc Light.....*126
Sub-station Design. (Editorial).....116
Sub-station Practice, Modern. (Institute discussion in Chicago).....52
Sub-station System, Chicago Edison and Commonwealth Electric Companies', Latest Developments in.....*139
Sub-stations, Portable.....*540
Sub-stations, Rotary-converter, of the Long Island Railroad.....*516, *539
Subway, London. (See London.)
Subway, New York. (See New York.)
Sunny, B. E......*67
Supreme Court Decision on 99-year Act...216, 218, 401
Surface-contact Traction in England.....108
Surging in High-tension Lines, Oscillographic Researches on. By C. David.....*43
Susquehanna River Power Development.217, 370, 409
Swedish Railways, Single-phase Locomotive for the, 20,000-volt. By C. Smith.....*191
Swinburne, James. (Efficiencies).....*42
Swinburne, James. (Metallic Lamp Filaments)...452
Switch, Knife, A Curious Home-made.....*414
Switch, Oil. (See Oil Switch.)
Switchboard Apparatus in Long Island City Power Station and Sub-stations.....*313, *539
Switchboard Equipment Company, New Circuit-breaker of.....*262
Switchboard in Mandel Brothers' Plant.....*252
Switchboard Practice, Modern, with Particular Reference to Automatic Devices. By E. M. Hewlett.....*546
Switchboard Structures, Glass Flooring for.....399
Switzerland, Hydro-electric Development in.....483
Switzerland, St. Gallen-Trogen Interurban Railway in. By Franz Koester.....*113
Switzerland, The Telephone in.....345
Symbols and Signs in Preparing Drawings.....177
Synchronizing of Alternators. (Editorial).....470
Synchronous and Asynchronous Motor, Difference Between.....321
Synchronous Converters, Shunt and Compound-wound, for Railway Work. By W. L. Waters.....474, 477

T

Tanning by Electricity.....169, 410
Tantalum Incandescent Lamps, General Electric.*554
Tantalum Lamp. (All references).....9, 15, 88, 347, 452, 491, *554, 555
Tariff Reform Agitation in Great Britain and the Electrical Trade. (Editorial).....98
Tasmania, The Telephone in.....345
Taylor, Frank H. (Electrical Development in Philadelphia).....*135
Technical Definition, Illustrated (Overhead Line Work).....*261
Technical Education. (Editorial).....138
Technical Education in Germany Overdone.....142
Technical Men as Dividend Earners. By George D. Shepardson.....339
Telegraph. (Notes).....130, 169, 208, 410, 432, 535
Telegraph Extension in Central America.....91
Telegraph Ciphers by the Billion.....243
Telegraph Messengers, Men as.....510
Telegraph, Printing, A Wireless.....38
Telegraph Work, Iron Wires Substituted for Copper in.....454
Telegraphs and Telephones in the United States in 1902.....428
Telegraphy, Rapid, on the Continent.....15
Telegraphy, Typewriting, Roussel's System of...*214
Telephone, Automatic. (See Automatic.)
Telephone Cable Roller, New Style of.....*531
Telephone Circuits, Auxiliary. By Charles H. Coar.....*62
Telephone Companies, New. (Notes).....88, 107, 126, 164, 184, 224, 244, 263, 455, 479
Telephone Conditions in London. (Editorial).....56
Telephone Construction Work. (Editorial).....356
Telephone Engineering. By J. J. Carty.182, 202, 222
Telephone Engineering as a Profession. By J. L. McQuarrie.....243
Telephone Equipment, Independent, in Meridian, Miss.....*518
Telephone Exchange in Chicago, The Newest Branch.....*133
Telephone Exchange, New, in Council Bluffs, Iowa.....385
Telephone-extension Litigation.....106
Telephone Extensions and Improvements. (Notes) 88
Telephone, False Teeth at the. (Editorial)....196
Telephone, Frivolous Use of the, in Washington, D. C......224
Telephone Inquiry, Canadian Government....323, 345
Telephone Line, The. By S. P. Grace.....*354
Telephone Lines on Highways.....224
Telephone Lines, Sectionalized Inductive Conductor for.....*397
Telephone Manufacturers and Dealers. (Notes).....25, 126, 185, 225, 263, 284, 506, 527, 545
Telephone Men. (Notes).....44, 63, 126, 165, 224
Telephone News, General. (Notes).....25, 45, 64, 88, 107, 126, 144, 165, 185, 225, 245, 265, 283, 305, 323, 345, 367, 405, 479, 506, 526, 545
[illegible]
Testing Wagon [illegible].....*[illegible]
Texas. (Correspondence).....[illegible]
Texas Independent Telephone Association, [illegible] Convention of.....[illegible]
Theater Excursions by Trolley.....[illegible]
Thermo-electric Couple [illegible] to Measure Temperatures.....[illegible]
Thermo-electric Pyrometer [illegible].....[illegible]
Third Rail, Ice on, Prevention of.....[illegible]
Third Rail versus Single Phase in England [illegible]
Third-rail System and Power-[illegible] of the Long Island Railroad.....*[illegible]
Thomas, P. H., on Mercury-vapor Apparatus. (Institute discussion).....[illegible]
Thomson, Elihu, on Free Alcohol.....[illegible]
Thomson's, Elihu, Means for Governing Steam Turbines.....[illegible]
Thomson's, Elihu, Power-transmitting Device.....*[illegible]
Thorntown, Ind., Municipal Ownership [illegible] Failure.....[illegible]
Three-conductor Direct-current Railway in Bohemia. By C. Smith.....*31
Three-phase to Quarter-phase Currents, Conversion of. (Steinmetz).....*[illegible]
Three-phase and Two-phase Motors, Comparison of. By Bradley McCormick.....447, *[illegible]
Thury's Direct-current Power Transmission.....[illegible]
Tin, High Price of.....[illegible]
Tokio Electrical Generating Station.....[illegible]
Toledo Telephone Rates.....[illegible]
Topeka, Central-station Affairs in.....368, 347, [illegible]
Torchio, Philip, on Tests for Wire Insulation.....[illegible]
Torpedo Exploder, Wireless New Form of.....[illegible]
Tourcoing International Exposition.....[illegible]
Towne, F. T., Death of.....147
Townley, Calvert, on Alternating-current Traction.....[illegible]
Track Circuits for Signaling.....[illegible]
Tracks, Street-railway, Two-part.....303
Traction, Alternating-current, in Heavy Railroading. (New York Railroad Club).....[illegible]
Traction, Electric. (New Year's Review)..6, 10, 14
Traction, Surface-contact. (See Surface-contact.)
Trade News. (Notes).....28, 49, 68, 91, 111, 130, 148, 169, 189, 209, 229, 248, 268, 288, 309, 328, 348, 371, 390, 410, 433, 460, 484, 512, [illegible], [illegible]
Train Lighting on the Great Western Railway of England.....[illegible]
Transformer Stations of Warren-Jamestown Single-phase Railway.....178
Transformer, Street, in Milan, Italy.....*488
Transformer Testing, Portable Wright Demand Indicator for.....*478
Transformers in Long Island Railroad Sub-stations 517
Transmission, Electric. (See Hydro-electric, Power Development, Power Transmission, etc.)
Transmitting and Utilizing Low-frequency Currents, Stanley's System of.....*396
Trenton Falls (N. Y.) Hydro-electric Development.....182
Tri-city Railway and Light Company, Formation of.....302
Tripp, George B., on Getting and Retaining Business.....548
Tri-state Telephone Company of St. Paul, Toll-board Equipment of the.....*194
Trolley Boat to Disperse Floating Ice at Niagara Falls Power House.....*[illegible]
Trolley Suspension on Seebach-Wettingen Line..*516
Trolley, Theater Excursions by.....142
Trolley Trip, A Long.....[illegible]
Trolley Wheel of Pure Copper.....*123
Tube Lighting, Electric, Moore System of..*219, 494
Tudor Apartment Building, Chicago, Hydro-electric Elevator in.....*175
Tungsten. (See Wolfram.)
Tunnel, Detroit. (See Detroit.)
Tunnel Excavator, Jackson's Electrically Operated.....182
Tunnel, Sarnia. (See Sarnia.)
Tunnel, Simplon. (See Simplon.)
Tunnels, Chicago Freight. (See Chicago Freight Tunnels.)
Turbine, Hydraulic 9,700-horsepower, for California Gas and Electric Corporation.....[illegible]
Turbine, Steam. (See Steam Turbine.)
Turbo-generator, Large, The Starting of a.....*381
Turbo-generators, Regulating, Emmet's System for.....*272
Turbo-generators of 25,000 Kilowatts Predicted..137
Turbo-generators, Westinghouse, in Long Island City Power Station.....*293, 297
Two-phase and Three-phase Motors, Comparison of. By Bradley McCormick.....447, *[illegible]
Two-speed Controller, Eastman's.....*312
Typewriting Telegraphy, Roussel's System of..*214

U

Ultra-violet Lamp with Heat-radiating Qualities..*376
Ultra-violet Wave-length Test to Detect Existence of Life. (Editorial).....296
Underground Cable Practice, Present. Comments on. By Wallace S. Clark.....359
Underground Cables, Maximum Voltage for.....445

Underground Construction in La Crosse, Wis. By W. D. Burford 180, 262
Underground Construction for Long Island Railroad *464
Underground Electrical Construction. The Modern Tendency in 262
Underground Mail Conveying System in Chicago. (See Chicago Freight Tunnels.)
Underground Versus Overhead Lines 201
Underground (Tube) Railways in London. (See London.)
Underwriters' Report on Electrical Conditions in Detroit 300
Underwriters' Requirements for a Standard Electric Light and Power Station 365
United Engineering Building 33, 99, 217, 406
United Engineering Building. Cornerstone Laying of 406
United States, Electrical Exports of. (See Exports.)
United States, Electrical Progress in, in 1905. By Henry H. Norris. (New Year's Review) 56
United States Telephone Company 204, 455, 479, 544
Units, Electrical. (Editorial) 296
Units, Electrical, International 257, 297
Units of Measurement, Electrical, The Charlottenburg Conference on. By Henry S. Carhart *297
Utica, N. Y., Large Waterpower Developments Near 182

V

Vacuum Tube, The, and Electrical Effluvia *376
Vacuum-tube Lighting. (See Tube Lighting.)
Valentine, E. H., Retires from Business 128
Variable-speed Operation of Induction Motors *234
Vesuvius, Eruption of 328, *332
Victoria Falls Power Transmission, Proposed 108
Victoria Park, Niagara Falls, Annual Report of Commissioners of 191
Voltmeter, Westinghouse Electrostatic *40
Voltmeters. (See also Instruments.)
Vose, Frederic P *101

W

Wagner Electric Manufacturing Company's New Works 329
Waldron, J. M. (Alternating-current Signal Circuits in the New York Subway) 10, *181
Wales, Power Transmission in 404, 458
Wallace, John F *395
Warren (Pa.) and Jamestown Single-phase Railway *158
Washington-Baltimore Electric Railway 347, 368
Washington, D. C., Frivolous Use of the Telephone in 224
Washington, D. C., New Telephone Building in 367
Washington, D. C., Potomac Electric Company's Power House in 200
Washington and Oregon, The Telephone in. (Correspondence) 405
Waterpower Development of Kakabeka Falls, near Port William, Ont 205
Waterpower Development at Sewalls Falls, N. H. *38
Waterpower Developments near Utica, N. Y., Large 182
Waterpower. (See also Hydro-electric Power Development, Turbine, etc.)
Water Purification, Electrical. (Editorial) 176
Water Purifier, Electrical, for Household Purposes *97
Waterworks, Schenectady, Electric Pumping Plant of the. By C. T. Wilkinson *351
Waters', W. L., Improvement in Motor Field Commutation *272
Waters, W. L. (Shunt and Compound-wound Synchronous Converters for Railway Work) 474, 477
Watseka, Ill., Proposed as Electrical Transmission Center 488
Weather Reports by Telephone 164
Webb, H. L., on European Telephone Service 305
Weeks, E. R. (Notes on the Lighting of Churches) *453
Welding Apparatus, Arc, Improved *469
Wellman Polar Expedition. (Editorial) 56
Wellman Polar Expedition, Plans of the 56, 200, 365, 404
Wellman Polar Expedition. (See also North Pole.)
Welsbach's (Dr. Carl Auer von Welsbach) Support for Osmium Lamp Filaments *254
Wessling, A. G. (Electrical Equipment of Louisville and Nashville Railroad Shops) *175
West Shore Railroad Electrification 258
West Virginia Independent Telephone Association, Parkersburg Convention of 244
Western Electric Company, Hawthorne Plant of, Chicago Edison Men Entertained at 361
Western Electric Company, Hawthorne Shops of the. By H. R. King *417
Western Electric Company, New Stock Issue of 169
Western Electric Fan Motor *219
Western Electrician's Statistics of Electrical Manufactures 17
Western Ohio Railway Extension *19, 206
Western Society of Engineers, Electrical Section of, Meetings of 100, 243, 423
Western Society of Engineers, New Officers of 19
Western Union Telegraph Company's Quarterly Reports 268, 535
Western Union Telegraph Company's Semi-centennial 299
Westinghouse Alternating-current Overload and Reverse-current Relay *553
Westinghouse 1906 Electric Fans *22
Westinghouse Electric and Manufacturing Company Increases Capital Stock 259
Westinghouse Electrostatic Voltmeter *40
Westinghouse, George, Awarded John Fritz Medal 168
Westinghouse Graphic Recording Electric Instruments *259
Westinghouse High-voltage Electrically Operated Oil Circuit-breaker *60
Westinghouse Motors, Small *219
Westinghouse Personnel, Changes in 327
Westinghouse Single-phase Compensated Motor *59
Westinghouse Turbo-generators in Long Island City Power Station 7, *293, 295
Westinghouse Variable-speed Motor with Auxiliary Poles *163
Weston, Edward, on Service Meters 491
Wheaton, Ill., Electrical Conditions at 202
Widnes-Runcorn Electrically Operated Transporter Bridge *12
Wiechmann's "Electrochemistry." (Book Review). 450
Wilgus, W. J., on Alternating-current Traction .. 239
Wilkinson, C. T. (Electric Pumping Plant of the Schenectady Waterworks) *351
Willey, D. A. (Electrically Operated Floating Fuel Depot for Coaling Warships) *93
Williams, Arthur *143, *494
Williams, C. H. (Modern Central-station Design as Exemplified in La Crosse, Wis.) *171
Wilmington, Del., New-business Campaign 424
Wilmington, Del., New Steam-turbine Plant for .. 488
Wilson-MacKean Insulator Pin *140
Wilson's, Leonard, Protection of Alternating-current Generators Against Reversal of Energy .. *136
Winnipeg, Electric Power Development in and near 521
Winnipeg, Electric-power Rates in 425
Winona, Ind., Interurban Railway Company, Equipment for 477
Winter Use of Electric Fans. (Editorial) 56
Wire and Cable Standardization. (Editorial) 356
Wire Glass 484
Wire, Hard-drawn Copper. By T. B. Doolittle 61
Wire, Insulated. (See Insulated Wire.)
Wire Stringing for Overhead Lines, Spencer on. *522
Wires and Cables, Rubber-covered, Standarizing. By John Langan 358
Wires, Electrical, Cold Bending of Pipes for. By R. G. Grayne *94
Wires, Iron, Substituted for Copper in Telegraph Work 454
Wires, Thin Insulation for 203
Wireless Conference, Another 363
Wireless Contract, Navy, Awarded 139
Wireless, Long-distance 61, 277, 407
Wireless Printing Telegraph, A 38
Wireless at San Francisco During the Great Fire 421
Wireless, Subterranean 116, 506
Wireless Telephony, Collins' System of *292
Wireless Torpedo Exploder, New Form of 401
Wireless. (See also Space Telegraphy.)
Wiring Conditions in Western Cities 35, 36, 129, 139, 193, 202, 271, 287, 300, 320, 483
"Wiring Diagrams and Switchboards." By Newton Harrison. (Book Review) 142
"Wiring Handbook." By Cecil P. Poole. (Book Review) 241
Wiring, Inside, in the East and in the West. (Editorial) 36
Wiring of New Houses, The 68
Wiring. (See also Construction.)
Wisconsin Light and Power Company's Central Station at La Crosse, Wis *171, 189
Wisconsin River Power Development at the Dells, Proposed 168
Wolfram Lamp, The New 179, 352
Wood, James J., Mrs., Death of 168
Worcester, Mass., Electric-lighting Situation in. (Editorial) 398
Worcester Polytechnic Institute, Electrical Engineering and Railway Laboratories at *441
Worcester, A Producer-gas Power Plant in 478
Wright Demand Indicator Business in the United States, Growth of the *43
Wright Demand Indicator, Portable, for Transformer Testing *478
Wright Demand System and Electric-light Rates. (Editorial) 356
Wright Demand System in England 265, 303, 362
Wright Demand System in England and the United States. By J. S. C 362

X

X-ray Apparatus, Portable, for Testing Cables .. *254

Y

Yerkes, Charles T., Death of *19, 64
Yerkes' Successors Named 41, 88
Yonkers, Municipal Ownership in 111
Yonkers Specialty Company's Ground-wire Clamp. *303
York, Pa., Street Railways of, Sold 300
Yorke, R. F., Death of 279

Z

Zahm, A. W *334, 340
Zahm, A. W. (The Care and Maintenance of Electric Meters) 384
Zeidler Gasoline Blow Torch *509
Zinc Refining Industry 308
Zirconium Lamp 15

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Fisk Street Station of the Commonwealth Electric Company, Chicago.

(With Supplement.)

CENTRAL-STATION practice in Chicago at the present time exemplifies in many ways the highest development of the art. A city with a population of nearly 2,000,000 souls, distributed over an area about 26 miles long and averaging some eight miles in width, with a central portion which is densely congested by business requirements, offers a great variety of problems to the central-station management.

Fifteen years ago several central-station companies were operating in the city, among them the Chicago Edison Company, which was the largest. To-day, however, a different state of affairs exists, and all the smaller independent companies have given place to the two large companies which now control Chicago's central-station business—the Chicago Edison Company and the Commonwealth Electric Company. Each generates and distributes electricity in its own territory, that of the Edison being the central portion of the city and that of the Commonwealth the surrounding parts. However, the two systems are interconnected, and that of the Chicago Edison Company receives much of its current from the principal generating plant of the Commonwealth Electric Company. This generating plant is known as the Fisk Street Station, the first steam-turbine central station to be put in operation. Equipped entirely with steam turbines and the most modern apparatus, and with an ultimate capacity of 156,000 kilowatts, the Fisk Street Station, from its great size and many new features, is one whose development has been followed closely by engineers and others interested in central-station practice. It is the purpose of the present article to describe the plant as it now stands with four large units complete. The previous articles which have appeared in the Western Electrician, notably that of May 23, 1903, were more preliminary in character.

It is to be noted that, whereas the three older units of the present equipment have a nominal rating of 5,000 kilowatts each, they have been run continuously at 6,000 kilowatts, and at times of peak load as high as 7,500 kilowatts each. The latest unit—No. 4—which is the farthest from the spectator in the picture on this page, and separately illustrated in Fig. 7, has a maximum capacity of 9,000 kilowatts. As it stands at present the station has a record of carrying 28,500 kilowatts.

But four more units have been ordered and will undoubtedly be placed in position during the year. These, like their predecessors, are General Electric outfits with Curtis turbines. These turbo-generators will have a nominal rating of 8,000 kilowatts, guaranteed, however, to run continuously at 9,000 kilowatts, and for two hours, the period of maximum load, up to 12,000 kilowatts. This equipment will add 48,000 kilowatts to the capacity of the station, bringing the total up to 76,500 kilowatts.

After this addition it is the intention to remodel the three older turbines now installed, so that no machine in the station shall have less than 9,000 kilowatts maximum capacity, while all after the first four will have 12,000. The plant is designed for an [illegible] the total [illegible] Station will be [illegible] that no other [illegible] where it now [illegible] Fisk Street plant when it is [illegible]

Fisk Street Properties.

Fisk Street Station is located at the [illegible] of Fisk Street and the South Branch of the Chicago River, and is about three miles from the downtown business district. At this point the Commonwealth company owns [illegible] location of the property being shown in Fig. 2, the heavy outlines denoting the company's property. On the north, the tracks of the Chicago, Burlington and Quincy Railroad enter the grounds, as shown, and at the south end of the property, across the river from the station, the tracks of the Chicago and Alton gain entrance, so that coal and supplies may be obtained from two separate roads.

Ample facilities for the storage of coal are provided, as will be seen by Fig. 2, not only across the river from the station, but on the same side as well, where sufficient trackage is provided, which, however, is not indicated on the diagram. As much as 60,000 tons has been in storage at once, and still the capacity was not taxed greatly. Coal is transported from the storage yard across the river to the station side by means of large scows or barges.

Most of the coal burned is screenings from the Springfield district, averaging about 10,500 B. T. U. The station has used as high as 1,000 tons in a day in December. This low grade coal has been

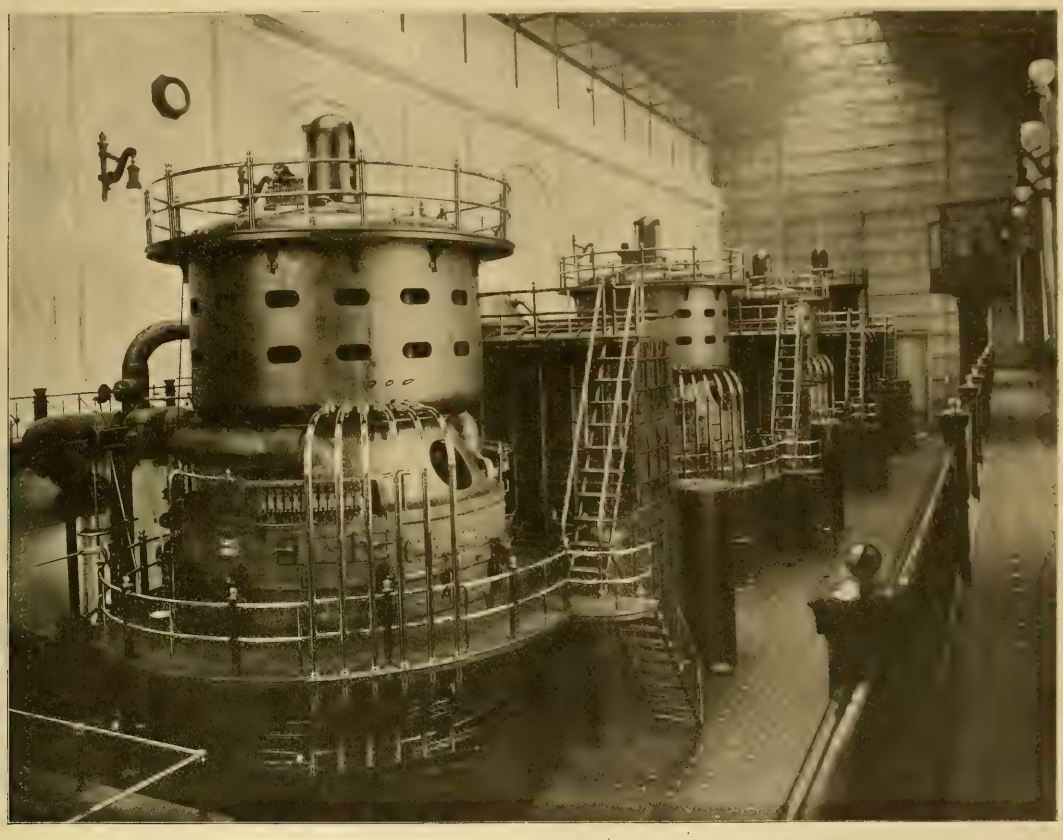

FIG. 1. INTERIOR VIEW IN FISK STREET STATION, SHOWING FOUR STEAM TURBINES NOW INSTALLED.

found very satisfactory and makes an intensely hot fire under the excellent firing conditions which exist in the plant. Combustion is nearly complete and very little smoke is noticeable; indeed, this 28,000-kilowatt plant emits less smoke than comes from a small nearby plant using an engine of probably a few hundred horsepower.

Located near the center of the property is the generating station and the switch house. The part indicated in heavy black in Fig. 2 is the present completed portion, the part indicated in solid lines is work now under construction and the part in dotted lines is for future extensions. The

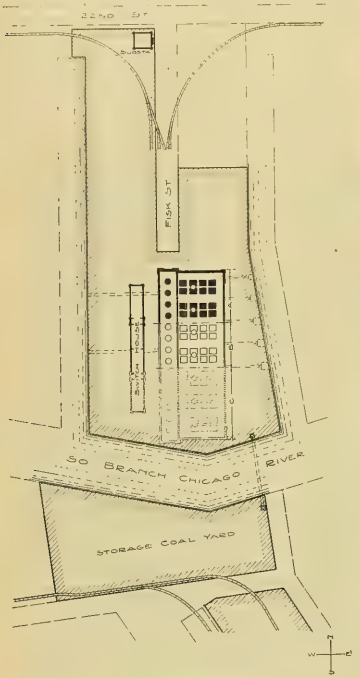

FIG. 2. PLOT OF FISK STREET PROPERTIES OF COMMONWEALTH ELECTRIC COMPANY.

width of the station is approximately 230 feet. The completed portion (A) is 185 feet long, the portion under construction (B) is 165 feet in length, leaving for the future extensions the portion (C) which is 265 feet in length.

At the north end of the property, near Twenty-second Street, is a substation now in process of construction, which is known as the West Twenty-second Street Substation.

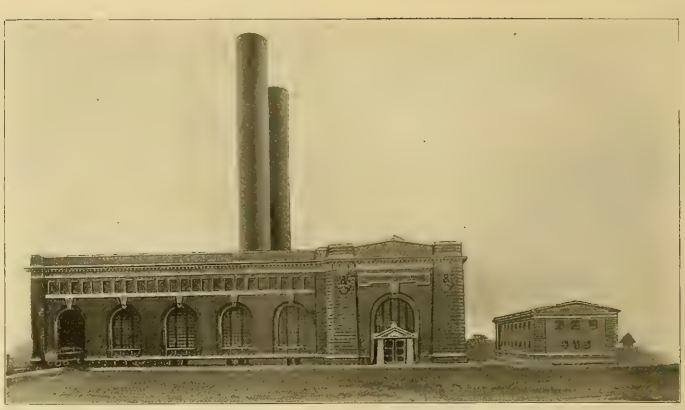

FIG. 3. EXTERIOR OF FISK STREET STATION OF COMMONWEALTH ELECTRIC COMPANY (SWITCH HOUSE AT RIGHT).

Generating Station and Equipment.

Fig. 3 is an exterior view of the Fisk Street Station as it now stands. The building is of the French style of architecture with red pressed-brick walls and cut-stone trimmings, the whole effect contrasting in a pleasing manner with the plain surroundings of the neighborhood. Reference to the accompanying supplement will show the general layout of the plant, both in plan and section. The unit idea pervades the whole installation, from the coal conveyors to the last outgoing line switch, each group or unit being complete in itself, with the idea of localizing and confining any possible trouble that might arise.

On the eastern side of the building is the train shed, which extends the entire length. Here the coal cars are run in for unloading into hoppers below the floor, which discharge the coal into crushers preparatory to its entering the conveyor system. The crushers are motor driven, and one is provided for each boiler unit. From the crushers the coal is carried by Meade conveyors having 24 by 24 inch buckets to the coal bunkers, which are located above the boilers, the bunkers for each boiler unit having a capacity of 1,000 tons. The conveyors travel continuously and are utilized to remove the ashes from the pits beneath the boilers to a hopper above the railroad track, from which they may be discharged into cars.

Boiler Plant.

Each boiler unit consists of eight Babcock & Wilcox boilers, the boilers of each two consecutive units facing each other as shown in Fig. 4. The boilers have 5,000 square feet of heating surface, there being in each 52 four-inch tubes 18 feet long, arranged in banks 18 tubes wide and 14 high. Nominally, the pressure carried is 180 pounds to the square inch. The chain-grate stokers are driven from a shaft extending the full length of each boiler unit, this being driven by either of two engines, one of which is always held in reserve.

Coal from the bunkers above the boilers is brought down to the grates through swinging chutes, which distribute the coal evenly along the grates. The bunkers for each boiler unit having a capacity of approximately 1,000 tons. The entrance of the coal into the chutes is governed by a valve-like arrangement controlled by chains which are within the reach of the boiler attendant on the floor. The furnace gases pass from the flues through curved uptakes, shown prominently in Fig. 5, to the boiler breechings which lead into the stack. One stack is provided for each two boiler units. The stacks are of steel construction, rising to a height

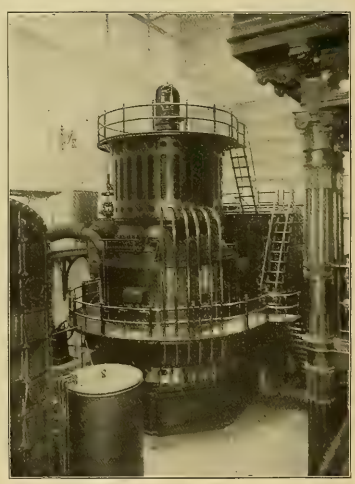

FIG. 7. STEAM-TURBINE UNIT NO. 4 IN FISK STREET STATION (MAXIMUM CAPACITY, 9,000 KILOWATTS).

of 205 feet above the boiler-room floor and with an inside diameter of 18 feet. They are not built from the ground up, but are supported above the boilers.

Superheat of 150° is used, which is obtained by a superheater receiving the direct influence of the hottest part of the furnace gases. The superheated steam from each pair of boiler units passes from the superheater upward to a point above the boilers and from there into a six-inch pipe passing down to the main steam header located in the basement. In the view above the boilers (Fig. 5) the arrangement of a portion of this piping is shown in the foreground. Reference to the supplement will indicate more clearly the arrangement of the boilers and piping, since one portion of the plan shows the top of a set of boilers with the piping arrangement, another portion shows in plan the piping in the header room below the boiler-room floor, and the third portion, which shows boiler units 5 and 6, not yet constructed, is a plan through the pent house with roof construction removed.

FIG. 4. INTERIOR OF FISK STREET BOILER PLANT, SHOWING FRONTS OF TWO BOILER UNITS.

In a separate compartment of the basement is a header room, as mentioned above, for each pair of boiler units. One of these header rooms is shown in Fig. 6. Two main steam headers, varying in diameter from five to 14 inches, extend lengthwise of this compartment, and into them are tapped the feeders coming down from above the boilers. These headers, as shown in the plan (see supplement), each pass into the turbine room, going direct to the turbines, thus preserving the unit idea. There is, however, an interconnection between each pair of main headers which will allow of one tur-

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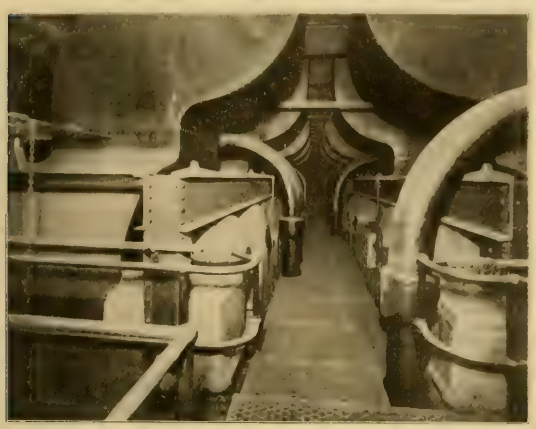


Fig. 5. View above Boilers in Fisk Street Plant, Showing Uptakes and Steam Piping.

Fig. 6. Header Room Beneath Boiler.

VIEWS IN FISK STREET STATION OF COMMONWEALTH ELECTRIC COMPANY, CHICAGO.

bine being run from its adjacent boiler unit if desired. Remote-control motor-operated valves are used. In the header room there are also located the feed and auxiliary headers for the auxiliary apparatus.

In the basement below the boilers is located an air-compressor outfit, which furnishes air at 90 pounds pressure for operating window shutters and

[illegible] the total height above the floor about 30 feet. In size and arrangement the buckets are so proportioned that the velocity of the steam, for any particular rotative speed, is only partially taken up in the first stage, the remaining part being practically all utilized in the second stage. So low is the velocity of the steam at exhaust that the exhaust openings are made of unusual size, and the condenser is placed close up to the turbine.

Governing is accomplished by the successive opening or closing of the various nozzles leading to the buckets. Each nozzle may be closed

[illegible] its general dimensions, weight and speed as the same as for the first three units. Fig. 7 is a good view of unit No. 4.

The turbine room, as seen in Fig. 1, extends north and south and is at right angles to the [illegible] of boilers forming each boiler unit. This is a radical departure from the usual practice of placing the lines of boilers parallel to the line of engines. The main steam headers pass in at the end of the station direct to the turbines, as previously mentioned. Fig. 8 is an interesting picture showing these headers as they emerge from the partition beneath the visitors' gallery and pass in sweeping curves to the various units.

The long room in which the turbines are installed is handsomely finished in white glazed brick and

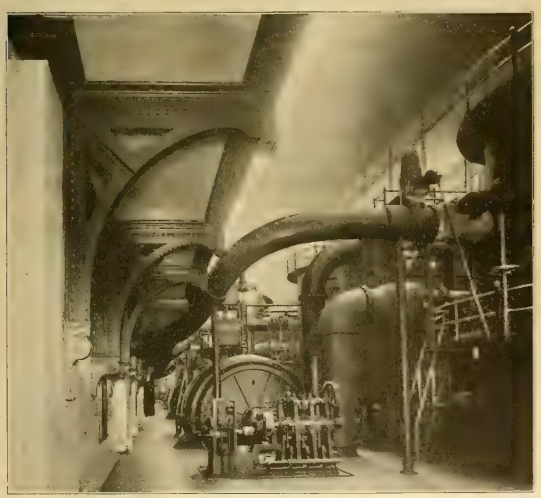


Fig. 8. View in Turbine Room, Showing Headers Leading to Turbines.

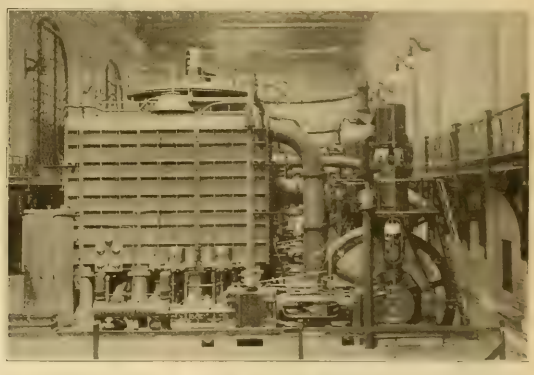


Fig. 9. Condenser Installation for Unit No. 4.

VIEWS IN FISK STREET STATION OF COMMONWEALTH ELECTRIC COMPANY, CHICAGO.

tools, cleaning electrical apparatus, etc. It is driven by a 35-horsepower motor, the whole being enclosed in a sheet-iron housing.

Steam-turbine Installation.

Above all other things that have made the Fisk Street Station a landmark in the progress of central-station development is the use of the steam turbine exclusively as the prime mover. This radical step was first taken in the Chicago plant, and the first 5,000-kilowatt steam turbine to be put in operation was here installed. Since the first turbo-alternator was put in, which was in the early part of 1903, three others have been installed, two gradually, and can be worked continuously at any position between full-open and closed. The governor is mounted on top of the alternator and connected to the end of the vertical shaft.

As the first unit installed represented the first type of 5,000-kilowatt turbo-generator (nominal rating) built by the General Electric Company, so the last unit, or No. 4, represents the latest phase of its development, which, though essentially similar, contains some few improvements as to detail. The essential points of difference between the No. 4 unit and the previous three are that the steam enters the turbine through two steam chests instead of three,

terra cotta from floor to ceiling, with ornamental terra cotta architraves to all openings. A visitors' gallery extends along both sides, giving a good view of all the units. A railroad track enters the building at the main entrance on the north front, so that parts for each successive unit may be taken direct from the car and put in position by the 50-ton crane that serves the turbine room. The floors are of vitrified German tile of small size laid in a pattern which gives a general mosaic effect.

Condensers and Auxiliary Apparatus.

The surface condensers, containing 20,000 square feet of heating surface each, were furnished by the

Alberger Condenser Company of New York city. These condensers are located close to the turbines and one of the units is shown in Fig. 9. For circulating the condensing water a centrifugal pump is used with each condenser, driven by a vertical Corliss engine, which is shown in Fig. 9. On the same shaft with the circulating pump is a vertical two-stage dry-air pump. The wet vacuum pump is installed as a tailpiece on the steam cylinder of the vertical engine.

Duplicate vertical boiler feed pumps, the hot well and the feed-water heater are located underneath or adjacent to the surface condenser, so that the entire equipment for each unit is compactly arranged as shown in Fig. 9. The boiler feed pumps take their supply directly from the hot well into which the condensers discharge.

Condensing water is taken from the slip on the east side of property, this being the upstream side, by means of one concrete tunnel for each two units. These tunnels deliver to wells from which the circulating pumps take suction. After passing through the condenser the circulating water is delivered to other concrete tunnels, one for each four or five units, which tunnels discharge into the slip on the west or down-stream side of the property.

Excellent results thus far obtained indicate that the power required for driving these various condenser auxiliaries is extremely small, in fact a considerably smaller percentage of the total output of the generator than is the usual practice.

Other machinery which might in a general way come under the head of auxiliary apparatus includes a complete fire-protection system maintained by the station. For this purpose a spherical pump capable of delivering water up to a pressure of 200 pounds to the square inch is located in a separate room off from the turbine room. This pump is driven by a 225-horsepower General Electric motor. By the use of a Cutler-Hammer control board, which is located in a sheet-iron housing in the pump room, the motor is automatically brought up to speed upon closing the switch.

Another important part of the auxiliary apparatus is the oil-pumping system for the step bearings of the turbines. This apparatus is located in the oil room, which opens out of the turbine room. The

FIG. 12. INSTRUMENT TRANSFORMERS IN SWITCH HOUSE AT FISK STREET STATION.

oil from the turbine bearing comes directly to the filters located in this room. After filtering it is taken to a storage tank, from which the various pumps supplying oil to the bearings derive their supply. To keep up the oil pressure in case of emergency a main oil pipe is provided which contains oil under 1,200 pounds' pressure, the pressure supplied to the bearings, and derives its supply from a steam-driven pump, the pressure being also maintained by an accumulator similar in construction to the type of accumulator used in high-pressure hydraulic elevator systems. Oil for lubrication is supplied by a gravity system.

GENERAL ELECTRICAL FEATURES.

Three-phase current is supplied by the turbo-alternators at 9,000 volts, 25 cycles. Each alternator, with its switching apparatus, forms a separate unit. While each of the different units will

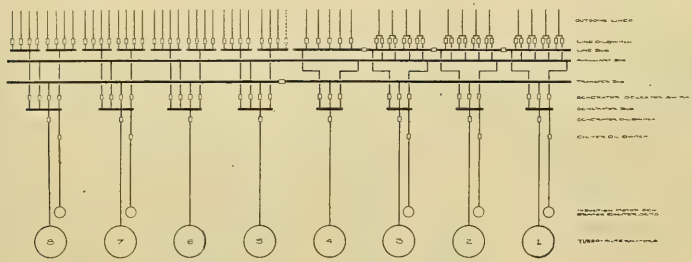


FIG. 10. WIRING CONNECTIONS OF HIGH-TENSION SYSTEM AT FISK STREET STATION.

ordinarily be operated independently, provision is made whereby any unit can be connected in multiple with any other in reference to its group of feeders.

The high-tension installation for the station is located in the switch house, a two-story building with a basement, which parallels the main station at a distance of 50 feet (see Fig. 3). One-half of this building, to accommodate seven units, has been erected. At the present time the electrical installation for units 6 and 7 is in progress. The wiring connections for the high-tension system are shown in Fig. 10.

High-tension oil switches and instrument switchboards are located on the first floor of the switch house, while the bus-bars and other high-tension connections, together with the instrument transformers and the necessary manholes and subways for the outgoing lines, are located in the basement. Fig. 11 is a view showing part of the oil switches for the first four units, and Fig. 12 shows the instrument transformers in the basement.

A distinctive and special feature in the design of the switch house is the isolation of all high-tension bus-bars and connections thereto in fireproof compartments. The oil switches, together with the instrument switchboards on the first floor have also been grouped in units, but not, however, in separate compartments. The control and instrument wiring in the switch house is brought to the controlling switchboard located in the operating gallery in the turbine room through separate groups of ducts for each unit.

As will be observed from the diagram of high-tension bus connections, the energy after leaving the turbo-generators in the turbine room is delivered by means of high-tension single-conductor lead-covered cables through an oil switch to the generator bus in the switch house. From this bus, in the first four units, the energy is delivered to three sets of busses, namely, transfer, auxiliary and line busses. The line busses for these four units are equipped with sectionalizing oil switches.

Beginning with the fifth and the following units, the generator bus is connected with four sets of busses, namely, transfer, auxiliary and two line busses. Here it will be observed there are no sectionalizing switches between the line busses.

In the first three units all lines are equipped with two selector switches and only four lines per unit. In the fourth and following units the lines are equipped with only one switch each, five lines emanating from the fourth and eight lines from each of the following units. The increased number of outgoing lines per unit is due to the larger size of turbines to be installed, beginning with the fifth unit.

There are installed at present three 50-kilowatt induction-motor exciter sets, on an inter-connected system. It is proposed to install two similar exciter sets in the portion now under construction. In each case these exciter sets are connected to the generator bus of that particular unit through an oil switch and a step-down transformer located in the switch house. In addition to these exciters there is an emergency steam-driven exciter which consists of a General Electric 127.5-volt 588-ampere generator direct connected to a vertical engine.

In the first four units the compartments for the high-tension bus-bars in the basement of the switch house are so arranged that all busses and connections to oil switches for each unit are contained in one compartment (see Fig. 13). The instrument transformers and underground cable connections for lines are also contained in a compartment by themselves and similar connections for generator leads are contained in another compartment, making three compartments per unit.

FIG. 11. OIL SWITCHES FOR FIRST FOUR UNITS IN SWITCH HOUSE AT FISK STREET STATION.

In the fifth, sixth and seventh units a feature of special interest has been introduced in the bus connections whereby each bus has a separate compartment and all oil-switch connections, together with the instrument transformers and bells for cables, are likewise contained in separate compartments, one for the generator and two for the outgoing lines, a total of seven compartments per unit. By this arrangement it has been possible to separate and isolate all phases of busses and connections, including the instrument transformers, by means of concrete barriers, thus insuring reliability in operation, simplicity in design and economy in investment. The busses are arranged in a vertical position and supported on porcelain petty-coated insulators, while the oil-switch connections in all cases consist of copper rods practically self-supporting.

It is possible by means of the transfer and auxiliary busses, in case of any disability of any particular unit, to furnish the necessary energy for its lines from any other unit. Ordinarily the units are operated independently. The outgoing lines leave the station in three-conductor 0000 underground cables and are distributed to the various substations, as shown on the diagram of the transmission system, Fig. 14. This diagram illustrates

admirably the relation of the Fisk Street Station to the combined system of the Commonwealth and Chicago Edison companies. As shown in Fig. 14, lines Nos. 1 to 200 inclusive are from the Fisk

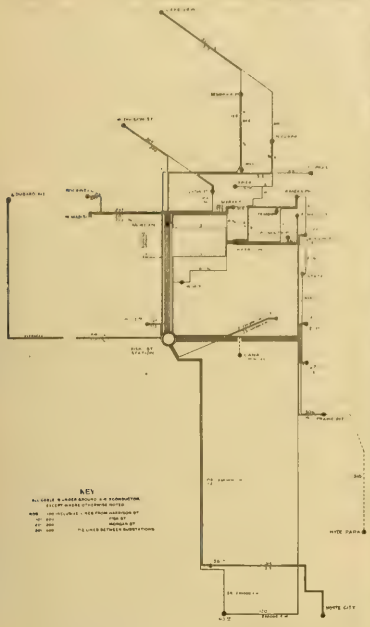


FIG. 14. HIGH-TENSION FEEDER SYSTEM OF COMMONWEALTH ELECTRIC AND CHICAGO EDISON COMPANIES.

Street Station, 201 to 300 from the Morgan Street Station and 301 to 400 are tie lines between substations.

Switchboard and Apparatus.

Remote-control apparatus which is used to operate the switches in the switch house is contained in an elevated switchboard room which is built up on the west side of the turbine room, as shown in Fig. 15. This compartment, which is supported on a highly ornamental structure, looks out upon the turbine room, and is entirely enclosed on the front and ends by glass, giving an unobstructed view of all the principal machines. The oil stwitches in the switch house are controlled from the station switchboard by means of an auxiliary low-pressure system operating at 110 volts. Here are located also the instruments for the outgoing lines. All remote-control wires are carried in multi-conductor lead-covered cable arranged so that the cables of one unit are absolutely separated from those of another unit, either by vitrified ducts, fireproof [illegible] or slate partitions. The wiring [illegible] designed that no crossings are necessary in any place.

All control switch contacts for the main operating switchboard are made on the under side of the table, the handles only projecting through the marble. A special synchronizing plug completes the closing circuit of the oil switch control switch, and causes on the synchronizer an indication of a synchronous or non-synchronous relation between the two points about to be closed by the oil switch.

At the rear of the board the wiring is particularly to be commended for its simplicity and neatness. All the control and instrument multi-conductor cables end at the terminal board, carefully lettered.

The switchboard attendant has at his command a signal system between each turbine and its operating panel.

FIG. 13. BUS-BAR COMPARTMENT IN FISK STREET SWITCH HOUSE.

Station Light and Power.

Light and power for the Fisk Street Station are supplied from West Twenty-second Street Substation, located on the same property (see Fig 2). At present there are about 1,200 incandescent and 50 arc lamps required for lighting the station and switch house. The light and power system is in duplicate. One main service board is located in the turbine room, also a controlling board in the boiler [illegible]

[illegible]

The kitchen is being equipped throughout with electrical cooking apparatus and is designed to provide for fifty people. The electrical stoves, broilers and toasters are mounted on a specially designed slate cooking table, which is built along the north and west walls of the room. This table consists of three shelves at suitable heighths, and of a width sufficient to accommodate the various cooking units. These shelves are built against a slate back, which is firmly secured to the wall, and on which the outlets for the various circuits are mounted.

Ovens and a five-gallon urn for providing hot water for cooking purposes are installed on a separate table near the center of the room. Coffee will be made in an electrical urn located in one of the dining rooms. Each outlet is controlled from a main cut-out cabinet and each circuit is of sufficient capacity to carry any one of the separate pieces of appartus.

In the store room adjacent to the kitchen is located a 200-pound motor-driven refrigerating apparatus, which provides the necessary cold storage space, and is also provided with facilities for manufacturing the ice necessary for cooling the drinking water.

In the design of this restaurant careful consideration has been given to sanitary conditions, and the dining rooms are fitted with a view to the comfort and convenience of the employes and all furniture and fittings have been selected so as to secure a neat and harmonious effect.

On the same floor as the dining room and kitchen are several comfortable bedrooms for employes who may be required to stay for any considerable length of time at the station.

One of the most interesting features of this part of the work is the assembly and reading room, which is accessible to those who may be off duty. A view of the interior of this room is shown in Fig. 16. It is fitted up with comfortable furniture which harmonizes well with the finish of the room. Large tables are provided, where the current technical literature is obtainable for those who desire to read. Well-filled bookcases stand along the wall, and their contents form part of the circulating library which the Chicago Edison and

FIG. 15. MAIN OPERATING SWITCHBOARD IN FISK STREET TURBINE ROOM.

Commonwealth companies keep up for the benefit of those in their employment.

Boiler-house employes have quarters located directly above the north boiler unit. Here are provided well-ventilated locker rooms, lavatories, shower baths, etc. In these quarters is also located the office of the boiler-house engineer, who is thus at all times in close communication with the men of his department.

The turbine-house employes have their quarters on the second floor of the switch house, where they have their own locker and bath rooms.

Miscellaneous Features.

To furnish excitation to the generators in case of emergency a storage battery has been provided, of the Electric Storage Battery Company's make, situated in the third story of the main station building. The battery contains 70 type G cells and is provided with the usual end-cell regulation, the

FIG. 16. ASSEMBLY AND READING ROOM FOR EMPLOYES OF FISK STREET STATION.

end-cell switches being contained in a separate room.

The West Twenty-second Street Substation, which is located on the Fisk street property, is now in course of construction. It contains one 1,000 and one 500 kilowatt motor generators, which transform the incoming current from 25 cycles to 60 cycles for distribution There is also a 2,000-volt rotary converter which supplies current to the station and for adjacent territory.

In order that better transit facilities be provided between the Fisk Street Station and the Harrison Street Station and downtown offices than is afforded by the street railway lines, the officers of the company have for their use an electric launch, which will take them by water between these points in a few minutes. The launch is one of those used at the Pan-American Exposition, and will seat 20 people. It is provided with 44 Chloride accumulator cells with 120 ampere-hour capacity, and may be propelled at five different speeds by a six-horse-power 88-volt motor.

Among the contributors to the success of this work should be mentioned Sargent & Lundy of Chicago, who were the consulting engineers; Shepley, Rutan & Coolidge of Chicago, the architects who designed the group of buildings, and the gentlemen composing the Commonwealth company's permanent engineering staff, under whose supervision the apparatus was installed. The result is an electric-light and power station, which, already one of the most notable in the country, is to be extended to be, perhaps, the largest in the world.

"A Power Plant."

It is not often that a power station forms the subject of a sonnet, but in the Century Magazine for January there is an example of this form of poetical composition inspired by the Fisk Street power house of the Commonwealth Electric Company, which is described at length in this issue of the Western Electrician. The author is Miss Harriet Monroe of Chicago, well known for her poetical gifts, and a sister of Mr. W. S. Monroe of the engineering firm of Sargent & Lundy. The title is "A Power Plant—the Fisk Street Turbine-engine Electric Station in Chicago." The verses, which are here reproduced by permission, are as follows:

The invisible wheels go softly round and round—
Light is the tread of brazen-footed Power.
Spirits of air, caged in the iron tower,
Sing as they labor with a purring sound.
The abysmal fires, grated and chained and bound,
Burn white and still, in swift obedience cower;
While far and wide the myriad lamps, a-flower,
Glow like star-gardens and the night confound.
This we have done for thee, almighty Lord;
Yea, even as they who built at thy command
The pillared temple, or in marble made
Thine image, or who sang thy deathless word.
We take the weapons of thy dread right hand,
And wield them in thy service unafraid.

ELECTRICAL PROGRESS IN UNITED STATES IN 1905.

By Henry H. Norris.

The year just closed has been one of remarkable activity in all of the fields of application of electrical engineering. The clearest indication of this is in the unprecedented demand for technically trained electrical engineers. The experience of all of the high-grade technical schools has been that their students are needed in all lines of development in numbers far greater than can be supplied. This shows that important undertakings requiring men with well-trained minds are attracting the attention of financiers, manufacturers and engineers. The demand also shows that the adaptability of carefully trained young engineers to all kinds of electrical activity is being more clearly recognized. There was a time when a recent graduate from a technical school was regarded with suspicion, the feeling being that he could not be trusted on account of his devotion to theory, with a supposedly corresponding neglect of practice. The technical graduate has proved to the satisfaction of the business world that his theoretical training does not necessarily make him unpractical, and that while his ideas at first may be crude, he has acquired the ability to adapt himself speedily to any new environment.

The year 1905 was a remarkable one in many ways, but particular attention has been devoted to the field of electric-railway engineering. Naturally the public views with keenest interest the development of improvements which have a tendency to increase its comfort and convenience. For this reason the actual introduction of alternating-current traction and the adaptation of electricity to steam-railroad conditions have received a large share of attention during the year. At the same time, telephone engineering has made as great, although less sensational, progress, and it is coming to be recognized as one of the most promising fields in which the activities of the rising generation of young engineers may be applied. Electric lighting is not far behind, while the use of the electric current as a means for transmitting mechanical power is steadily increasing.

Electric Railways.

At the convention of the American Street Railway Association held at Philadelphia during September a plan of reorganization was adopted which

Direct-current Locomotive.

Single-phase Locomotive.

TWO TYPES OF ELECTRIC LOCOMOTIVES.

it is expected will introduce a new epoch in the history of that very useful organization. This step was made necessary by the enormous expansion of the electric-railway industry and by the diversity of the interests now associated with the electric-railway business. When the association was founded the organization of a street-railway system was a very simple affair, each officer being conversant with the conduct of all divisions of the work. When the horse was supplanted by the electric motor, necessitating power stations and complicated systems of distribution, it was necessary to add engineering talent to the operating force properly to care for the new and expensive equipment. As speeds increased, accidents became common, and the further addition of legal talent became absolutely necessary. The rather simple forms of bookkeeping employed in the early days were entirely inadequate to the later demands made upon them, and elaborate systems of accounting were gradually developed by men trained for that line of work. Finally, as the simple tram-rail construction proved to be inadequate to the strains introduced by the heavier rolling stock, track departments, similar to those of steam railways, were introduced.

The present age is one of associations and conventions, and it was therefore natural that, one by one, the various departments of the street-railway organization should form associations, in the conventions of which their methods of work could be discussed, and as a result improved. The American Street Railway Association, the parent organization, was organized in 1882, and for a long time sufficed for the needs of all departments. Within the last few years, however, there have sprung into existence the Street Railway Accountants' Association, the American Railway Mechanical and Electrical Association, the American Association of Street Railway Claim Agents, and the American Street Railway Manufacturers' Association, the last named being composed of manufacturers, and organized for the purpose of bringing to the attention of the other associations the merits of the various lines of street-railway supplies.

The necessity for affiliating all of these associations, without at the same time interfering with their individual development, has been apparent for several years to all persons conversant with street-railway affairs. This necessity finally resulted in the appointment of a reorganization committee, the results of the work of which were approved at the Philadelphia convention. The present plan of the organization consists in establishing close connection among all of the associations, with the central authority vested in the American Street and Interurban Railway Association. A permanent secretary for this association has been appointed, with headquarters at New York, and through this central office will pass all material affecting the electric-railway business. At the secretary's headquarters are maintained reference files of all kinds of information for the benefit of the members. The proceedings of the association are to be assembled and issued to members of the parent association in the form of bound volumes.

The affiliated associations are represented on the executive committee of the parent association, so that each has a voice in the general management. It is expected that this arrangement will conduce to very systematic work, each association confining its activities to its particular field, but each having due consideration for the work of the others. The scope of the work has been further enlarged by introducing the feature of associate membership, to which any person interested in a practical way in electric-railway work is eligible.

The Philadelphia convention was without doubt the finest ever held by the association. In addition to the excellent papers and discussion, a prominent feature was the exhibition of products of the electric-railway manufacturers. This was on a most elaborate scale, and the exhibits will undoubtedly form an increasingly instructive and attractive part of the conventions. The re-election of Hon. W. Caryl Ely to the responsible post of president was not only a token of appreciation of his valuable services to the association, but it was evidence of a desire to effect a continuity of management which shall tend to greatest efficiency.

It has been stated that one of the functions of the railway association is to furnish reliable data to its members. In this connection it is well also to note the excellent work of the United States Census Bureau. The entire electric-railway profession is indebted to the United States Bureau of Commerce and Labor for the publication during the last year of the Census Bureau report on street and electric railways. In addition to the numerous data compiled by the bureau, the report contains a great amount of information on the general subject, prepared by the special expert, Mr. T. C. Martin. The report has been widely appreciated

and is finding many useful fields of application. Such work as this, combined with the resources which will be afforded by the central office of the Street Railway Association, will place at the disposal of the profession much valuable information.

During the year 1905 the Electric Railway Test Commission, which was organized in connection with the Louisiana Purchase Exposition, completed a long programme of experimental work and devoted a large amount of time and money to the preparation of a report of this work. The funds expended in making the tests and in deducing the results were furnished by individuals and companies interested in furthering the development of a scientific basis of electric railway operation. The project is important in that it is one of the few undertakings in which all of the contributions were made for the general good and not for the

LONG ISLAND CITY POWER HOUSE OF PENNSYLVANIA RAILROAD ON EAST RIVER.

direct benefit of any one contributor. The report was completed in December and is coming from the press at the present time.

Among the most important features of electric-railway development last year were the opening of traffic on two single-phase interurban lines, the adoption of heavy single-phase alternating-current locomotives for use on steam lines by the New York, New Haven and Hartford Railroad Company, the successful test of the New York Central direct-current locomotive and the decision of the Pennsylvania Railroad Company to equip its Philadelphia-Atlantic City line with electricity.

The Indianapolis and Cincinnati Traction Company's line started regular operation, after three weeks' preliminary trial, on January 21, 1905. This line has since been in successful operation, and it illustrates the most modern type of construction. The cars weigh over 48 tons each, with an electrical equipment of four 75-horsepower Westinghouse single-phase motors and the Westinghouse electro-pneumatic system of control. This road may be said to be the first of its kind to be operated on a large scale. On March 15th the second single-phase road, the Bloomington, Pontiac and Joliet railway, equipped with General Electric apparatus, was opened for traffic. It is the first large system using alternating-current apparatus of General Electric manufacture in this country, although a small line has been in practical operation for some time. This road was constructed by the Arnold Company, and it has been in successful operation to date, with practically no expense for repairs. The cost of this road without the power plant was less than $15,000 a mile, showing that the single-phase system can be installed at reasonable expense.

This road and the one previously described are furnishing the evidence so much desired by engineers in regard to the practicability of single-phase traction. The alternating-current motor appears to be entirely satisfactory, and the special line construction difficulties have been overcome. A satisfactory type of trolley wire suspension has been developed; insulators have been produced to withstand the high electric pressures combined with the shocks incident to this service, and on the whole the single-phase motor completes its test year with satisfaction to all concerned.

The announcement made by Mr. C. F. Scott, consulting engineer of the Westinghouse Electric and Manufacturing Company, at the Philadelphia convention of the American [illegible] Association, to the effect that the New York, New Haven and Hartford Railroad Company had decided to use single-phase locomotives, aroused great interest. [illegible] locomotives for [illegible] will weigh approximately [illegible] tons and will be capable of reaching speeds of 70 [illegible] heavy train. [illegible] tion upon either direct or alternating [illegible] cuits, and the trains will enter [illegible] the tracks of the New York Central and Hudson River railroad, which will be equipped with direct current. Each motor will have a capacity of [illegible] horsepower when operating with direct current, or a total of 1,000 horsepower for four motors.

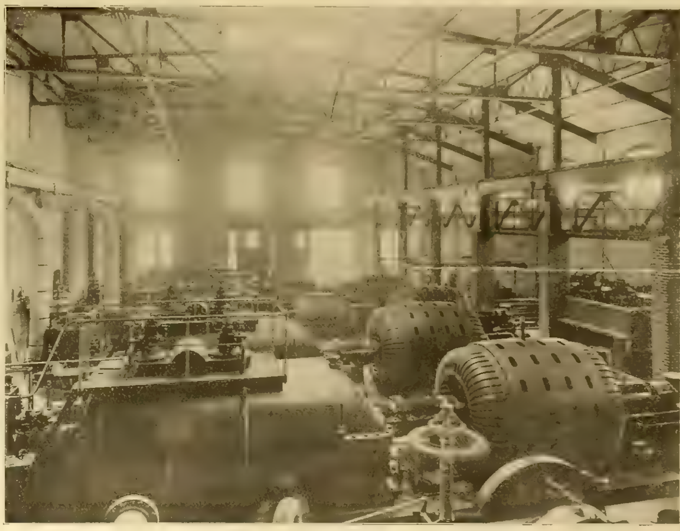
While alternating-current traction has made considerable progress during the year, there has also been development of direct-current apparatus for railway purposes. The direct-current locomotive recently built by the General Electric Company and the American Locomotive Company has during the last year been undergoing the severe test specified by the engineers of the New York Central Railroad Company. It will be remembered that the required service tests comprised 50,000 miles of operation, which mileage is now nearly complete. The locomotive has stood the severe strains without undue heating or wear, and the statement is made that the operation improves as the tests progress.

Another important feature of direct-current traction has been the completion of the Long Island Railroad power house and the beginning of electric service upon that road. This system is an example of the adaptability of the electric current on steam railroads, particularly in the operation of suburban cars. The Long Island Railroad Company has gone into this matter with great thoroughness, and the success of the present venture reflects credit upon the engineering talent of the road and of the consulting engineers, Messrs. Westinghouse, Church, Kerr & Co. The system was opened for operation on July 20, 1905, upon approximately 90 miles of single track. Direct current at 600 volts is used in the cars, and the transmission is with alternating current at 11,000 volts. The power house, located at Long Island City, is equipped entirely with Westinghouse steam turbines of 5,500 kilowatts each. There are at present three units installed, with provision for doubling the capacity of the plant as the demand increases.

The completion of this work marks one step in the entrance of the Pennsylvania Railroad system into the city of New York, as the Long Island Railroad will connect with the Pennsylvania Railroad in the large station now under construction between Seventh and Ninth avenues and Thirty-first and Thirty-second streets in the Borough of Manhattan. This station will be reached from Long Island by four tunnels under the East River. [illegible]

The New York Central Railroad has [illegible] of which will [illegible] 30,000 kilowatts, and [illegible] tested in [illegible] equipped with [illegible] General Electric Company [illegible] being 5,000 kilowatts [illegible] 15 feet in diameter and [illegible] of the generator. The work is under the [illegible] supervision of Vice-president W. J. Wilgus of the New York Central Railroad and [illegible] in a remarkably thorough manner. [illegible] engineering talent [illegible] the work is subdivided so as to place the responsibility upon those most capable of bearing it. The character of the electrical part of the work is indicated by the names of the men comprising the electrical traction committee, which consists of Messrs. W. J. Wilgus, J. F. Deems, B. J. Arnold and F. J. Sprague, while Messrs. E. B. Katte and J. D. Keiley are the company's electrical engineers.

As has already been noted, many [illegible] electric roads are using steam turbines as the source of power and in units of increasing size. [illegible] extreme in this direction is in the case of the new Williamsburg power house of the Brooklyn Rapid Transit Company. This station will contain at present three turbines, two being of the Westinghouse type and of 7,500 kilowatts capacity each. The other is one of the new turbines recently designed by the Allis-Chalmers Company, having a capacity of about 9,000 horsepower or 5,500 kilowatts electrical output. The Williamsburg station is remarkable for its compactness, the space taken by the engines being almost negligible in comparison with that occupied by the boilers.



POWER STATION OF PHILADELPHIA RAPID TRANSIT COMPANY, SHOWING TURBO-GENERATORS.

The most noticeable step yet taken by a steam road in substituting electricity for steam as the source of motive power is that of the Pennsyl-

vania Railroad, which just awarded the contract for the electrical apparatus needed to equip electrically its high-speed line between Philadelphia and Atlantic City. The Pennsylvania Railroad maintains a remarkable express service between these two cities, and the steam trains make as great speed as upon any road in the country. The service is mainly between the terminal cities, as no stops are made by the fast trains except at the terminals. It is announced that the intention is to maintain 15-minute service between the two cities as well as to provide some local service to the suburbs of Philadelphia. It is noticeable that direct-current motors are to be used, and in accordance with what appears to be standard practice at present steam turbines will be the prime movers, the Curtis turbines being adopted in this case.

It is to be expected that electric traction will be most rapidly developed in the eastern states, where the population is dense and cities near together. This is particularly true of interurban and suburban development. It should not be inferred, however, that there is a lack of activity in the Middle and Far West. The Middle West has always been a center of very great activity, especially in the line of interurban railways. The Bloomington, Pontiac and Joliet railway has already been referred to, and there is a direct-current line now under construction by the Arnold Company between the high-speed Aurora, Elgin and Chicago railway and the interurban system centering at Rockford, Ill. This road is mentioned merely as an indication of the tendency to interconnect the high-speed interurban railways, which tendency has now resulted in the formation of a more or less complete network covering the states of Ohio, Indiana and Illinois. The result is that the "interurban" has now lost its novelty in these sections and has taken its place as a necessity of every-day life.

Power Generation and Transmission.

The statements already made in connection with electric-railway work indicate two tendencies in the design and construction of steam engines for electric power generation. The first of these is the increasing use of the steam turbine and the second the increase in size of units. This latter tendency is also noted in the case of water turbines. Stationary water turbines or steam turbines with capacities of 10,000 horsepower and upward are not now considered remarkable, although of course the actual number of units in use is not very great. These large units are used not only for railway purposes but for lighting and for power transmission.

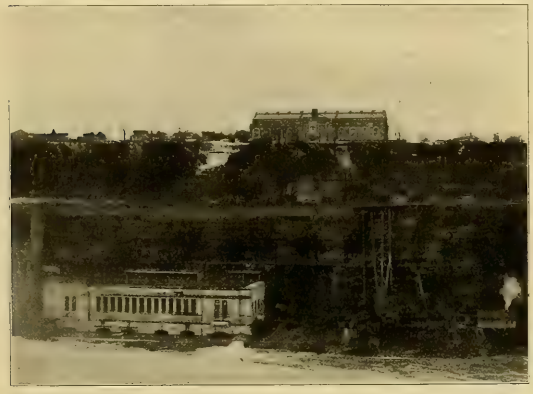
A number of power-transmission undertakings have been recently described in the electrical press, but only a few of these have been brought to completion during the year just passed. Niagara Falls continues to attract attention as the power-generation center of the East. There appears to be no limit to the extension of the five plants forming the equipment of this great power-producing region. Of the new plants now practically complete those of the Ontario Power Company and of the Canadian Niagara Falls Power Company have begun practical operation during the year. Each of these plants has several large units now delivering power, and both companies are increasing their equipment at a rapid rate. Both of these companies are also active in preparing for the distribution of their power to considerable distances. The plant of the Ontario Power Company is located in the gorge below the Horseshoe Fall, and a large transformer station is placed immediatcly behind and above. Early in the year it was announced that contracts had been made for the supply of a considerable proportion of the power to the Niagara, Lockport and Ontario Power Company. The transmission lines of the company are also being extended into Central New York. It is expected that in March of the present year power will be available at Syracuse for the operation of the extensive railway system of that city.

The Canadian Niagara Power Company has practically completed a splendid power plant along the same general lines as those of the power houses upon the American side. This company will be able to supplement the output of the Niagara Falls Power Company, which has found an ample market for the sale of its product in the immediate vicinity of the Falls and in the city of Buffalo.

The Electrical Development Company of Ontario was organized to develop Niagara power and to transmit this to Toronto over the lines of the Toronto and Niagara Power Company. The Development Company is installing a large power plant above the other two just described, and before very long will be delivering 20,000 horsepower in Toronto over a line 75.5 miles long.

On the American side of the Niagara River ground has just been broken for a new power plant for the Niagara Falls Hydraulic Power and Manufacturing Company. This company has been gradually increasing its output, and the new plant, which will add a capacity of 20,000 kilowatts, is to be in operation within the next two years. The plant will contain 5,000-kilowatt alternators, built for 11,000 volts pressure and 25 cycles. In adopting a uniform pressure for all of the units in the plant the company departs from its original practice, in which each unit was adapted to the particular kind of service which it was to supply. The present practice indicates that the engineers believe, as do many others, that it is more economical to transform a standard variety of current to the desired form at the point of application rather than to have a variety of machines for the various kinds of load.

The above statements show in general the present status of affairs at Niagara Falls and in a general way indicate the fields of application of Niagara power. In other parts of the country the same condition of affairs exists in regard to the rapid extension of existing systems. The important power plants are being enlarged and the most recent types of apparatus installed. The tendency is to generate a standard form of power by means of large units and to transmit this at high tension over increasingly large areas. The attention which has been given to the matter of high-tension transmission by the important electrical engineering associations indicates that further development in this direction is to be expected. It is a pleasure to note that high American tension work is being recognized abroad. The latest evidence of this is the selection of Mr. R. D. Mershon, who has had charge of the high-tension work of the American Institute of Electrical Engineers, as consulting engineer of an important African transmission system, in which it is proposed to transmit power a distance of 700 miles from Victoria Falls to the Rand. In this proposition there is under consideration the possibility of using the Thury direct-current system of distribution, which is opposed to the present American practice.



PRESENT APPEARANCE OF TRANSFORMER HOUSE AND POWER HOUSE OF ONTARIO POWER COMPANY AT NIAGARA FALLS.

POWER PLANT OF JEANESVILLE (PA.) IRON WORKS COMPANY, SHOWING TURBO-GENERATORS.

DETROIT EDISON COMPANY'S DELRAY POWER HOUSE.

Gas-engine Power.

This general survey of the subject of power generation would not be complete without some mention of the gas-engine installation, now nearly complete, for the California Gas and Electric Corporation. In spite of the fact that this company is located within reasonable reach of large waterpowers already electrically developed, the engineers concluded that a combination of maximum economy and reliability would be secured by the introduction of large gas-engine units. They have, therefore, had constructed three gas-engine electric-generating units of 4,000 kilowatts capacity each, the units being contracted for under the most rigid specifications. This remarkable experiment is regarded with great interest in view of the fact that the gas engine is here in competition with a very cheap form of electric power, and if successful a most important problem will be solved. If gas-engine power can be produced more cheaply than waterpower, it can also be produced much more cheaply than steam power.

The Electric Motor.

This subject deserves special mention on account of the expiration of the Tesla induction motor patents, which occurred in May, 1905. While there is still some question as to the exact results of this important event, it is the general belief that induction-motor manufacture is now thrown open to all who desire to compete for this very desirable business. A number of companies are entering the field, and there is prospect of keen competition. The larger companies which have been manufacturing this type of motor for many years have developed an improved type to meet this competition. The motors of this year are designed for maximum economy of material, combined with good efficiency. Undoubtedly under the present circumstances the induction motor will compete even more sharply than before for supremacy over the direct-current shunt motor, over which it has some important advantages. These induction motors are being built in very large sizes. The Westinghouse company recently turned out a number of 1,500-horsepower motors with squirrel-cage secondaries,

these being probably the largest motors of this type ever built, for while the motors built for the World's Fair were large, they had wound secondaries.

The Bullock Electric Manufacturing Company has recently constructed for the Shawinigan Water and Power Company a synchronous motor of 8,000 horsepower capacity, this being at present the largest motor in the world. It is for use in a motor-generator set which has a total capacity of 12,000 kilowatts.

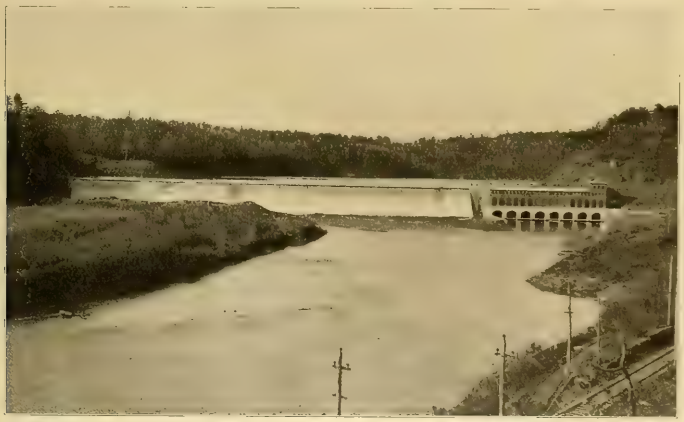
It is interesting to note also that during the last year the Wagner Electric Manufacturing Company has perfected and put into operation a development of its single-phase alternating-current motor for elevator service. This makes possible the operation of elevators on the ordinary lighting circuit, and it will undoubtedly have a tendency to improve the status of the electric elevator. In many locations it is impossible to secure current for direct-curent motors or for polyphase induction motors, and under these circumstances the new Wagner motor will undoubtedly meet with considerable favor.

Electric Lighting.

The National Electric Light Association continues to exert a great influence in assisting in the development of that important industry. The Denver convention held during June, 1905, was a remarkably successful gathering, this result being due to the energy displayed by the officers in arousing interest throughout the whole length and breadth of the country.

The vacuum-tube and mercury-vapor lamps are finding special fields for themselves where the quality of light combined with high efficiency are important items. Cadmium amalgam has been suggested as a substitute for mercury vapor, and it has been applied already with more or less success.

The tantalum incandescent lamp, which permits of an exceptionally high-filament temperature, has great promise as a competitor of the carbon-filament lamp. The efficiency of this lamp is almost twice as high as that of the carbon lamp, while its useful life is quite as long. The osmium lamp, which has about the same efficiency as that employing tantalum, is another example of the effort to replace carbon by metallic filaments. The discovery of these highly refractory metals has made this change possible. It will be remembered that platinum was used in the earliest incandescent lamps, but this metal did not give as great satisfaction as carbon on account of its comparatively low melting point.



DAM AND POWER HOUSE OF ATLANTA WATER AND ELECTRIC POWER COMPANY.

The Nernst lamp continues to fill an actual want in the field of street and house lighting. For the former purpose it occupies a position intermediate between the arc and the incandescent lamp, giving a good distribution of light with high efficiency. The fact that it has continued to increase in popularity and permanence shows that it is well beyond the experimental stage. The number of lamps in use has increased rapidly, and where installed they appear to remain.

No remarkable changes in regard to the arc lamps have been made during the last year, but the possibility of using smaller carbons in enclosed lamps with higher current [illegible] clearly pointed out during the [illegible] that it is entirely [illegible] the carbons at very high [illegible] with a marked improvement in the [illegible] of the light.

Among the many details which go to make up the success of the lighting [illegible] are among the most important. In the [illegible] interesting and practicable device is the [illegible] attachment which has just been placed on the market by the Fort Wayne Electric Works. By means of this device a coin may be inserted and current will continue until the amount of energy paid for has been consumed.

NEW (BELL) TELEPHONE EXCHANGE IN BALTIMORE.

In the matter of electric-lighting power stations there has been great progress during the year 1905 both in the generation and distribution of power. The Waterside station of the New York Edison Company has been enlarged and now contains two additional Westinghouse turbine units of 7,500 kilowatts each. It will be remembered that there are already in this station 5,000-kilowatt turbine units of the Curtis type.

The city of Baltimore has also a new lighting station containing two 2,000-kilowatt Westinghouse turbine units with 6,600-volt three-phase distribution. These two stations are mentioned merely as examples of the present practice in electric lighting, which is following the same general trend as that of electric railways.

In concluding this part of the subject attention should be called to the special report of the United States Census Bureau on Central Light and Power Stations, published in 1905 from data collected in 1902. The report comprises an elaborate summary of the history and development of electric lighting, with numerous data concerning financial features and general statistics.

Transmission of Intelligence.

The several means of communication are being increasingly utilized, and a steady and substantial [illegible] apparatus it will be possible for a ship to retain communication with both shores during its entire voyage. Numerous minor improvements in the apparatus have been made.

In the telephone field the most healthy growth is evidenced both in the number and the size of the new exchanges. Large exchanges are being installed by the Western Electric Company in San Francisco, Philadelphia, Baltimore, Washington and a number of other large cities. The installations for New York city provide for approximately 60,000 lines, while numerous other exchanges of from 8,000 lines upward have been constructed during the year. Other telephone manufacturers show similar activity.

A noticeable feature of the telephone situation is the growing appreciation of this field of activity on the part of young electrical engineers just starting out in their practical work. As the number of subscribers increases the complication of the system grows even more rapidly. The systems of distribution require the very best engineering construction, and in addition there are the power plants and other features of a general engineering nature. These facts are coming to be realized by the technical schools, and telephone engineering is taking its place with railway engineering, lighting and power engineering.

In electric-railway work the telephone plays a most important part, as it is used in train dispatching on the high-speed interurban lines. By enabling the dispatchers to be in almost constant communication with train crews it is practicable to reduce accidents, even on a single-track road, to an insignificant number.

Conclusions.

In taking a retrospective view of electrical progress in 1905 it is noted that a general prosperity is indicated on the part of all branches of the electrical industry. There is at the present time passing over our country a wave of popular interest in municipal ownership of public utilities. Electric railways and electric lighting are the particular subjects of attention by politicians, corporations and the general public. The climax of this agitation has not yet been reached, and interesting developments may be expected. The matter is being investigated carefully by the various associations concerned in providing electric service for the public, and the amount of time being devoted to the subject indicates its importance.

The rapid progress being made on the United Engineering Building in New York city, which will in the course of a year house a number of engineering associations, is very encouraging to those whose associations will use the building. The funds for the erection of this building were contributed by Mr. Carnegie, while the site was provided by the associations, who will divide the space among them.

ELECTRICAL INDUSTRY IN GREAT BRITAIN IN 1905.

[From the London correspondent of the Western Electrician.]

We have passed through a notable twelvemonth in Great Britain from the electrical engineering viewpoint, as the result both of what has been accomplished and what it is sought soon to bring about. The predominant feature has been power supply, for not only have several "bulk" supply companies in England and Scotland put their works into operation, but since March, 1905, London has been the center of a raging controversy, the strenuousness of which has been such that even in the "close" season the matter has not been allowed to rest, and at the moment of writing promoters of schemes for giving London electricity at prices ranging between one and two cents per unit (kilowatt-hour) are treading upon one another's heels in their anxiety. Nearly a dozen schemes may be expected to be placed before Parliament in the 1906 session.

The far-reaching recommendations of the Royal Commission on London Traffic and the official promise that the government will develop what many people regard as the one practical and practicable proposal made, viz., the establishment of a traffic board, has given an impetus to this branch of the industry.

Thus in two most important directions may the year 1905 be said to have witnessed the commencement of a development, the ultimate limits of which one dare not attempt to define. The highly successful electrical exhibition held in London in the autumn has given the industry generally a much-needed revival, and many firms have reported a welcome increase in the volume of business transacted since the exhibition closed.

These are the most important events during the year without going into detail, which will be done later. Industrially it can truthfully be said that the British manufacturer has progressed, for although prices, and consequently the financial results, are not all that may be desired, the large majority of firms are well filled with work, and the tendency for orders to go abroad is far less prominent than hitherto, for which the difficulty of ascertaining and controlling the conditions of labor when work is carried out abroad (a sine qua non of many specifications) is to some extent responsible.

Electric Power Supply.

Putting on one side for the present the proposals for giving a cheap supply of electric power in London—which was work of a negative character, so to speak—the most important development in the matter of power supply has been the progress made with the North Wales electric power scheme. This project deserves attention for many reasons. First, although not a technical reason, the expedition with which the works have been carried out, the bill only having been obtained a couple of years ago; second, the plant is water-driven, and third, a more extensive use of overhead mains will be made than in connection with any undertaking of the kind in Great Britain previously. As a complete description will be available within a very short time, a bare outline of the undertaking will suffice. The waters of Llyn Llydaw, a portion of the crater of Mount Snowdon, are to be made use of, the area being 5,500,000 square feet. The lake is one and one-fifth miles in length and one-fifth mile wide. A fall of 1,500 feet is available, a pipe line of 600 feet length having been constructed for driving the Pelton wheels, which are attached to three-phase generators. About 12,000 horsepower will be available at this spot, but another water area farther north in Wales, Llyn Eigan, will, when necessity arises, furnish the company with double this power. The estimate for the high-tension transmission cable was $3,000 a mile.

Indirectly the North Wales scheme has no doubt been responsible for broader views being held in certain official quarters on the question of overhead mains, for a great development in this direction is now being witnessed. Only quite recently an important sewage scheme in Birmingham was put into operation in which bare overhead transmission mains are employed. To continue the record of the work of the "power" companies, it is to be mentioned that four such undertakings have started operations during the year, viz., the Yorkshire Power Company, the Lancashire Power Company, the Clyde Valley company and the Fife company. The latter two concerns are in Scotland and have started on somewhat moderate lines, possibly owing to the nature of their areas. Two views of the Fife company's works are given herewith, and the Yorkshire scheme has been described already in the Western Electrician. The Lancashire scheme is a twin of the latter, for both undertakings were designed by the same consulting engineer and both have adopted Curtis turbines. The Clyde Valley works are on similar lines to the Fife.

That the "power" companies are now in full swing and rapidly developing there are abundant signs. An engineering adjunct of much importance to these undertakings is a telephone system. To pick out one, the Lancashire company, which has many miles of 10,000-volt transmission mains, both overhead and underground, has recently had a specially designed switchboard installed for connecting up its various consumers, many of whom have their own sub-stations.

Industries of the most varied character are rapidly adopting electric driving, and the opportunities for cheap power which these "bulk" supply companies afford have resulted in a greater expansion of this nature than in any previous year. The effect of load factor and diversity factor upon economical production is now borne upon the manufacturer to an extent not attempted in the past, with the result that in many cases the charges for current vary according to the period of the day during which supply is demanded.

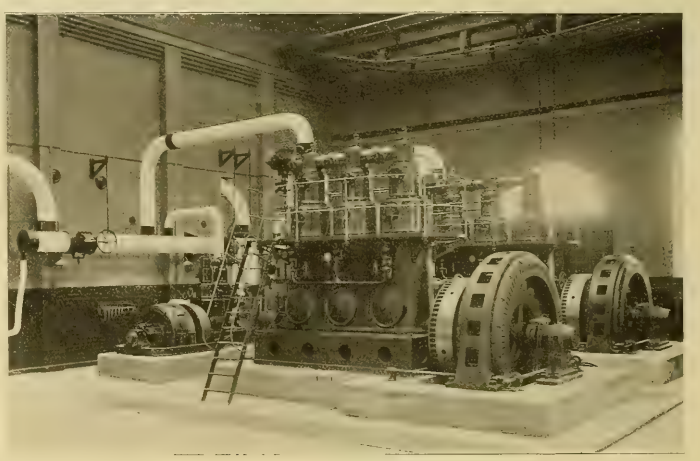
High-power generating units are of course intimately bound up with such undertakings, and it is satisfactory to note that attention has been paid to both the prime movers and the electric generators. Quite a number of firms have taken up the manufacture of the Parsons turbine with improvements of their own. The Curtis turbine also has shown a marked increase in its sales.

The increasing adoption of what are called here extra-high pressures has called forth a set of regulations at the hands of the Board of Trade especially to deal with such cases. These regulations stipulate that two trunk mains shall be laid to each sub-station and that the electrical power transmitted by any extra-high trunk main shall not exceed 1,000 kilowatts except with the consent of the Board of Trade. These rules apply to all systems using more than 3,000 volts. A set of overhead regulations has also been drafted by the Board of Trade. The use of electric power in mines and the development brought about therein by the report of the Home Office committee some time ago has necessitated special regulations being drafted for this purpose, which have been found to work to the benefit of the mine owner and for the safety of the miner. High-tension switch gear, too, has undergone considerable change and modification, one leading firm having discarded practically all its old patterns and re-designed its apparatus as a necessary corollary to modern methods of supply.

This section of my article may fittingly be concluded with some reference to the power schemes for London that were before Parliament last year. In all no less than eight companies came forward with such schemes, but only one proposed to deal with London and its surrounding districts as a whole. This scheme, which came to be known as the $25,000,000 scheme (and in which more than one American subscribed to the preliminary expenses), estimated that a power scheme worked on true "power" lines could supply current at anything from two cents per unit downward, and that the average selling price of the company would be 1½ cents. When the existing high prices in London are remembered the effect of such a proposition was naturally consternation, and although toward the end all of the existing companies came to terms with the new promoters, the opposition of the local authorities was so skillfully drawn out that there was not sufficient time for the bill to receive the royal assent, although it was passed by committees of both houses of Parliament.

Electric Traction.

The first matter of importance to be dealt with under this head is the report of the Royal Commission on London Traffic, whose labors, extending over three years, culminated last year in a number of voluminous reports. These reports made certain recommendations which by many people were considered obvious ones and aimed at a Utopian condition of affairs which can hardly ever be hoped for in the present building condition of the metropolis. These provided for the construction of a number of very wide main avenues passing across London from the four cardinal points of the compass, accommodating tramways to a very considerable degree. In addition a great extension of electric tramway was suggested, although no hint was given as to the responsible authority to find the necessary capital for the works. That the reports of the commission will be valuable as a future guide there can be no doubt; but whether the advantage so gained will be sufficient to justify the immense labor involved is disputable. One very necessary and practical reform, however, has resulted, and that is the recommendation to appoint a traffic tribunal for London consisting of well-qualified and amply paid gentlemen whose business it shall be to scrutinize all schemes of locomotion submitted to Parliament respecting London, and so to bring about a little uniformity which is so sorely needed. The past history of traffic legislation in London, so far as railways, at any rate, are concerned, is that everyone has selected the most likely routes, leaving many bare patches of undeveloped district. Such a condition of affairs will be entirely eliminated by the establishment of a traffic tribunal such as that suggested above; and this has already been promised by the government.



ENGINE ROOM OF FIFE ELECTRIC POWER HOUSE.

Travelers upon the much-maligned District Railway and Metropolitan Railway (familiarly referred to as the "Inner Circle") will look back with pleasure to the year 1905, for the last steam train has been withdrawn, and swift and more or less comfortable traveling is in vogue, although a new order (to us) of unfortunate human beings has been created, viz., the "strap-hangers," who under the old regime traveled under even worse conditions than holding on to the straps provided in the new electric cars for standing passengers.

The equipment of these railways and some contiguous lines, over which there are running powers, is on the standard direct-current system, with two electric rail conductors, but another London rail-

way company in the south has stated its intention to adopt, experimentally, on a short length of line the single-phase system with overhead equipment. A rumor has just been published that the order has been given to the Allgemeine Elektricitat Gesellschaft, although I cannot vouch for it.

Up to the present all the other railway companies having termini in London have kept aloof from electric traction, although it is not unlikely that several of them will seriously attack the problem in the near future, in consequence of the

FIFE ELECTRIC POWER HOUSE IN SCOTLAND.

electric power proposals which are now being made. Initial expense has been a noteworthy deterrent, and much of this would disappear if a reliable supply could be obtained from outside sources. A new tube railway running to the northeast of London was authorized by Parliament, the district much requiring improved facilities. The North-eastern Railway Company, too, has decided upon a considerable extension to its electrically equipped system, and some talk of overhead traction has been heard in this connection. Experiments have been carried out on these lines with a limestone ballast, the property of which is said to be that while it remains dry it is safe to touch the 500-volt rail when standing on it. I have not heard of any considerable use of it, however.

Considerable interest has manifested itself in the tramway systems at Torquay and Lincoln, where the Dolter and Griffiths-Bedell systems, respectively, have been adopted. Very little can be said about either at present, for whereas the cars have only just commenced running at Lincoln, so many squabbles have taken place between the contractors at Torquay and the corporation that the progress there has been unsatisfactory, and the lines will probably not be completed for some time yet. Apart from these two instances, the trolley system has continued to be adopted, and considerable extension has taken place, intercommunication being so freely adopted between various towns that runs of 20 and 30 miles are almost common in the northern Midlands.

The possibility of these long tram journeys, with

ARMATURE OF 3,500-KILOWATT ALTERNATOR FOR LONDON TRAMWAY POWER HOUSE.

cheap fares, has had a most prejudicial effect upon the local revenue of the railway companies which, in many cases, have resorted to the use of single motor coaches upon their ordinary rails, in order to accelerate and cheapen the service.

The use of top decks, although most ungainly, has proved a profitable investment to many authorities, and especially in industrial towns, where the traffic is congested, and even the [illegible] London County Council has [illegible] [illegible] important.

[illegible] everything that tends to [illegible] busy service [illegible] as a reliable device for the [illegible] of the trolley arm from one [illegible] to the other made its appearance [illegible]. The introduction of [illegible] obviate the necessity for the [illegible] the arm with the [illegible] at the same time remove the temptation [illegible] characteristically gave [illegible] rope in order to ring the bell to stop [illegible]. I believe it was this [illegible] year ago that led to the order that all the [illegible] were to be twisted out of reach. Several [illegible] for short-circuiting the trolley wire should it break have also been adopted.

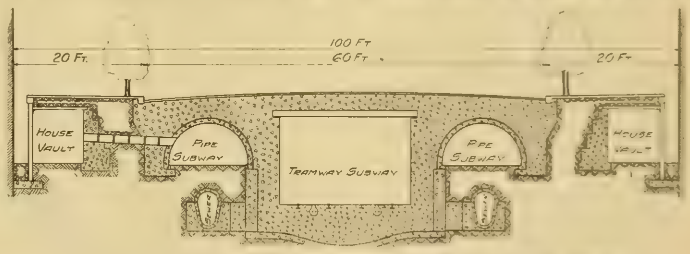
The tramway question in London has continued to excite much interest and [illegible] comment. The County Council early in the year made offers to the company which runs the horse lines on the north, and the lease of these lines will be surrendered in April, some two or three years earlier than would be otherwise the case. There are over 40 miles, and the reconstruction for electric traction—a combination of trolley and conduit—will take place immediately the council has acquired them. The large generating station which the London County Council is erecting at Greenwich is now well forward, and a view of one of the 3,500-volt alternators in course of erection is shown.

The sketch (section) of the subway tramway under the new thoroughfare in London, by which

[illegible]

[illegible] brilliantly lighted [illegible]

[illegible] types have been placed on the market [illegible] many of the [illegible] for street lighting, the change from the vertical



SECTIONAL SKETCH OF NEW THOROUGHFARE IN LONDON (KINGSWAY), SHOWING SUBWAYS.

it is hoped eventually to connect the north and the south, will also be interesting, in so far as this subway was decided upon after a visit to America. Tram cars will run in this subway from the city to the north of London very shortly. The subway is a little less than one mile in length, but the cars will continue into the open, and the passengers will not have to change.

The continued efforts to secure parliamentary powers along the Victoria Embankment were again frustrated, this time by the House of Lords, when it was almost regarded as a foregone conclusion that these powers, after many attempts, would be granted. Until these powers are granted we shall always have the north and the south of London divided by the river, and with no tramway communication, although doubt is frequently expressed as to whether the latter is really necessary.

Several new companies have been formed for exploiting motor omnibuses, and with the help of a daily paper something like a scare was created among tramway shareholders, and also among some municipalities. It was soon laid to rest, however, and although the horse omnibus is fast being superseded by the motor vehicle, the status quo ante seems to have been maintained.

Regenerative control on tramways has made considerable development, and Mr. Raworth has succeeded in equipping a large number of tram cars with his system, for the exploitation of which a company has now been formed. On one particular test the consumption of energy per car-mile was shown to be only one unit, and the general expenses have been materially reduced. Another regenerative tramway motor has been placed on the market by Johnson-Lundell, but hitherto no practical application of it is known.

Once again there is little progress to report with regard to electrically driven automobiles.

The Engineering Standards Committee has had the question of standardizing tramway poles and trolley wire under consideration, and reports have been issued concerning these matters. A number of

glower to the horizontal not being regarded as a wise one in some quarters. Efforts have also been made to improve the scope of the mercury vapor lamp, by the addition of a few ordinary glow lamps, and the combination certainly produces a pleasing effect. Imitation candle lamps have also become popular, while long-filament lamps for shop-window effects have so "taken on" that one firm has commenced to manufacture tubes and filaments for this of no less a length than four feet. Osmium and tantalum lamps are now purchasable, but only so recently that their development can hardly be recorded.

The use of prepayment meters and hire purchase wiring has received rather more attention than in previous years, but the results can hardly be termed satisfactory. The uncertainty of the tenant moving before anything like an adequate return [illegible] money has been arrived at, and the many other unsatisfactory conditions surrounding tenants of the class so wired, has resulted in most supply authorities keeping aloof, although success seems to have been achieved in some towns. The proposal made by the London County Council in Parliament that all the London borough councils owning electricity works should embark upon municipal wiring was defeated, the London electrical contractors offering most strenuous opposition. Many towns have authority to spend money for wiring and fitting houses of electric supply, but in almost all cases the work is done through a contractor.

Toward the end of the year a proposition was made by the Engineering Standards Committee that a conference of glow-lamp makers should be held for the purpose of arriving at some degree of standardization in incandescent lamps. This was acted upon, but the result cannot be made known yet. The Cable Makers' Association, which consists of the majority of the leading firms, agreed upon a standard form of tender for cables during the year.

Two other important features of the year have been the large number of provisional electric-light-

ing orders which have been revoked by the Board of Trade, and the failure of the Government, for the third time, to secure the passing of the Supply of Electricity Bill, which would have introduced several very necessary reforms into the present condition of legislation. With regard to provisional orders, many urban councils secured orders years ago, and they shelved them with the sole idea of keeping others out, but yet not intending to put them into force themselves. The policy of the Board of Trade is fast breaking down this condition of things.

TELEPHONY, TELEGRAPHY AND SPACE TELEGRAPHY.

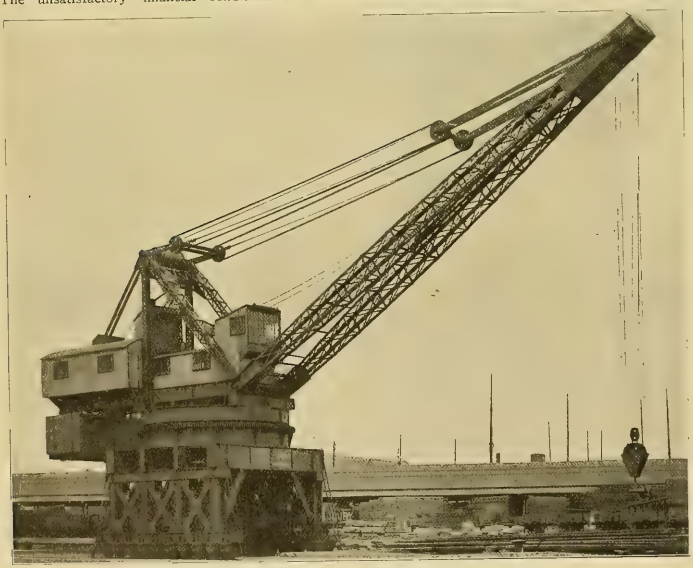
An important event has been the ratification of the agreement between the National Telephone Company and the government, by which the undertaking of the former will be acquired in 1911 upon agreed terms, as set out in the parliamentary agreement. These terms have been much criticized, but all those who have thought about the matter agree that the best interests of the telephone-using public have been considered thereby. Many extreme people have argued that inasmuch as the telephone company could not, by law, carry on its business after 1911, and that, furthermore, the postmaster-general was not bound to acquire its business on any terms whatever, no agreement involving purchase money should have been entered into. It will at once be seen, however, that to avoid utter stagnation of the telephone service of the country—a wholly impossible proposition—the government was forced to one of two courses, viz., the laying down of a separate system, which would mean an almost wicked waste of money, so great would have been the duplication of plant, or an amicable agreement with the company. This latter suggested itself as the most common-sense course, and Parliament, together with a big majority of the public, agreed. The outstanding question now is the position of the few local authorities which have taken up telephony. This has not yet been decided, but so bare was the response to the offer contained in the Telephone Act of 1899, to allow municipalities to erect competing exchanges, that the responsible officials of the postmaster-general are firmly convinced that they should all be absorbed by the government when their licenses expire.

The unsatisfactory financial conditions of the Wheatstone working between England and Teheran (Persia) was put into operation, and the results have been quite satisfactory. The Murray type-printing telegraph has again been prominent, the British government having adopted it. McDonald Murray, the inventor of the system, received a premium for a paper on the subject before the Institution of Electrical Engineers.

A standard of telegraph material has been worked at by the Engineering Standards Committee, and a report has been issued in connection therewith.

For the last two or three years the Marconi Wireless Telegraph Company has not failed to introduce some new practical application of its system which very quickly disappeared. The year 1905 has been no exception, for after continued negotiations with the postmaster-general, it was agreed to accept wireless messages at any postoffice for transmission by ordinary telegraph to certain specified ports, whence at scheduled times outward-bound liners could be reached by the Marconi operators. The system worked for a time, but was abandoned after a few months. The whole world is familiar with the exploits of the London Times steamer Haimun, fitted with the De Forest system, in the neighborhood of Port Arthur during the Russo-Japanese war, and the eminently successful results obtained. The very success of this new departure in war chronicling led to its being discontinued by request. Some interesting work is being carried out by the Lodge-Muirhead syndicate, which is working well with the British government. The system has also been adopted by one of the railway companies in its cross-Channel steamer service with pronounced success. The Admiralty has entered into an agreement with the Marconi company for connecting a number of lightships with the mainland.

The first return issued by the government since it assumed control of the wireless telegraph industry here has been put out and makes interesting reading. The return was dated March 31, 1905. There were 78 applications for licenses of the various classes, and of these two were made by American companies, viz., the De Forest company and the National Electric Signaling Company. At the time of the report no definite arrangements had been come to between the parties, but a license for another site was offered in one case, and a license is said to be in course of execution in the case of the National Signaling company for a site on the Irish coast. In both cases the license would be for experimental work between Great Britain and America.



50-TON ELECTRIC TRAVELING CRANE AT SOUTHAMPTON DOCKS.

government Pacific Cable and some differences between the Pacific Cable Board and the competing telegraph companies were the cause of a Pacific Cable conference in London. Although the exact decisions come to were not published—the conference was private—it is understood that something in the nature of an amicable arrangement was settled. The submarine telegraph companies have also been the cause of a deputation to the chancellor of the exchequer as to the high rates charged between London and Egypt, Africa, India and China, and it is satisfactory to note that concessions in this direction have been made. Direct

MISCELLANEOUS.

Illustrations herewith show a large electric crane and an electrically operated transporter bridge across the River Weaver in Cheshire, and they demonstrate two of the most interesting pieces of electrical engineering work that have been carried out during the year. Some figures as to the crane will be of use. It was designed and constructed for the London and Southwestern Railway Company's new graving dock at Southampton, and with the exception of the electrical equipment, which is German, it is wholly British made. It has a lifting capacity of 50 tons, and the following are the principal dimensions: Gauge between rail centers, 25 feet six inches; clearance under truck cross centers, 15 feet; diameter of roller path centers, 25 feet 6 inches; wheel base, 30 feet; length of jib, 85 feet; height of jib from ground level at

WIDNES-RUNCORN ELECTRICALLY OPERATED TRANSPORTER BRIDGE IN CHESHIRE, ENGLAND.

maximum radius, 60 feet; height from ground level at minimum radius, 103 feet. There are three 50-horsepower motors, one 80-horsepower motor and one 25-horsepower motor for the various operations of lifting, derricking, traveling and slewing. The net weight of the crane is about 250 tons, unloaded.

The Widnes-Runcorn transporter bridge will not need much description; the illustrations are almost self-explanatory. A separate power house has been erected and is seen in the end view of the bridge, together with the transporter car. The dynamos are gas-driven. The motors on the car, which is operated on a sort of tramway trolley principle, are 35 horsepower, the whole of the operations being controlled by a driver in the roof of the car.

Mention has already been made of the good work that has been carried out by the Engineering Standards Committee, but the National Physical Laboratory has been in rather hot water, owing to the feeling that has been engendered in private testing undertakings that the laboratory officials have exceeded the scope of their mandate. In other words, that state-aided competition is being carried on—a thing not contemplated at the time of the inauguration of the laboratory.

The electrical exhibition at Olympia, in London, has had most beneficial results, and very great interest is now being taken in electric heating and cooking, to mention only one result. The general result exceeded anticipations.

Municipal trading, if anything, has been checked, so far as new undertakings are concerned, and especially in connection with trading outside the area. Parliament has very decided views upon this matter, and it is almost hopeless at present to ask for such powers.

Technical education, although not quite so prominent as in past years, has again been well to the front, and the establishment of the British Science Guild has also indirectly helped the matter forward. The facilities now are far greater than ever, and to quote only one instance, $50,000 was given by an anonymous donor toward the completion of the electrical department of the new Birmingham University.

Space forbids detailed reference to the several improvements in single-phase motors, the development in the design of gas suction plants and small oil generating sets, etc., but a real improvement in these and many other directions has been manifest.

COLONIAL.

As usual it will be impossible to give anything approaching an exhaustive review of what has taken place in the colonies during the year, and if attention is drawn to a few of the leading features this must suffice. At the moment of writing there is much discussion of the proposal to generate electricity at the Victoria Falls in South Africa and to transmit it a distance of 700 miles to the Rand. I believe that English, Continental and American engineers are agreed as to the technical possibilities of the scheme, but as to how far they agree as to the adoption of the high-tension continuous-current

system, which the financial syndicate at the back of the project seems to favor, I am not aware.

In Australia, South Africa and elsewhere considerable extensions to existing electricity works have been made, and many new works, principally municipal, have been put into operation. The Pretoria (South Africa) corporation has passed a bill authorizing the expenditure of $5,000,000 for electric supply. At Sydney (N. S. W.) $1,125,000 has been voted for extensions for both tramways and lighting. A new three-phase plant has been erected at Launceston, Tasmania, and a scheme involving $275,000 has been authorized for Auckland (N. Z.). In New Zealand, also, a report as to the waterpower resources of the country for the purposes of generating electricity shows that there exists sufficient for almost all the needs of those islands, and the future will without doubt see this report acted upon.

A vast extension of the use of electricity in its application to mining purposes has occurred, and for very few purposes now is electricity not adapted. In the development of electric energy as a power agent in other directions it should be noted that at the Table Bay Harbor no less than

ELECTRICAL PROGRESS OF 1905 ON THE CONTINENT.

By [illegible]

Business has been generally good on the Continent during the last year and the leading electrical factories have been supplying considerable apparatus, owing to the flourishing condition of the steam-turbine and hydroelectric industries and the steady development of electric traction. In Germany a large syndicate has been formed to manufacture the new Zoelly steam turbine. This includes the Krupp, Augsburg-Nuremburg, North German Lloyd, Escher-Wyss and Siemens-Schuckert firms. The business in France is to be carried on by the Schneider firm of Creusot. Outside of this combine we find the Brown-Boveri Company, which is making a great number of steam turbines on the Parsons system in Switzerland and also in Germany. The Allgemeine Elektricitats Gesellschaft of Berlin is also building the turbine.

The French Thomson-Houston Company has turned out a large amount of electrical machinery at its Paris works. Part of it went to supply the hydraulic plants on the coast near Nice and the

END VIEW OF WIDNES-RUNCORN TRANSPORTER BRIDGE, CHESHIRE, ENGLAND.

21 electric cranes, manufactured in England, have been erected, costing some $1,750,000. And this brings me to the point that British manufacturers are greatly in the ascendancy in the large majority of the colonies. In Calcutta the trams have been converted to electric traction by British plant and British contractors; similarly at Hong Kong, Singapore and Bangkok. Again, at Johannesburg, some very large continuous-current dynamos, made in the Midlands, have been erected, and they will be driven by gas engines. At Durban the corporation is so far up with the times that funeral tram cars are in existence. The South Australian tramways, to the extent of 70 miles, are being converted from horse haulage, as also are the Adelaide lines. The Stone system of train lighting has been adopted on the New South Wales railways.

The Australian colonies also had a big share in the Pacific Cable conference in London. The competition of the cable companies is so keen that a pooling of the receipts was suggested, but a later proposal is to nationalize the company's eastern lines. Trunk-line telephony is also making headway, and Melbourne and Sydney were joined up at a cost of $250,000.

All this is sufficient indication—as the facts are—that if anything, owing to the commencement of development being later, the electrical industry in the British colonies is more active than at home.

extensive tramway lines which are now running on the Mediterranean coast. The addition to the Metropolitan station in Paris required several groups of large capacity, and the increase in the subway keeps up the demand for motor equipments. Some of these have also been supplied by the French Westinghouse Company. The latter has erected a large hydraulic plant at Clermont-Ferrand, and is also to equip several large electric railroads in Italy. A number of companies in Switzerland and Germany are making trials of single-phase or three-phase systems for railroad lines. Among these are the Oerlikon and Siemens-Schuckert for Switzerland, while the Union Electric Company intends to equip the Hamburg electric road. The Allgemeine and the Siemens-Schuckert companies have made a combine for obtaining the concession for the Cologne-Düsseldorf railway.

Stations and Power Transmission.

Two hydraulic plants of large capacity are to be erected in the Lyons region for obtaining the additional current which the city now requires for lighting and power, including the extensions of the tramway lines. When finished these will figure among the largest hydraulic stations in France. The first is located at Moutiers, and it is to use the high-tension constant-current series sys-

[illegible] plant [illegible] M. [illegible] The method [illegible] miles long, and a fall [illegible] week in the highest [illegible] rent. Here the current [illegible] of their machines run at [illegible] The station will contain [illegible] The second hydraulic plant [illegible] the Romanche River and [illegible] to have three turbines and [illegible] kilowatts each, and [illegible] miles long running to [illegible] fit is supplied by the [illegible]

Considerable waterpower is being [illegible] the Alpine region near the Mediterranean coast of France to supply Nice, Monte Carlo and other towns in the region, also the extensive system of tramways along the coast. Besides the plant which have been already erected, I may mention a new one which the Thomson-Houston Company is installed at Plan du Var for the Mediterranean Coast Electric Company. When finished the station will have two turbine and generator sets, like the one shown in the illustration, of 600 kilowatts each. Turbines of the Francis type, built by Escher, Wyss & Co., are coupled to three-phase 11,000-volt alternators.

The Ganz Company of Budapest has lately installed a hydraulic plant which [illegible] new the border in Bohemia. It furnishes current mainly to the extensive paper and cellulose factory of the J. Spiro Company at Krummau as well as to some of the neighboring towns. The fall at Hohenfurth is about 300 feet. When complete the station will contain five turbine sets using Ganz three-phase alternators of 2,500 kilowatts each. The overhead line which runs to Krummau is operated at 15,000 volts, and the step-down transformers lower it to 300 volts. The two large paper factories use a number of three-phase motors ranging from 100 horsepower down.

The gas company of Clermont-Ferrand, which is one of the large towns of France in the Auvergne region, put in a large hydraulic plant not long ago in order to secure the increase of current which the town requires. The plant is located on the Sioule River about 20 miles off, and the outfit will include six turbo-alternator sets of 1,200 horsepower each, using Escher-Wyss turbines (75 foot fall) and alternators which have been built at the Havre works of the French Westinghouse Company. The overhead line uses 20,000 volts, which is furnished by oil transformers. At Clermont there is a large sub-station containing similar transformers for reducing to 3,000 volts.

Among the hydraulic plants in Italy which are to be erected I may mention the Naples station, which is to be situated on the Volturno, and is expected to give 3,000 horsepower at the start. An overhead line will run to Naples, operating at 45,000 volts, and a sub-station will deliver current for lighting and for the tramways. Rome is to have a new power plant, according to the project of the Sila Industrial Company. The current will be used mainly for operating some of the local traction lines. The Sila River affords a 2,000-foot head of water, and it is expected to obtain 6,000 horsepower. A new station on the Cellina River is to furnish a large amount of current for the city of Venice, where an increase of power has been needed for some time.

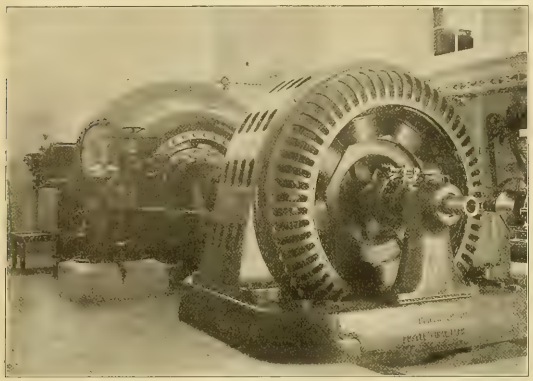
Development of the Steam Turbine.

The station which is now building in the suburbs of Paris, at St. Denis, will be one of the largest steam-turbine plants in Europe. It is intended to supply current for the Paris subway as well as for different surface traction lines and some of the city lighting circuits. The station consists of a three-part building lying on the Seine, and the main hall for the machines is 325 feet long and 70 feet wide. The boiler room is to have 20 Babcock & Wilcox boilers, each having 500 square yards heating surface. Special mechanical devices, motor-driven conveyors, etc., will handle the coal as it comes on the barges. The dynamo hall is laid out to contain four steam-turbine and dynamo groups of the Brown-Boveri type, built at the Swiss factory of Baden. Each of these sets will have a capacity of 10,000 horsepower. The alternators are of the three-phase 10,000-volt type, working at 25 cycles and 750 revolutions per minute.

A large steam-turbine set on the same system is now running in the Essen plant, Germany, and

it operates at 1,000 revolutions per minute. The alternator is of the 5,000-kilowatt three-phase pattern and delivers 5,000 volts at 50 cycles. The same turbine, which has a capacity of 8,000 horsepower, also drives a direct-current machine of 1,500 kilowatts and 600 volts. A good speed regulation is secured here, and it is said that there is but five per cent. variation between no load and full load.

Among other steam-turbine plants in Germany I may mention the large unit which has been installed in the Rheno-Westphalian station. This is a 10,000-horsepower group and has a three-phase



ONE UNIT OF PLAN DU VAR HYDRO-ELECTRIC STATION NEAR MEDITERRANEAN COAST OF FRANCE.

5,000-kilowatt alternator working at 5,000 volts besides a 1,500-kilowatt direct-current machine at 600 volts. The speed is 1,000 revolutions per minute. The turbine set with the two machines occupies a length of 65 feet and weighs some 200 tons. It was built at the Mannheim factory of the Brown-Boveri Company.

To show the development of the steam turbine in Europe I may mention some of the large plants which the above firm has installed in the different cities up to the present. The largest equipment in France consists of four 6,000-kilowatt turbo-alternator sets which are running in the plant belonging to the Compagnie Russo-Francaise at St. Ouen in the suburbs of Paris. In Switzerland we find a 2,400-kilowatt set at Beznau and one of 1,500 kilowatts in the Rheinfelden station. Russia has two large groups of 2,000 kilowatts each in the St. Petersburg city plant, while the Moscow station has lately installed a group of the same

MOTOR-CAR AND TRAILER ON BERTHOUD-THOUNE ELECTRIC RAILWAY IN SWITZERLAND.

size, and a 1,500-kilowatt set is running at Kieff. Besides the Essen plant mentioned above we find in Germany two large sets of 3,000 kilowatts each in the municipal station of Frankfort, a 2,000-kilowatt group at Cologne and many others of large size. One of the largest steam-turbine sets on the Continent has lately been installed at the Bruckhausen mines in Germany, and it delivers some 6,000 kilowatts on the three-phase 5,600-volt system for operating the mining machines. A large textile factory at Orjechow, Russia, uses a thousand-kilowatt set.

The French Thomson-Houston Company is to supply a steam-turbine outfit for the large plant which the Gas and Electric Lighting Company proposes to erect at Marseilles. It will furnish a large amount of current for the city circuits and also for the tramway lines which are being extended. The new plant will be built alongside the gas works, and when finished it will contain six steam-driven sets besides three units (300-kilowatt), which will have Curtis steam turbines. The Thomson-Houston Company has adopted the Curtis turbine and expects to use it in the future on the Continent. These groups will have a capacity of 1,000 kilowatts and operate at 50 cycles. The other six units of the station will be run by steam engines and have a capacity of 1,000 kilowatts.

Garbage-burning Plant in Zurich.

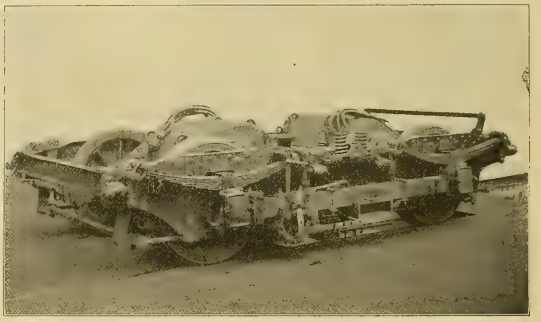
A successful plant is now running at Zurich in which the steam is furnished by garbage-consuming furnaces. There are 12 of these furnaces, which have been built by the Horsfall Company of Leeds. In 24 hours they will consume 150 tons of waste. A system of motor-driven conveyors and cranes is used to feed the furnaces, and electric fans produce a strong draught for the combustion. The hot gases from the furnaces go by a main conduit to two boilers, which have 200 square yards heating surface each. The steam is superheated and supplied to a Brown-Boveri steam-turbine group which is placed in the dynamo room. The alternator, of the three-phase 50-cycle type, is designed for 3,000 revolutions and furnishes 500 kilowatts at 220 volts. The turbine set not only delivers current for running the motors of the furnace plant but also supplies a certain amount to the city mains.

Moabit Station in Berlin.

Among the large electric stations of Berlin is the Moabit plant, which is located in the northwestern part of the city between the Spandau Canal and the Hamburg railroad. At present the station has four engine-driven units of 3,500 horsepower each, and it is expected to install four new sets of 6,000 horsepower before long, which will give the plant nearly 40,000 horsepower. Triple-expansion Sulzer engines, built at Winterthür, Switzerland, are used here. The boiler room is laid out on the most modern principles and contains 35 boilers at present, having 330 square yards heating surface each. The motor-driven apparatus for handling the coal and ashes is most complete, and in a 10-hour day it takes care of 380 tons of coal. The engines, which are of the triple-expansion type, with 60-inch stroke and 85 revolutions, have mounted on the main shaft a 3,000-kilowatt alternator having a 70-pole interior field. An extensive switchboard is used to handle the different circuits of the station.

Traction.

The question of using electric traction upon the railroads is one which has been occupying the attention of the different governments or private railroad companies in nearly all the leading countries of Europe. In many cases experiments are being carried out upon short lines to show what can be expected of single-phase or three-phase systems. During the year a number of electric railroads of greater or less length have been installed or completed, and their successful working has had a favorable influence on the electrifying of the main railroad lines. This is especially true in countries like Switzerland and Italy, where a large amount of hydraulic power can be secured for operating the roads.



NEW MOTOR TRUCK USED ON PARIS METROPOLITAN RAILWAY.

The Austrian government is considering the question of electrifying the main lines and using hydraulic power to operate them, especially the roads which lie in the region of the Alps. The railroad companies are working in connection with the government to develop this idea, and the first step will be to obtain accurate data as to which of the falls will be best adapted for the purpose. The Swedish government is also interested in the question, and experiments are now being made with a single-phase locomotive built by the Westinghouse company. An overhead trolley system using voltages varying from 18,000 to 3,000 volts is proposed. Oil transformers mounted on the locomotive will reduce the voltage. On each of the two axles is placed a single-phase 150-horsepower motor. Government engineers are overseeing the trials at present. In Switzerland, where the interest taken in the question is probably the greatest, the Oerlikon and Siemens-Schuckert companies have made an agreement in relation to carrying on the preliminary work and making experiments which are to lead to the electrifying of the Swiss railroads. For some time past the Oerlikon company has been working under the direction of the government, and the Seebach-Wittingen line has been allotted to it in order to carry out a series of experiments with locomotives using 15,000 volts. The first trials will be made over a two-mile section from Seebach to Affolten. At the same time the Siemens-Schuckert firm has its experience of the Berlin-Zossen experimental road to aid in solving the problem.

In Germany a number of projects for high-speed electric railroads are on foot. The Allgemeine company and the Siemens-Schuckert company have lately made a combine in order to secure the concession for a high-speed line from Cologne to Düsseldorf. The government is also considering a project for a direct line between Berlin and Hamburg, using high-speed trains, which will run between the two cities without stopping, at 80 or 90 miles an hour. On one proposed system such a line would cost $20,000,000 for a single track, while another project which calls for double track gives $40,000,000 as the cost. Belgium is also interested in high-speed roads, and a recent project relates to a direct line from Louvain to the Ger-

man frontier, with trains running at 80 miles an hour, so as to reduce the time between Brussels and Aix la Chapelle. Here the cost is figured at $15,000,000.

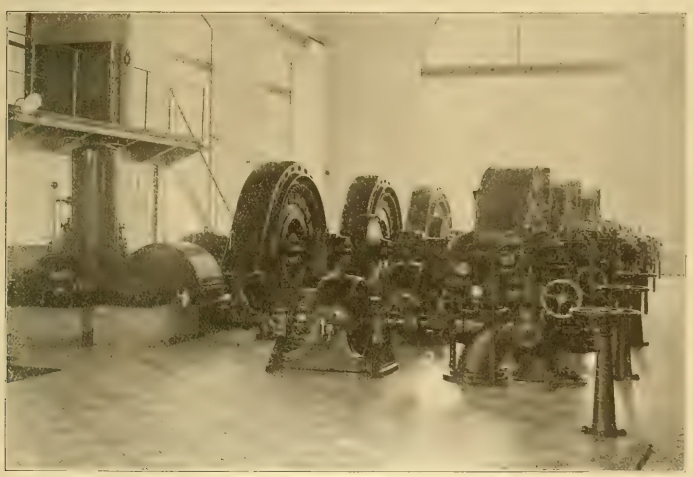
In relation to short lines of standard or narrow-gauge electric railroad, one notes a considerable progress during the year on the Continent, both as to the increase of traffic and addition of new material on the already existing lines, as well as the construction of a number of new roads. A very successful standard-guage road in Switzerland is the line which connects across between two of the main railroad lines, and runs between Berthoud on the Zurich Geneva railroad, and the station of Thoune, on the Berne Interlaken road. The new electric road now has a large traffic, as it gives a direct connection between the north or east of Switzerland and the Bernese Oberland. Motor cars are used with trailers to form the trains, as shown in the illustration. The line is about 25 miles long and uses current from a hydraulic plant. It is an example of the use of the three-phase system with 750 volts on the trolley. Brown-Boveri electrical outfits are used here. The freight trains are drawn by electric locomotives carrying two 150-horsepower motors.

An important line in Greece, running from Athens to the coast, has been equipped by the Thomson Houston company; it uses motor cars and trailers. Several new lines on the single-phase system are to be built in Italy by the Westinghouse company. Among these is a 35-mile road from Rome to Civita Castellana, using 6,000 volts.

Electric trains are now running on the Orleans company's tracks in the suburbs of Paris as far as Juvisy, 12 miles, where the electric line uses the two outer tracks, and the steam trains of the main road run on the two inner tracks. Current from the Ivry plant is transformed in three substations to 600 volts direct current for the locomotives and motor cars. The latter are fitted with four Thomson-Houston motors of 270 horsepower.

The Berlin subway is to have a new section which will be 12 miles long and will cost some $12,000,000, while the present subway is also being extended. Turning to the Paris subway, the last year has seen the opening up of a new section, while several other sections are under way. The line will cross the Seine for the first time upon two bridges, and at present a tunnel is being laid under the river for a newer portion. The Westinghouse and Thomson-Houston companies are furnishing the material for the new trains. A picture shows one of the new trucks for the motor cars which the latter company furnished. This truck carries two 175-horsepower motors.

HOHENFELTH HYDRO-ELECTRIC PLANT IN BOHEMIA



SIOULE HYDRO-ELECTRIC PLANT FOR TOWN OF CLERMONT-FERRAND.

Electric Lighting.

The new tantalum lamps seem to have met with some success during the year, as the Siemens & Halske firm is said to have already sold more than 100,000 of them. It appears that they should be run as much as possible on direct current, where they have a longer life and less blackening than with alternating current. Official tests made at Vienna show that a 25-candlepower lamp gave at first 22.35 candlepower, and after 600 hours 24.6 candlepower; at 1,200 hours it still held at 23.7 used to form filaments, and Professor Wedding recently brought out some new lamps in which the filament is obtained from a mixture of oxides of magnesium and zirconium. An improved mercury-vapor lamp is made in Germany by the Schott company of Jena. It consists of a glass tube seven or eight inches long having a carbon stopper at each end. Current is brought by platinum wires, fused in the glass, and enters the mercury which the tube contains. The new lamp is remarkable for giving a large amount of violet light. A mercury-vapor lamp having a quartz tube has also been placed on the market by the Heraeus Company.

Space Telegraphy.

One notes considerable progress in space telegraphy during the year, and stations have been erected in nearly all the countries of Europe. The Telefunken Company is one of the most active in Germany Not long ago it installed an important system, which works between Berlin and Dresden, over 115 miles distance. The mast wires are placed upon four towers, and within the area so formed is located the electric station. The machines deliver alternating current at 15,000 volts on the primary. The electrical oscillations are very powerful, and there is no difficulty in sending the the island of Rhodes with Derna, a port situated on the African coast. The French Thomson-Houston company has lately brought out a system of apparatus, and already has stations erected in Germany, Sweden, Holland and other countries. It is already operating 20 coast stations in Germany alone, and has equipped 80 war vessels. In Russia there are five portable military stations working, and four in Austria.

Telegraphy and Telephony.

This year has seen the opening of the Paris-Rome telephone line, which is one of the most important in Europe, and conversation can now be carried on between these two cities. It is reported that G. Angelini, the chief engineer of Italian telegraphs, has invented a new form of microphone transmitter, or rather an improvement in the granulated-carbon microphone, and that he used it on the Rome-Brussels line, which has not as yet been covered, even by the most powerful instruments. The new transmitter gave good results in this case. It is said to be of a simple construction and can be adapted to any line.

The new telephone cable which is to be laid in Lake Constance will use the Pupin coil system. The three governments of Wurtemberg, Bavaria and Switzerland have made an agreement in relation to the new cable. It has been ordered from the Siemens & Halske works of Berlin, and is some nine miles in length. The Pupin system is also to be adopted on the new telephone line which will run from Vienna to Innsprück, over a distance of 340 miles. The line consists of three-millimeter bronze wire, and is mostly overhead The Siemens & Halske factory at Vienna furnishes the coils, and they will be spaced 2½ miles apart on the overhead portion.

The Rowland rapid telegraph has proved very successful on the Continent during the year. It has been in use on the Rome-Naples line, which has a very heavy traffic, and the Italian government gives a very favorable opinion of the system in its last report. The same company is making negotiations in Germany, in order to have the octoplex system used on the Berlin-Hamburg and the Berlin-Frankfort lines.

Chicago Elevated Railway Traffic.

Traffic on the elevated railways of Chicago for December continued good. Compared with December 1904 the percentage of increase in the daily number of passengers carried was: Metropolitan, 12.60 per cent.; Northwestern, 11.12 per cent.; South Side, 9.81 per cent. The average daily number of passengers carried by these roads in 1905 and the percentage of increase which that number represents over the figures for 1904 is as follows: Metropolitan, 124,271, 9.30 per cent.; Northwestern, 77,366, 9.89 per cent.; South Side, 90,301, 8.47 per cent.

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CONTENTS OF THIS NUMBER.

Fisk Street Station of the Commonwealth Electric Company, Chicago. With Supplement. Illustrated 1, 2, 3, 4, 5, 6
"A Power Plant" 6
Electrical Progress in the United States in 1905. By Henry H. Norris. Illustrated 6, 7, 8, 9
Electrical Industry in Great Britain in 1905. Illustrated 10, 11, 12, 13
Electrical Progress of 1905 on the Continent. By A. De Courcy. Illustrated 13, 14, 15
Chicago Elevated Railway Traffic 15
Editorial 16
Statistics of Electrical Manufactures 17
Mortuary Record of 1905 18
Electrical Exports of 1905 18
November Exports 18
American Association for the Advancement of Science 18, 19
Death of Charles T. Yerkes. Portrait 19
Northwestern Convention in Chicago 19
Chicago Gas Inquiry 19
Illinois Central Electrification May be Hastened 19
A "Missing Link" in Electric Railroading Supplied. Illustrated 19
Mr. Arnold Elected President of the Western Society 19
Business of the Year 1905 in Review 20, 21
"Poke Bonnet" Reflector for Window Lighting. Illustrated 21
Chicago Street-railway Situation 21
Richardson Lighting Outfit. Illustrated 21
Universal Space-telegraph Intercepter for Signal Service 21
Westinghouse 1906 Electric Fans. Illustrated 22
Heating and Lighting Plant at Parkville, Mo. Illustrated 23
Ohio and Indiana Interurban Associations May be Merged 23
Labor-saving Receptacle for Signs. Illustrated 23
Coming Exhibition of Balloons and Air Ships 23, 24
"International" Switchboard Instruments and Their Makers. Illustrated 24
Mayor Dunne's Views on Pending Municipal Problems 24, 25
New Stromberg-Carlson Transmitter. Illustrated 25
General Telephone News 25
Manufacturers and Dealers 25

DEPARTMENTS.

Correspondence 26, 27
Great Britain 26
New York 26
Dominion of Canada 26
Pacific Slope 26
Ohio 26, 27
Personal 27
Electric Lighting 27
Electric Railways 27
Publications 27, 28
Miscellaneous 28
Trade News 28
Business 28
Illustrated Electrical Patent Record 28, 29, 30

DATES AHEAD.

Railway Signal Association (annual meeting), Grand Union Hotel, New York city, January 9, 1906.

Indiana Electric Railway Association (annual meeting), Claypool Hotel, Indianapolis, January 11th.

Automobile Club of America (annual exhibition), Sixty-ninth Regiment Armory, New York city, January 13th to 20th.

Chicago Electrical Show (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

American Electrical Salesmen's Association (first annual meeting), Grand Pacific Hotel, Chicago, January 20th, 9 a. m.

Nebraska Independent Telephone Association (annual convention), Lindell Hotel, Lincoln, Neb., January 23d and 24th.

Ohio Interurban Railway Association (annual meeting), Algonquin Hotel, Dayton, Ohio, January 25th.

THE YEAR 1905 was a prosperous one for the electrical interests generally, not only at home but abroad. In the United States, as is shown by the statistical statement on the opposite page, the value of electrical and auxiliary manufactures (meaning by "auxiliary" only such as are necessary in the employment of electricity) was over 16 per cent. greater in 1905 than in 1904. The totals were: 1904, $230,510,000; 1905; $268,075,000. This rate of growth is accentuated by the fact that 1904 was an "off" year, falling behind the year before in value of electrical manufactures. Comparing 1903 and 1905, the increase is seen to be 14 per cent., which, while somewhat less, is nevertheless gratifying. In the matter of electrical exports from the United States, too, the year 1905 seems to have made a high-water mark, although the figures for December are not available at this writing. With the missing month estimated, the total is $12,552,360, which is larger than for any previous year.

While the year has been one of advance in all departments, there has been no striking departure from existing practice, although apparatus and methods previously advocated, such as the tantalum lamp, the use of the direct current for long-distance power transmission and single-phase locomotives have attracted much attention.

In the electric-lighting field the nearest approach to a novelty has been the tantalum lamp, which was, however, mentioned in the Western Electrician's New Years number of 1905 (the first reference, we believe, in an American electrical journal), so that it belongs, strictly speaking, to 1904. Mr. De Courcy, in his article in this issue on "Electrical Progress of 1905 on the Continent," notes the assertion that 100,000 of these lamps have been sold in Germany. Tantalum lamps are also commercially available in England, but not yet, in quantities, in this country.

The flame-arc lamp is making friends in localities where it can be used; the osmium lamp continues to excite discussion; the Nernst and mercury-vapor lamps both show healthy growth; and the year has been marked by the appearance of an improved "metallized" carbon filament which is put forward as resulting in greater efficiency, especially in incandescent lamps of the larger sizes.

Gas interests, both in respect to light and power, have been more active than in former years, but fortunately there has been a conspicuous awakening of central-station companies also, largely due to the efforts of the rejuvenated National Electric Light Association, and campaigns for new business and the study of the manufacture and marketing of electricity as a product now receive more intelligent attention than was formerly the case.

Municipal ownership of public utilities attracted more attention in the United States during 1905 than ever before. Chicago elected a municipal-ownership mayor. New York almost did so; in fact, there are many residents of that city who insist that a fair count of the votes would show a plurality for the municipal-ownership candidate. Cleveland has for its chief magistrate one of the leading apostles of the cult. All over the country the question has been agitated and debated, and a very strong popular interest has been aroused for municipalization. But there are some signs of a revulsion of feeling, and this the private-ownership advocates are endeavoring to encourage by a campaign of education.

Electric railroading has gone forward with great impetus during the year. The work on the New York Central terminal electrification in New York city is well advanced toward completion. The great electric locomotive (direct-current) to be employed in this work has nobly withstood all its tests. The New York, New Haven and Hartford Railroad made the interesting decision to employ single-phase locomotives entering the same terminal. This brought about a controversy that reminds one of the old days, when all Gaul was divided into two parts—direct current and alternating current. Happily, there seems to be no question that either type of apparatus will fail to perform the duty required of it. In all parts of the country, from the Atlantic to the Pacific, the electric railway is being extended. Steam-railroad companies, in not a few cases, are no longer such, but rather steam-railroad and electric-railway companies. The electric railway is no more merely a rank outsider; it has been taken to the bosom of its elder brother. In Chicago the interesting electric-railway freight tunnels have been greatly extended during the year. Considerable material has been moved through the tunnels, which are not, however, fairly in operation as yet.

Power transmission continued to press forward, if the expression may be allowed, during 1905. The work at Niagara, on the Pacific Slope and in other centers was pushed with unabated vigor. Following the meeting of the British Association in South Africa, there was renewed discussion of the proposal to transmit power over a distance of 745 miles from Victoria Falls on the Zambesi River to Johannesburg. There is, however, grave doubt of the practicability of this scheme from the commercial point of view. It is also suggested that direct current may be used, which would be at variance with American practice. But in France a 115-mile, 57,000-volt direct-current transmission system is to be built from Moutiers to Lyons after the design of Mr. Thury, whose work on the similar St. Maurice-Lausanne plant is well known. This will be the most ambitious direct-current transmission in existence, and the practical results will be awaited with great interest. In the United States polyphase transmission is used almost exclusively.

The steam turbine continues its triumphant march in the electric power stations of the world. The first large steam turbine in the United States was installed in the Fisk Street Station of the Commonwealth Electric Company in Chicago and was first put in operation October 5, 1903. Last year it is estimated that the value of steam turbines sold in the United States to drive electrical generators was $4,000,000. The leading feature of this issue of the Western Electrician is the first complete description which has been published of the Fisk Street Station. This great generating plant has now four turbo-generator units which have carried a maximum load of 28,500 kilowatts. Four more, larger machines, are on order, and will be installed as soon as possible, bringing the maximum capacity of the power house up to 76,500 kilowatts, while the total ultimate maximum capacity will be 156,000 kilowatts, or 200,000 horsepower.

The gas engine is also pushing to the front, being made in units of constantly increasing size, and there are not wanting those who predict that, with producer plant, it will yet prove to be a serious rival of the steam turbine, which, even now, seems to have distanced the reciprocating engine as a prime mover in large steam power plants.

Telephonic growth was more marked in 1905, in the United States, than in 1904. The automatic system continues to expand, several large exchanges built last year being provided with the apparatus which takes the eplace of operators. In Europe important events were the reaching of an agreement between the English government and the National Telephone Company, by which the formere will take over the latter's system in 1911, and the opening of the Paris-Rome long-distance line. Some progress is reported in rapid systems of telegraphy, while space telegraphy has demonstrated its usefulness in such widely separated fields of endeavor as saving life at sea and naval warfare.

Several subjects which still remain to be mentioned must be touched upon briefly. One relates to the subject of standardization of electrical apparatus, which is given more earnest discussion. In England, especially, the standardization of incandescent lamps has received attention. It is evident that there will be no lack of work for the International Electrical Standardizing Conference—when it meets.

That electrical pioneers are not forgotten in Belgium after their death was shown by the unveiling of the monument to Zenobe Gramme last fall in Liège. Perhaps there is a monument to Joseph Henry in the United States, but at the moment it would puzzle us to say just where it is.

A large portion of the space in this New Years issue is devoted to articles reviewing the electrical history which the year 1905 has made. It is a year that will be classed among the "fat" years, and we hope that the year now entered upon will equal or surpass it.

STATISTICS OF ELECTRICAL MANUFACTURES.

The general prosperity of the country is well reflected in the increase of value of electrical and closely allied manufacture in the United States for 1905, as shown by the annual New Year estimates of the Western Electrician, given below in tabulated form. The total is $268,075,000, which, compared with the $230,510,000 of 1904, shows the large increase of $37,565,000, or over 16 per cent. It is to be remembered, however, that in 1904 there was a slight falling off in electrical and allied manufactures compared with the year before, so that the increase shown by the figures of last year is larger than it would have been were it not for the comparatively poor showing of 1904. Taking the period from January 1, 1904, to January 1, 1906, the increase was something over 14 per cent., which, distributed through the two years, shows a rate of growth which is not abnormal in the electrical business. Furthermore, the figures given express the value of the output in the various lines in dollars, so that prices as well as volume of product affect the result. But, no matter how the figures are analyzed, it is pleasing to reflect that the year just closed witnessed a larger total value of electrical apparatus and apparatus made necessary by the use of electricity than any year that preceded it.

In nearly every one of the classifications adopted for the following table there is shown a good gain and in some instances a surprising increase. Indeed, in only one item is there a marked decrease, and this is in reciprocating steam engines used to drive electrical machinery. Here the falling off is no doubt due to the advance of the steam turbine and perhaps of the gas engine. Reciprocating engine [illegible] 170,000, while gas [illegible] pare [illegible] team turbines [illegible] Cranes and hoists, electrically [illegible] a marked increase [illegible] both cases, however, the [illegible] excellent estimates [illegible] toplating and other electrolytic [illegible] other instances where the estimates [illegible] much greater, proportionately, than [illegible] the case of electric elevators the [illegible] ness is much greater than would be [illegible] one who has not made an [illegible] subject. It is also growing very [illegible] tively as the electrolytic apparatus [illegible] possible that the value of output per [illegible] underestimated. Indeed, in all [illegible] more apt to be too low rather than too high. Continued experience in gathering information of this character inspires one with the fact that the United States is a big country and the electrical business is a big business.

Nernst lamps show an increase in value of output of over 100 per cent. This jumps well at first attention, but the authority for the figures is unimpeachable. The same may be said of mercury vapor lamps. In both cases the influence of price as well as volume of output is to be considered. Shafting, pulleys, clutches, etc., used in electrical stations, is another item that shows a large proportionate increase. But here, probably, there was an underestimate for 1904.

Space telegraphy shows an increase of but a little over five per cent. The practical utilization of this truly marvelous invention seems to be proceeding but slowly.

Telephone apparatus shows a good increase over the year before, although the figure is in nowise [illegible] avoiding duplication [illegible] are [illegible] but [illegible] number [illegible] reduced [illegible] the [illegible] over, that are [illegible] formation [illegible] of progress.

To the large number of [illegible] the [illegible] mitted to the [illegible] trician returns its heart [illegible]

WESTERN ELECTRICIAN'S ESTIMATES OF THE VALUE OF ELECTRICAL AND AUXILIARY MANUFACTURES IN THE UNITED STATES.

Articles.	For the Year: 1902.	1903.	1904.	1905.
Arc lamps and appurtenances	$ 1,935,000	$ 2,025,000	$ 2,200,000	$ 2,600,000
Auxiliary steam plant for electrical installations, such as pumps, condensers, separators, feed-water heaters, injectors, piping, etc	2,000,000	1,950,000	2,300,000	2,725,000
Bells, buzzers, push-buttons, call-boxes, annunciators	815,000	800,000	900,000	1,000,000
Belting used in electrical plants	615,000	575,000	500,000	550,000
Boilers for electrical plants (water-tube)	5,100,000	4,500,000	5,600,000	6,750,000
Boilers for electrical plants (other than water-tube)	2,400,000	2,000,000	2,800,000	2,850,000
Cables, underground, aerial and submarine	18,650,000	19,700,000	16,500,000	17,750,000
Carbons for lamps, batteries, brushes or other electrical purposes	2,300,000	2,600,000	3,100,000	3,600,000
Cars and trucks for electric railways	7,500,000	7,500,000	7,500,000	8,000,000
Circuit-breakers	300,000	1,200,000	1,350,000	1,450,000
Conduits (underground) and similar material	1,925,000	2,350,000	2,650,000	3,200,000
Conveyors, coal and ash, used in electrical plants	750,000	750,000	800,000	900,000
Cranes and hoists, electrically operated	3,500,000	4,750,000	3,875,000	5,250,000
Dynamos and motors, including parts of machines, boosters, rotary converters, motor-generators, etc., and all motor applications, such as automobiles, not specifically enumerated in this list	48,000,000	52,000,000	51,000,000	60,000,000
Electroplating and other electrolytic apparatus not elsewhere specified	275,000	300,000	250,000	300,000
Electrostatic machines, induction coils, medical sets, etc	325,000	425,000	550,000	575,000
Elevators, electric (mechanism only)	2,000,000	2,000,000	2,000,000	4,350,000
Engines, gas, gasoline or oil, used to drive electrical machinery	1,300,000	1,500,000	1,800,000	2,500,000
Engines, steam (reciprocating), used to drive electrical machinery	17,000,000	16,500,000	14,500,000	13,350,000
Fans, electrically operated and direct-connected	1,500,000	1,450,000	1,200,000	1,375,000
Fire-alarm apparatus, also burglar alarms, crossing indicators, etc	950,000	950,000	1,100,000	1,400,000
Fixtures for electric lighting	4,100,000	4,250,000	4,125,000	4,750,000
Fuses	185,000	250,000	300,000	650,000
Glassware, electrical	500,000	450,000	600,000	700,000
Heating and cooking apparatus, electrical	330,000	325,000	425,000	650,000
Incandescent lamps	5,000,000	5,400,000	5,750,000	6,625,000
Instruments for measurement and meters of all kinds; also ground detectors, scientific and laboratory apparatus, photometers, Leyden jars, X-ray outfits, etc	3,750,000	3,850,000	3,850,000	4,200,000
Insulating material, fiber, tape, etc	1,250,000	1,400,000	1,600,000	1,800,000
Insulators (glass and porcelain)	1,750,000	1,900,000	1,550,000	1,700,000
Interior wiring supplies, as tubing, interior conduit, molding, junction boxes, rosettes, outlet boxes, etc	1,000,000	1,950,000	1,975,000	2,250,000
Lightning arresters	425,000	470,000	450,000	500,000
Mercury-vapor lamps		30,000	60,000	125,000
Nernst lamps	350,000	450,000	425,000	880,000
Poles, cross-arms, brackets and pins	4,350,000	4,700,000	4,850,000	5,400,000
Primary batteries	685,000	775,000	800,000	1,200,000
Railway supplies, electric, such as trolleys and other contact devices, strain insulators, cross-overs, rail-bonds, etc	2,150,000	2,150,000	1,900,000	2,200,000
Rheostats, car controllers, motor starters, etc	3,200,000	3,400,000	2,850,000	3,250,000
Shafting, pulleys, clutches, etc., used in electrical generating plants	425,000	400,000	285,000	750,000
Sockets, switches, cut-outs	3,500,000	3,675,000	3,800,000	4,150,000
Space-telegraph apparatus	200,000	250,000	380,000	400,000
Steam turbines used to drive electrical machinery	500,000	1,200,000	2,500,000	4,000,000
Storage batteries, including those used on automobiles	4,500,000	5,000,000	5,000,000	6,200,000
Telegraph instruments and apparatus	200,000	200,000	265,000	300,000
Telephones, telephone switchboards and distinctively telephonic apparatus	21,000,000	19,500,000	17,200,000	19,200,000
Third rail for electric railways	500,000	500,000	715,000	750,000
Transformers, stationary	4,200,000	4,500,000	4,450,000	5,175,000
Waterwheels, used to drive electrical machinery	1,300,000	1,500,000	1,230,000	1,700,000
Welding apparatus, electric				95,000
Wire, bare	17,500,000	18,350,000	18,000,000	20,000,000
Wire, rubber covered	6,425,000	8,250,000	8,200,000	11,000,000
Wire, weatherproof	8,750,000	9,000,000	8,500,000	9,500,000
Wire, all other electrical	2,000,000	2,700,000	2,500,000	3,500,000
Miscellaneous, including switchboard frames and panels, signs and flashers, automatic stokers for electrical plants, wire guards, electrical tools and toys, projectors, solenoids, igniters for gas engines, waterwheel governors for hydro-electric plants, voltage regulators, electric drills, commutator compounds, lamp adjusters, etc	2,000,000	2,150,000	3,500,000	4,000,000
Total	$221,165,000	$234,750,000	$230,510,000	$268,075,000

Mortuary Record of 1905.

Deaths among men in the electrical field who had achieved more than ordinary distinction in their chosen profession were numerous in 1905. No great figure in the purely scientific world died during the year, but many who have been of benefit to the cause of applied science in electrical lines will no longer continue their work. Among these, one of some prominence in the manufacturing field, was Charles C. Warren, who was president of the Warren Electric Manufacturing Company, and who, with his son, was the designer of the well-known Warren alternator. Eugene F. Phillips of Phillipsdale, R. I., was a business man of wide electrical acquaintance. Charles T. Yerkes, who died but a few days ago, while not an engineer, did a great deal for street-railway interests, both in Chicago and in London. One man who did much in his time in the laying of submarine cables was Charles Cuttriss, who died while performing work of this character on the connecting link of the American Pacific Cable. William B. Rankine was a conspicuous figure in the financing and promoting of electrical enterprises, and it was due to him that the Niagara Falls Power Company was organized. The telephone industry lost in John I. Sabin and S. P. Sheerin two of its most useful workers, who had achieved noteworthy things in their respective spheres.

A list of the men connected in some way with electrical development in its various phases who died in 1905 is as follows:

January 7th.—Charles M. Wilkes of Chicago, mechanical engineer for D. H. Burnham & Co.; aged 47 years.

January 12th.—George S. Bowen of Elgin, Ill., who called the meeting in Chicago for the organization of the National Electric Light Association; president of the Elgin Electric Light Company in 1883; aged 76 years.

January 22d.—Victor Serrin of Neuilly-en-Tel, France, said to have been the inventor of the automatic regulator for arc lamps; aged 75 years.

January 25th.—Edward H. Mullin of Milburn, N. J., chief of the literary and advertising department of the General Electric Company; aged 46 years.

February.—S. L. Barriet of Dayton, Ohio, of the Barriet Electric Company, inventor and designer of electrical machinery.

February 19th.—Albon Man of Brooklyn, N. Y., associated with William E. Sawyer in the invention of the Sawyer-Man incandescent lamp; a lawyer by profession; aged 78 years.

February 22d.—Eugene F. Phillips of Phillipsdale, R. I., general manager of the American Electrical Works; aged 62 years.

March.—W. H. Durin of Cedar Rapids, Ia., well-known Independent telephone man.

March 1st.—Dudley B. Wick of Cleveland, chief engineer of the North Electric Company; aged 29 years.

March 4th.—Frederick A. La Roche of New York, former electrical inventor and business man; aged 46 years.

March 15th.—Edward C. Cockey of New York, superintendent of supplies and general purchasing agent of the Western Union Telegraph Company; aged 73 years.

March 21st.—Arthur B. Davis of Baltimore, general manager of the Viaduct Manufacturing Company; aged 74 years.

March 22d.—Charles C. Warren, Sandusky, Ohio, president of the Warren Electric Manufacturing Company; aged 70 years.

March 29th.—William O. Mundy of Pittsburg, commercial engineer of the Westinghouse Electric and Manufacturing Company; former master mechanic of the St. Louis Traction Company; aged 30 years.

April.—John Verity of Wellingford, England, of the firm of Verity & Sons, engaged in gas and electric-lighting enterprises; aged 41 years.

April 2d.—Charles Alexander Gerhardi of London, England, well-known in the field of telegraphy and submarine signaling; aged 68 years.

May 18th.—George W. Davenport of Niagara Falls, N. Y., third vice-president of the Niagara Falls Power Company; aged 47 years.

May 19th.—James P. McKinstry at Clifton Park, Cleveland, Ohio, treasurer of Cleveland Telephone Company, known as the father of the telephone in Cleveland; aged 63 years.

May 24th.—Dr. J. E. Lowes of Dayton, Ohio, a pioneer electric-railway man.

June 1st.—F. M. Haines of Fort Worth, Texas, general manager of the Northern Texas Traction Company; aged 45 years.

June 5th.—Edward A. Leslie of Brooklyn, N. Y., general manager of the Kings County Electric Light and Power Company; aged 56 years.

June 20th.—S. P. Sheerin of Indianapolis, prominent manager of Independent telephone properties.

July.—T. C. Wales, Jr., of Boston, chief electrical engineer of the New England Telephone and Telegraph Company; aged 35 years.

July.—William B. Dick of Sevenoaks, England, founder of the establishment of Dick, Kerr & Co. of London; aged 76 years.

July 6th.—William E. Matson of Lynn, Mass., head of the stationary-motor division of the General Electric Works at Lynn; aged 31 years.

July 13th.—J. Holt Gates of Chicago, electrical business man; aged 43 years.

July 28th.—Jacob C. Chamberlain of New York, electrical engineer.

August 12th.—William E. Langdon of Ramsgate, England, telegraph engineer; aged 73 years.

September 1st.—Edwin R. Whitney of Penacook, N. H., head of the Whitney Electric Instrument Company.

September 19th.—J. Frank Butterfield of Chicago, electrical contractor; aged 44 years.

September 30th.—William B. Rankine of Niagara Falls, N. Y., second vice-president of the Niagara Falls Power Company; aged 47 years.

October 10th.—John I. Sabin of San Francisco, prominent Bell telephone manager.

October 16th.—William D. Barnard of Philadelphia, Pa., a pioneer in the Independent telephone movement.

October 27th.—George C. Bailey of Chicago, general western manager of the John A. Roebling's Sons Company; aged 62 years.

November.—G. A. Grindle of London, late general manager of the Chloride Electrical Power Storage Company of London.

November 11th.—Frederic H. Betts of New York, patent lawyer; aged 62 years.

November 14th.—James C. Warner of Chicago, who made the original Morse telegraph instruments used in line between Washington and Baltimore; aged 82 years.

November 17th.—Charles Cuttriss, electrician of the Commercial Cable Company; aged 55 years.

November 26th.—William H. Edgar of Chicago, president of the Dearborn Drug and Chemical Works; aged 40 years.

November 27th.—Charles A. Thompson of Brooklyn, founder of the Thompson-Bonney Company, and electrical contractor; aged 44 years.

December 29th.—Charles T. Yerkes of London, large financial promoter of street-railway enterprises; aged 68 years.

Electrical Exports for 1905.

Electrical exports from the United States for the calendar year 1905 were the largest of any year on record. With complete figures for 11 months of the year, but estimating the month of December, for which month the official figures are not yet available, the total value of electrical exports from this country for the year just closed amounted to $12,552,370. This is $1,512,612 more than the total for 1904. For the last five years the total value of all electrical exports from the United States was as follows: 1905, $12,552,370; 1904, $11,039,758; 1903, $9,856,047; 1902, $9,997,105; 1901, $7,452,783.

The following table shows the value of electrical exports from the United States by months for the year 1905, the month of December, as stated, being estimated. The first column of figures represents goods classified as electrical appliances, which includes telegraph and telephone instruments; the second column is for electrical machinery, and the third gives the totals:

EXPORTS BY MONTHS FOR 1905.

	Appliances.	Machinery.	Total.
January	$ 387,610	$ 554,999	$ 942,609
February	418,483	637,479	1,055,962
March	505,705	620,496	1,126,201
April	443,478	564,883	1,008,361
May	430,692	806,702	1,237,394
June	472,154	629,256	1,101,410
July	373,191	597,483	970,674
August	542,270	589,233	1,131,503
September	386,887	465,882	852,769
October	454,224	527,669	981,893
November	546,856	547,738	1,004,594
*December	404,000	645,000	1,049,000
Total	$5,365,550	$7,186,820	$12,552,370

*Estimated.

Both appliances and machinery show a good gain as compared with 1904, in which year the figures were: Appliances, $4,363,992; machinery, $6,675,766. For the first 11 months of the year British North America was, as also in 1904, the largest purchaser of electrical machinery from the United States, having imported $1,783,850 worth. Japan, as in 1904, was second on the list with $1,180,033; Mexico was third with $947,228, and the United Kingdom, which previous to 1904 was the principal buyer of electrical machinery from the United States, was fourth, with $740,596.

NOVEMBER EXPORTS.

Electrical exports from the United States for the month of November reached a total value of $1,094,594, or $94,738 less than those of November, 1904. The decrease is due to a falling off in the amount of electrical machinery exported. Goods classified as electrical appliances, which include telegraph and telephone instruments, show a good increase over November, 1904. The figures compared are as follows. Electrical appliances—November, 1904, $459,476; November, 1905, $546,856. Electrical machinery—November, 1904, $729,856; November, 1905, $547,738.

The following-named countries were the principal buyers of electrical machinery from the United States in November, 1905, the figures given being the values of the respective purchases: British North America, $175,323; Japan, $102,757; Mexico, $69,269; United Kingdom, $46,356; Argentina, $22,556; Cuba, $13,180; Philippine Islands, $12,347; France, $11,748; Brazil, $10,452; British Africa, $9,305; British Australasia, $9,264; British East Indies, $7,071; Germany, $5,043; Hongkong, $2,184; Chinese Empire, $1,035.

American Association for the Advancement of Science.

The American Association for the Advancement of Science opened the initial session of its fifty-fifth annual meeting in New Orleans on December 29th, the first session being attended by the delegates of all sections. The retiring president, W. G. Farlow, was taken sick during the preceding night and was unable to attend the meeting. The attendance was small, there being barely 100 people in the auditorium of the Temple Sinai. Nearly all the various sections began on their programmes on the opening day, all but one holding their meetings at Tulane University. The annual address of the president was given on the night of the 29th, President Farlow being then able to speak.

At the opening session in the morning the Hon. Charles F. Buck welcomed the visitors in behalf of Governor Blanchard; Mayor Martin Behrman of New Orleans afterward welcomed the delegates to the city. President E. B. Craighead of Tulane University also extended a friendly greeting to the visitors in behalf of the schools and colleges of the city.

Section A, Mathematics and Astronomy, elected Prof. Howe of Cleveland a member of the council at its first meeting. Dr. Alexander Ziwet delivered his vice-presidential address upon "The Relation of Mechanics to Physics."

Section B, Physics, elected Prof. C. C. Trowbridge of the University of Wisconsin member of the council, and began its regular programme on December 30th.

Section C, Chemistry, at the opening session elected Dr. J. H. Long of Northwestern University member of the council. Several talks on subjects relating to chemistry were given at the opening session of this section.

Mechanical Science and Engineering supplied the topics discussed by Section D, which began its first session on the 29th by electing Prof. F. O. Marvin of the University of Kansas member of the council.

Section E, Geology and Geography, elected President C. R. Van Hise of the University of Wisconsin member of the council.

Section F, Zoology and Botany, organized and elected Prof. Herbert Osborne member of the council.

Many interesting things were brought out in President Farlow's address. Speaking of the ways the public could aid scientific men he said that this might be done directly by endowments for paying salaries and indirectly by providing properly equipped laboratories and other necessary equipment, and especially for paying the services of assistants. If, as it appears, the public has reached a better conception of the position of the scientific man, he said, it might be that he could hope that he could appeal to the public not only for pecuniary but for moral support. He thought it well to state somewhat explicitly some of the conditions which were unfavorable to the progress of science in this country, or which tended to retard it. Here it is not so much a question of money as of just appreciation of the true position of scientific men in their relation to those for whom their work was undertaken. That work, using a rough classification, might be considered under three heads—that done in technical and commercial concerns, that done for the government and that done in universities, including colleges, scientific schools and similar institutions which have a permanent endowment of some kind.

Taking up the commercial side of the question, he commented on the "reluctance of Americans to employ original investigators for the purpose of developing their business," and contrasted that with the policy of the Germans, who have coined money in chemical industries. "If our business men are too stupid to take advantage of the help afforded by science," said he, "although informed as to what is done by their foreign competitor, we shall not be called upon to shed many tears over their ultimate failure in the competition for business."

All sections held regular sessions on the 30th. One of the most interesting of the speakers was Dr. James Carroll of the Army, who was one of

the four men who demonstrated the mosquito theory of the transmission of yellow fever germs.

The engineering section accepted an invitation to later visit the sewerage works, having already visited the electric light plant on the opening day.

Section I, upon meeting Saturday, listened to a paper prepared by Martin A. Knapp, the chairman of the section and chairman of the Interstate Commerce Commission, upon "Transportation and Competition." Mr. Knapp was not present and the paper was read by Acting Chairman Power.

Colonel J. F. Merry, general immigration agent of the Illinois Central railroad, read a paper on the "Methods of Developing Traffic, Industry and Immigration by a Modern Railway." Following him the Hon. H. T. Newcomb read a paper upon a "Proposed Solution of the Railway Rate Problem."

In the matter of attendance the second day of the convention turned out more favorably than the first, as members kept arriving by all trains. At the general session on that day it was proposed to make the section of anthropology include also psychology, and also to form a new section on education. Twenty-two new members were also elected at this session.

A brief report of the later sessions of the convention will be given in the Western Electrician of next week.

Death of Charles T. Yerkes.

Charles T. Yerkes, a "traction magnate" well known in two hemispheres, died in New York city on December 29th. Bright's disease and heart trouble are said to have been the immediate cause of death. He had been ill for some time with a complication of diseases. During last summer he had a rather serious illness in London, but recovered sufficiently to permit him to come to the United States. His condition became serious soon after his arrival, however, and for several weeks he was seriously ill at the Waldorf-Astoria Hotel in New York.

CHARLES T. YERKES.

Mr. Yerkes was a man of conspicuous business ability and accumulated a large fortune by his exploitation and management of street-railway properties, principally in Chicago, but afterward in London. In recent years he devoted his energies to the building of underground railways in London. A large portion of this system is now in successful operation.

Mr. Yerkes was born in Philadelphia on June 25, 1837. After a varied career he came to Chicago in 1881 and opened a bank at La Salle and Madison streets. In 1886 he obtained control of the North Chicago street-railway lines. One of the first things he did was to change the motive power from horse to cable. The LaSalle Street Tunnel was constructed by him. The first cable trains on the North Side began running March 26, 1888. In 1888 he also got control of the West Side lines and converted them to cable operation. He and his associates also built electric lines running to the suburbs, and became interested in elevated lines. In 1899 he sold his North and West Side lines for $10,000,000 to a syndicate which organized the present Union Traction Company. In 1900 he sold his outlying electric lines and a year later his stock in the elevated railways. He soon after went to London, where he became interested in the construction of underground roads.

Northwestern Convention in Chicago.

The Northwestern Electrical Association will hold its next annual convention at the Great Northern Hotel, Chicago, commencing on Wednesday morning, January 17th, and continuing through the 18th. A very full and interesting programme will be rendered. The entertainment committee is composed of James Wolff, H. Almert, W. W. Low and George S. Whyte. The entertainment programme will consist of theater parties on Wednesday night, visiting the [illegible] night and a [illegible] on Thursday [illegible]

Chicago Gas Inquiry.

The [illegible] Chicago City Council [illegible] tion of the cost of [illegible] and [illegible] the offer of the People's Gas Light and Coke Company to make a rate of 90 cents [illegible] feet to consumers, and [illegible] cost of manufacture and [illegible] cents a thousand the committee [illegible] evidence from other [illegible] tion.

Edward [illegible] Bemis of Cleveland [illegible] committee that gas could be sold at 75 cents in Chicago and leave a profit. He estimated the total cost of each thousand feet of gas [illegible] tured by the People's company at 71 [illegible] cents and of the Ogden company 74 cents. In the estimate for the People's company he divided the items as follows:

Cost of manufacture	[illegible]
Cost of distribution	[illegible]
Repairs, renewals and reserve	[illegible]
Interest	[illegible]
Total	[illegible]

Prof. Bemis thought 20 cents a thousand sufficient for interest and dividends instead of the company's 35 cents. He did not think the company had a right to collect more interest than would pay six per cent dividends on the actual cost of its plant—the price for which it could be duplicated. "It is safe to say," he added, "that a reduction of 30 cents per thousand cubic feet for gas in any large city in the country would not reduce the profits 15 cents; the increased consumption would make up the difference. I think it a needless expense to require 24-candlepower. I believe better results and reduced cost would follow if 18 candlepower were substituted. In Boston 16 candlepower is used and in England as low as 14."

E. G. Cowdery, general manager of the Laclede Gas Company of St. Louis, testified before the committee. He considered 90 cents a thousand a reasonable price for gas in Chicago and thought the council should accept the offer of the People's company at that figure. He based his conclusions on the following figures, being his estimate:

Cost of manufacture	$0.3000
Cost of distribution	.2375
Reserve fund	.1000
Interest on capitalization and dividends	.2500
Total	$0.8875

Mr. Cowdery said the cost of gas fluctuates from five to 15 cents a thousand feet during a year. He said it costs more to establish a coal-gas than a water-gas plant, but the coal gas can be manufactured cheaper on account of the sale of by-products. He said the surplus set aside to meet contingencies ought to be at least 10 per cent. above all profits and expenses. In large cities also the repair account was heavier "on account of the impairment of pipes through electrolysis," which also produces a loss by leakage. He placed the repair item at 2½ per cent. The average life of gas mains he put at 12 years, and of a meter 15 years, and of an entire plant at 25 years.

Illinois Central Electrification May Be Hastened.

For years the Western Electrician has been calling attention to the desirability of "electrifying" the extensive suburban service of the Illinois Central Railroad Company in Chicago. It is a satisfaction, therefore, to print in full the following, which is the full text of a resolution introduced in the Chicago City Council on January 2d by Alderman Potter:

Whereas, The right of way of the Illinois Central Railway within the city limits traverses almost exclusively a residence district; and,

Whereas, This railroad operates an unusually large number of trains per day by reason of its extensive suburban service; and,

Whereas, The people of Chicago are constructing at large expense an extensive park along the lake front, between Twelfth and Randolph streets, which park is to contain the Field Museum and the Crerar Library, with their valuable collections; and,

Whereas, The noise and smoke of the locomotives of said railway are an intolerable nuisance to the residents along its right of way, and the smoke and dirt are most destructive to personal and public property and will be most destructive to the valuable collections of the Field Museum and the Crerar Library, and to the lawns, shrubs and trees of the Lake Front Park; and,

Whereas, It has been amply demonstrated that electricity is a practicable and economical motive power for the operation of railways, as is witnessed by the elevated roads of this city and great numbers of interurban railways, and notably by its adoption by the New York Central and Pennsylvania railways for their New York City terminals; now, therefore, be it

Resolved, That on and after three years from the date of the adoption of this resolution the use of steam locomotives shall be forbidden to the Illinois Central Railway within the limits of the city of Chicago, or to any railway using the right-of-way and terminals of the Illinois Central Railway within the limits of the city of Chicago; and be it further

Resolved, That the committee on local transportation be and it is hereby required to prepare an ordinance and submit same to this council requiring the Illinois Central Railway to conform to the terms of this resolution.

The resolution was referred to the committee on local transportation.

A "Missing Link" in Electric Railroad[ing] Supplied.

[illegible] Mich., [illegible]

A "MISSING LINK" [illegible]

that point connects [illegible] electric [illegible] These include [illegible] age of 2,20[illegible], [illegible] mileage of 482, 11 [illegible] age of 888, and three roads in Pennsylvania [illegible] lines 75 miles long, making a total of 3,70[illegible] without reference to city lines.

To mark the completion of the line a golden spike was drawn by A. E. Akins of Cleveland. Addresses were made by Walter Richey and S. S. Wheeler of Lima and F. D. Carpenter.

Arrangements have already been completed by the Western Ohio, Dayton and [illegible] and the Toledo, Bowling Green and Southern for the operation of cars from Dayton to Toledo, a distance of 162 miles, the schedule time being five hours. The arrangements will probably be extended to Detroit, 60 miles further, within a short time, on a [illegible] hour schedule.

Traction men from Ohio, Indiana, Michigan and other places attended the ceremonies at Findlay and the day was made a holiday. A special car from Cleveland and one from the Indiana Union Traction Company of Indianapolis stood on either side of the gap when the latter was being closed up.

Mr. Arnold Elected President of the Western Society.

Installation of officers and a banquet were held by the Western Society of Engineers on January 2nd at the Sherman House in Chicago, this being the 36th annual meeting. The new officers, who had previously been elected by sealed ballots sent in by the members of the society, are as follows:

President, Bion J. Arnold; first vice-president, W. L. Abbott; second vice-president, Andrews Allen; third vice-president, Prof. Dugald C. Jackson of Madison, Wis.; treasurer, A. Reichmann; trustee for three years, F. H. Bainbridge. The election was hotly contested for both president and first vice-president, Mr. Arnold securing his election by a margin of two votes and Mr. Abbott by 12 votes. Mr. Arnold is the first electrical engineer to be elected president of the society.

About 100 members were present at the banquet. Willard A. Smith was the toastmaster, and performed his duty admirably. The numbers on the programme included the address of the retiring president, E. C. Carter, and addresses by several of the members. L. E. Cooley spoke upon the "Ownership of Public Utilities." Isham Randolph talked upon "The Engineer in the Law." Onward Bates took for his subject "The Contracting Engineer," and Prof. D. C. Jackson the "Development of University-trained Engineers." Samuel G. McMeen gave some interesting facts on "Electrical Communication," and the last speaker, Bion J. Arnold, took as his subject "Public Utilities." Mr. Arnold showed a number of views of the New York Central terminal work, and his talk was of special interest to Chicago people in view of the rapidly growing sentiment in favor of similar changes in the Illinois Central and other suburban systems.

BUSINESS OF THE YEAR 1905 IN REVIEW.

That 1905 was a prosperous year for the electrical and allied interests of the United States is amply shown by the following expressions of opinion on the subject. Without a dissenting voice, all the authorities agree that the business of the year was large in volume and satisfactory in character. The outlook for 1906 is considered equally bright. It is therefore a pleasure to lay the following symposium before the readers of the Western Electrician.

Carbons.

National Carbon Company, Cleveland (N. C. Cotabish, sales manager): Our business for the year 1905 fully met with our expectations, and was about in line with my letter to you a year ago. The outlook for 1906 is promising and I look for a year fully as prosperous as 1905.

Cranes and Hoists.

Pawling & Harnischfeger, Milwaukee (F. P. Bieck): The volume of business for 1905 in the building of cranes and allied machinery has been very satisfactory, the output for the year being fully one-quarter more than for the previous years. The amount of business offered during the latter part of the year was very heavy and the indications present a very promising outlook for the year of 1906. Many large engineering and building propositions are in contemplation or under way which will involve the use of cranes and hoists. For some time it has been necessary to operate the works nights to keep up with the orders. Shipments are not confined to any particular locality or section of the Union, which is an indication that all parts of the country are enjoying a prosperous era of business.

Yale & Towne Manufacturing Company, New York (C. W. Beaver): Our electric hoist sales have reached a very high figure during the last 12 months. We expect this business for the ensuing year to more than double that of the last 12 months in this line. These hoists are being adopted for every class of lifting.

Dynamos, Motors, Electrical Machinery.

Crocker-Wheeler Company, Ampere, N. J.: Our most important achievement in the year 1905 was our successful entrance into the field of alternating-current manufacture. After 17 year's experience in the direct-current field (in which we hold an enviable position), we entered the market with a complete line of alternating-current generators, motors, transformers, etc. In a short time, still holding our place in the direct-current field, we had established ourselves in the front rank of alternating-current manufacturers.

Emerson Electric Manufacturing Company, St. Louis (H. L. Parker, president): In our fan-motor department we are largely dependent on weather, and last season, while not generally considered a hot season, was nearer the ideal of the "poor fan man" than any since 1901, and from that fact and the great general prosperity of the country we can assuredly place the season of 1905 in our list as a good one. In the line of small power motors we received a portion of the grand division of prosperity in the shape of a handsome increase of business. For the future we can see nothing but the best of prospects, and in all departments are increasing our facilities and force with a view to greater output and all possible improvements, believing that we can still keep our old position at the head of the procession.

General Electric Company, Schenectady, N. Y. (B. E. Sunny, western manager, Chicago): There has been a tremendous demand for a great variety of apparatus, in many cases necessitating special development, especially in the line of large machinery. More attention is being paid to switchboard work than previously, and with the higher voltages now in general use, many elaborate and expensive boards are being installed. The rapid development of the steam turbine has created a very large and increasing volume of business, and we look for a very heavy demand for such prime movers during the coming year.

Gregory Electric Company, Chicago (A. O. Kuehmsted, vice-president): The year 1905 has been a very good one for the Gregory Electric Company, in fact the best year in its history. There is considerable difference in the outlook for the coming year when compared with the outlook of a year ago. The latter part of 1904 particularly must have been a very unsatisfactory period for all people in the electrical business. Orders were scarce and prices were continually dropping, and manufacturers were making cut after cut in order to meet competition and in order to force business, which was slow in coming. The tide, however, turned early in 1905, confidence apparently being once more restored, and since then there has been a satisfactory increase, and the last half of the year has developed into a "boom," the end of which is not yet in sight. We consider the prices at present abnormally low, when the high cost of raw material and labor are considered, and predict higher prices for everything, and believe that a standard apparatus for immediate delivery would almost command a premium. Owing to a great increase in our business we have been compelled to build a large addition to our warehouse and works at Sixteenth and Lincoln streets, and have also just let additional contracts for largely increasing the office space. We hope to have these improvements completed by March 1st. We believe 1906 will be a phenomenal year and that people should prepare for good business.

Robbins & Myers Company, Springfield, Ohio (W. W. Mumma): We are glad to say that our business during the year 1905 exceeded any previous year. The trade in our motors has been exceptionally good since the first of September, and indications are that there will be an increased rather than a decreased demand for 1906. At least the outlook to us is promising.

Sterling Electric Motor Company, Dayton, Ohio (J. A. Gauthier, president): The last year has been gratifying to us. We have managed a good increase over our previous output. Our line is now from one-twelfth horsepower to 10 horsepower in motors. We are also making generators in the same frames. Of course our increase in sizes had a good deal to do with the increase of business. We look on 1906 with all the hope possible for heathens or Christians to have. We don't see any reason why we should be disappointed. Business all around is in the healthiest condition that we have ever seen. The crops are immense; we are not going to elect any president. If we don't have any coal strike, 1906 ought to be a "hummer" for everybody to refer to in years to come.

Engines, Gas and Steam.

Harrisburg Foundry and Machine Works, Harrisburg, Pa. (Robert S. Beecher): Our experience has been most gratifying. It is undoubtedly true that there has never been such activity in all lines of business, nor such substantial evidence of secure and permanent financial stability during any previous year of this particular era of prosperity now being enjoyed by the people of this republic. Prosperity is evident everywhere, while it is a striking and interesting fact that users of steam engines in particular are becoming more awake to the possibilities found in machinery designed along definite and fixed lines and with due consideration to certain scientific principles controlled by natural laws. It has been truthfully said that "The material progress of the world hinges on the cost of power." What a marked contrast in power development is found in the ox-driven power machinery employed in Eastern countries centuries ago and the magnificent prime movers of the present day. We look with no small degree of pride upon our present attainments, and without being desirous of displaying undue egotism, we feel that hundreds and thousands of scientifically designed power units, driving electric generators of all types, and found in perhaps 75 per cent. of the industrial establishments of this broad land, have much to do with the material progress of the present day. We look for a continuance of these conditions during the year to follow.

Union Gas Engine Company, San Francisco, Cal. (O. H. Fisher): A large number of "Union" engines were sold in this country and in most of the principal foreign countries during the last year for the purpose of driving generators. In addition a large number of vessels were equipped with electric-lighting plants. We are receiving many inquiries for generating sets at the present time, which leads us to believe that our business in this line will be very much larger in 1906 than it was the last year.

Watertown Engine Company, Watertown, N. Y.: Business in our line for the year 1905 has been better than that of any previous year in the last five. So far as we can see the prospects for a good business in 1906 are excellent.

R. D. Wood & Co., Philadelphia, Pa. (H. G. H. Tarr): The year 1905 will be memorable as marking the practical beginning of gas-engine installations in large units in this country. There are now five or six builders who are prepared to install plants in units of 3,000 to 5,000 kilowatts in connection with producer gas. The largest under way now is one for San Francisco, where they are using engines of 5,000 kilowatts. In the East probably the most interesting plant now building is that of the Boston Elevated railway, consisting of three 500-horsepower gas engines, with our water-seal pressure-type producers. This plant is designed for a coal economy of 1.6 pounds per kilowatt-hour at 85-per cent. load. The ultimate economy, so far as we can now see, will be obtained by the use of by-product producers and the gas engine, and to 1906 we look for a practical demonstration of this. We are now building a Mond by-product plant near Detroit, which, unfortunately, will not be used as a power proposition during the coming year. With a credit of 75 pounds of sulphate of ammonia from one ton of coal and engine consuming only 1.6 pounds per kilowatt-hour, we shall have very cheap current, probably as cheap as will be attained in a good many years to come. The gas engine and producer have passed the experimental stage and are now in straight competition with the perfected reciprocating engine and the turbine, and it remains to be seen who will have the courage of their convictions that it is the cheapest power.

Fuses and Fuse Wire.

American Electric Fuse Company, Muskegon, Mich. (F. G. Jones, president): The year 1905, especially in the later months, has been the most favorable year in point of activity in our line of business which we have ever experienced. Our customers seem to be planning big things for 1906 and are already letting us know something about their requirements and placing orders ahead for future delivery. We have on hand at the present time a larger amount of contract orders than ever before for practically every kind of goods. We notice the same tendency as was observable last year on the part of our customers, who are insistent upon the point of quality, in many instances almost regardless of the cost. We believe this tendency means permanence in growth and is an indication of the stability of the telephone industry. We predict for 1906 a business exceeding by 25 per cent. at least, the volume of any previous year's business in the telephone and electrical business, and barring the happening of some unfavorable event liable to affect national credit or finances, we believe that the coming year will be but the beginning of an era of greater prosperity than this country has ever known.

Appleton Electric Company, Chicago (A. I. Appleton, manager): We are pleased to state that our business for this year has been exceedingly satisfactory, and unless something unforeseen occurs we believe that the year 1906 will prove to be one of the best years for manufacturers and dealers in electrical and telephone supplies.

Chicago Fuse Wire and Manufacturing Company, Chicago (W. W. Merrill, manager): Our business during the year 1905 has shown a steady and substantial increase, particularly in enclosed fuse material. We have every reason to expect that from present indications the same ratio of increase will be shown during 1906.

Incandescent Lamps.

Buckeye Electric Company, Cleveland (L. P. Sawyer, manager): It is with pleasure that I am able to state that this company during the year 1905 has had more than the normal increase of business. In fact, I am very much pleased with the business we have done in the last year, and believe it is due largely to the general awakening of the central-station men and consumers of current to the possibilities of electricity in general. Early last fall I predicted that the incandescent-lamp business would show a very decided increase for the balance of 1905 over the same period for 1904. This prediction, I believe, has come true, and the lamp manufacturers, as well as all electrical manufacturers, are today looking forward to a still greater volume of business in 1906. I further believe that this volume of increase will be greater in proportion than in previous years, owing to the activity of the electrical manufacturers in pushing the electrical industry as a whole. It seems as though the central-station men and all users of electrical apparatus and current are just beginning to see the great possibilities of electricity in every-day life rather than as a luxury. I have just returned from a rather extended trip through the South and Southwest, and as an example cite the case of one large lighting company, which, up to November 1, 1905, had installed twice as many meters for those 10 months of this year as it had for the entire 12 months of 1904. This increase of business, so I was informed, was due almost entirely to the company's development of a new-business department, whereby they make a house-to-house canvass and make it a point to show each and every possible consumer the different ways and means of using electrical current. Should it be possible for all of the electrical manufacturers to get together and act with the central-station men and consumers along the lines of a new-business-getting scheme, I think there would be no question that the year 1906 would be the banner year for all electrical industries.

Poles, Ties, Cross-Arms.

H. M. Loud's Sons Company, Au Sable, Mich. (H. Kimball Loud): Regarding the cedar-pole market, we may remark that we have had a very good year both as to demand and prices. The demand became so brisk the latter part of 1905 that we raised our prices, and find that we still receive orders. We believe that next year will open with a strong demand for poles and a general level of prices approximately 25 per cent. above the level of 1905.

W. C. Sterling & Sons Company, Monroe, Mich.: We have just closed a very successful year. During the last year we have furnished over half a million cedar ties and 100,000 poles, and the outlook for next year is a bright one. The output last year was somewhat under the demand and a shortage in several lengths occurred during the fall, especially in 35-foot seven-inch tops. Thus far the weather has not been the most favorable weather for getting out stock, and unless the weather for working the swamps improves there will be quite a shortage. The demand for cedar ties in 1906 is going to be much larger than last year, as there are inquiries for twice the number thus far. All dealers are getting as large a stock of poles as they possibly can. Our stock of about 40,000 poles will just about carry us through until we get our new stock in. We are getting some large orders in now. There is going to be a big demand for short poles because of the large development in the farmer telephone lines.

C. H. Worcester Company, Chicago (William P. Bowring, secretary): The year 1905 has been one of steady demand for our product—cedar poles. The end of the year finds several standard sizes not in supply, while stocks of poles are not large in any size and are in perhaps better condition in this respect than they have been for several years at the same time. Much construction work has not been started because of the scarcity of standard poles, and this work, with the building of telephone and trolley lines that will be started in 1906, insures a healthy demand for cedar poles, and prices will be correspondingly firm. The average will probably be maintained in the production of new stock. It is impossible to know what quantities of cedar poles will be produced during any season, for the output of cedar stock is controlled by physical conditions which govern the woods work very largely.

Storage Batteries.

Electric Storage Battery Company, Philadelphia (Charles Blizard, manager sales department): The sales of the "Chloride Accumulator" during the year just closing have been the largest in the history of the industry. Many new applications for the use of storage batteries have been developed and the prospects are excellent for a continued expansion of the business during 1906.

National Battery Company, Buffalo (Gaston Harbison): Our sales of storage batteries for central-energy telephone systems have been very great during the last year, as a result of the large improvements and extensions which are being carried on in that field. Our sales of National batteries for electric vehicles and of sparking batteries for gasoline automobiles have shown a remarkable growth. Other departments of our business have shown a corresponding increase, and present indications are that our own business for the year 1906 will be greater in volume than ever in our history. There has been no over-production in the electrical field. Manufacturers of electrical apparatus generally are rushed to keep up with their orders. This is not the result of a boom. It is genuine demand, created by rapid development in an industry which is yet in its infancy.

Supplies.

Central Electric Company, Chicago (George A. McKinlock, president): The electrical supply business is one that it is thought responds quickly to general trade conditions, and it therefore may be regarded in a way as a barometer of business conditions. The results of our business for the year 1905 have been, we believe, satisfactory, although in the early part of the year we met with an unfortunate disaster in the complete destruction by fire of our warehouse and offices. Outside of the physical change in our conditions, the fire did not affect, except in a slight and unimportant way, the general course of our progress. While we have been very much cramped in our temporary quarters and have been doing business under difficulties, we are very much gratified to be able to say that our sales for the year exceed those of the previous year. On January 1st we return to our old stand, a new modern mill-constructed building having been erected on the old site. Our facilities will be very much enlarged and increased, and we are looking forward to 1906 as a year of great activity and are making preparations to meet what we expect will be a heavy demand for electrical supplies. The great increase in the applied uses of electricity has stimulated a like demand for copper in its various forms, and we foresee a continuation of present prices for this metal. There does not seem to be anything in the conditions at home or abroad, in our opinion, that is likely to interfere with our growth and prosperity, although there is always the unexpected to be considered.

Telegraph and Telephone Apparatus.

Automatic Electric Company, Chicago (H. H. Woodworth): We are gratified to report a most prosperous year's business during 1905, with every prospect of greatly increasing it during 1906. The sentiment in favor of the automatic telephone is spreading rapidly. The public is learning that it is the ideal service. The operating companies are learning that it is not only the best but also the most profitable service to render. The greatest growth in automatic telephony during the coming year will probably be on the Pacific Coast, where several cities will have automatic exchanges, franchises having been granted to Independent companies in these cities, in which the automatic system is specified. At least a million dollars' worth of business is in sight in this territory alone. Among the developments of our system during the last year which are notable are the party-line system and a new trunk selector switch. This latter development bids fair to revolutionize the telephone business. This switch takes up very much less space than the previous first selector switch used by us and will admit of the installation of a multiple-unit system consisting of scattered branch exchanges of one hundred lines each, which can be put in the corner of a building, in the manhole of a conduit under the street, or any convenient place, leaving the main exchange in the central part of the town for trunking purposes. This new system does away with at least 80 per cent of the outside lines and makes a proportionate saving in outside construction and maintenance cost. Taking it all in all, the year 1905 has been a gratifying one for the automatic telephone. The growth has been a steady and sure one and is based upon the principle that the automatic is the ideal telephone service both as to quality and economy of production. The public at large and practical telephone men are coming to see this more clearly every day.

J. H. Bunnell & Co., New York (John J. Ghegan, president): We are pleased to say that our business for the year just closing has been quite satisfactory and the output of our high-grade telegraphic appliances much larger than the previous year. We attribute this increase principally to the superior qualities of our product. We have every reason to believe that the coming year will be at least as fully successful as the past.

Farr Telephone and Construction Supply Company, Chicago (C. W. Farr, president): The year of 1905 certainly was a very prosperous year for every branch of the electrical trade. The telephone business has taken the lead, from East to West, there being an average of from 50 to 100 per cent. increase in telephone users. The construction of telephone lines in all states has made a tremendous demand for all kinds of telephone construction material. The prospects for the coming year are better than ever before, and the demand for telephones and telephone material will far exceed any previous year.

Waterwheels.

Abner Doble Company, San Francisco (C. W. Whitney): On the whole, our business in the waterwheel

line for 1905 has been very satisfactory. Although our business for 1904 showed the remarkable increase of 110 per cent. in horsepower of wheels sold, over the business transacted the preceding year, we have made still further progress during 1905, our year's orders, estimated in horsepower, exceeding the total for 1904 by 37 per cent. This splendid showing is due in some measure to the continued demand for hydro-electric units of large capacities. Our orders for the year include one single waterwheel unit which will develop 13,000 horsepower from a single jet of water, and also one of 9,000 horsepower. There is also a noticeable increasing demand for waterwheels of high-grade construction. Our export business to foreign countries has witnessed a substantial increase during the year. Prominent among the foreign orders we have secured is the contract for the complete hydraulic equipment of the Jhelum River power installation in Kashmir, India. As for 1906, we look forward with confidence to a year of satisfactory business, and before the twelvemonth is passed we expect to be well settled in our new shops, where our facilities for hydraulic manufacturing will be greatly increased.

Pelton Water Wheel Company, San Francisco (Edward L. Brayton, manager): Although we are not strictly in the electrical field, we may claim close kinship to it, in that our specialty is the manufacture of waterwheel apparatus, which is now so closely identified with the electric transmission of power. Although waterpower is adaptable to almost any purpose, we may safely say that 75 per cent. of our business within the last few years has been directly associated with the electrical industry. Perhaps the most noteworthy feature of the year's development is the pronounced tendency toward high speed and large power units. This is no doubt due in a large measure to the advent of the steam turbine, which is so eminently adapted to such conditions. As a result the electrical manufacturers have adopted standards of capacity and speed heretofore regarded as beyond the scope of the impulse wheel. For example, but a few years ago a 750-kilowatt unit direct connected to a wheel of the Pelton type was considered of almost abnormal proportions. Today we are building Pelton wheel units of 10,000-horsepower capacity at 300 revolutions per minute, and as copper is such a factor in the construction of electric generators, with the present upward tendency in the price of that metal, it is likely that the electrical manufacturers will be driven to the adoption of still higher speed standards. In fact, at this writing we are requested to submit tenders on similar units at a speed of 500 revolutions. There seems to be an increasing demand for hydro-electric apparatus, and certainly as far as the Pacific Coast is concerned the year 1905 will have to its credit a greater kilowatt capacity sold than any previous year. Judging from the interest that is evinced and the number of large enterprises that are on the tapis, it would seem that the coming year will be equally progressive.

Wires and Cables.

Eastern Electric Cable and Wire Company, Boston: The year 1905 has been an exceedingly busy one for us. We purchased of the receiver the plant for manufacturing rubber-covered wire of the Eastern Electric Cable Company in January last. We had the usual trouble with help, which held us back considerably. This question was settled and some new machinery installed and a good business was done. In fact, we have not been able to accept all the business offered us. We have ordered more machinery and are looking for a much larger business during 1906.

Standard Underground Cable Company, Pittsburg (J. W. Marsh, vice-president): Our business for the year 1905 has been very much larger than that of the year 1904. This is all the more remarkable because of the very high prices that have obtained for all the classes of raw materials entering into our products. With regard to the outlook for the year 1906, it appears to us certain that it is going to be a big year unless serious financial troubles, amounting to a panic, should occur, and we see absolutely nothing to indicate that anything of this kind is impending or is likely to occur during the year.

Miscellaneous.

American District Steam Company, Lockport, N. Y. (H. C. Eddy, Chicago, district manager): During the year 1905 the volume of business in our line—that of installing underground steam mains for district heating systems—was entirely without precedent in the last 28 years. Some of the more notable installations were made in Birmingham, Ala., Easton, Pa., Baltimore, Md., Chatham, Ont., Detroit, Mich., Springfield, Ohio, Cheyenne and Evanston, Wyo., together with a considerable number of plants in cities of lesser importance, and a number of extensions to plants already existing. Our merchandise business has been far in excess of any previous year, both in amount and in geographical distribution. The outlook for 1906 is flattering in the extreme, a number of large installations being planned, for which the preliminary engineering work has already been done. The company has enlarged the selling force for 1906, and shortly after the first of the year expects to issue a new catalogue of merchandise far exceeding in size and number of articles listed any previous publication of this character.

L. P. Brown & Co., Chicago (F. J. Holmes): The year 1905, which was our pioneer year, has brought us very gratifying results. During the year our sales have consisted principally of electric soldering tools, and we find that they are meeting with quite general acceptance. Our business has increased rapidly and indications are that electrically heated soldering tools will rapidly replace those heated in other ways. The new year will find us considerably behind with our orders, but we are planning such increases in our facilities that we hope soon to be able to make shipments promptly.

Colonial Sign and Insulator Company, Akron, Ohio (C. R. Quine, secretary): While the year's business on the whole has been quite satisfactory, we suffered together with the other electrical porcelain manufacturers from ruinous price-cutting on standard goods. It is to be regretted that the manufacturers and jobbers did not stand together and maintain their organization. This association could have resulted in permanent benefit to all concerned. Our sign-letter department has enjoyed a very good year. Central-station managers in even the smaller towns are awakening to the opportunity for increased profit to be derived from having electric signs on their circuits and are making active campaigns for sign business. Electric signs are no longer considered a luxury or a novelty by advertisers, but as much a necessity as attractive show windows or newspaper advertising. A feature of the year's sign business is that the first cost of a sign is no longer the most important consideration. The purchaser insists upon durability, safety and economy of operation rather than low first cost. Many cities are modifying their city ordinances so that electric signs may be hung over the sidewalk. The authorities are willing to do this on account of the benefit the city received from the light. The year 1905 was one of the best we have had and there is every indication that 1906 will be a banner year for the electric sign and the porcelain business in general.

Pass & Seymour, Inc., Solvay, N. Y. (J. W. Brooks, general sales manager): On P. & S. material we wish to say that the outlook has never been better. At the present time we are absolutely swamped with orders, and it is more a question of making shipments than of securing more orders. We are at the present time making some additions to our plant in order to take care of this increased business, and the prospects are that we shall duplicate the entire plant in the spring.

W. H. Schott, Chicago: [illegible] the more [illegible] of [illegible] heating [illegible] properly [illegible] the right [illegible] greater and more [illegible] utility, as the [illegible] from a central station [illegible] buildings [illegible] of [illegible] the [illegible] heating plants [illegible] educated along these lines [illegible] not true, it would be [illegible] construction. The business [illegible] year has been double that of any preceding [illegible] outlook for 1906 is excellent.

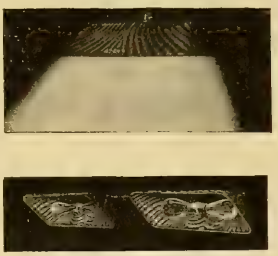
United Iron Works, Oakland, Cal. [illegible] Electric motor [illegible] During the last year we have been [illegible] ice plants motor driven instead of [illegible] call for small waterwheels [illegible] 1905 than in former years, [illegible] electricity.

Xylotite Product Company, Cincinnati, O. (Neil Macneale, general manager): During [illegible] small motor business seemed rather slack, but [illegible] number of large motors and generators were sold [illegible] the country. During the fall the large business [illegible] keep up and the small motor business has increased enormously. During the last two weeks of November our factory ran night and day in order to supply these motors with pulleys. The tendency of the operators of belted electrical machinery seems to be to increase the belt speed. This we can tell from the fact that we are supplying pulleys which are considerably larger in diameter than they were some time ago for the same machines. This condition seems to apply particularly to the Middle West. In regard to the outlook for 1906, we can only say that it appears to be very good, or at least the electrical manufacturers think so, for most of them are building large stock orders of small motors and many are even building 75 and 100-horsepower motors in large numbers.

"Poke Bonnet" Reflector for Window Lighting.

Proper light for show windows has been a perplexing problem, usually requiring special orders for fixtures to fit the window exactly. This difficulty has been done away with to some extent, and it is possible to buy from stock various types of window-lighting fixtures. A "poke-bonnet searchlight" is what a manager of one of Chicago's largest department stores called a novel reflector, which is here illustrated.

The "poke-bonnet" reflector, as shown by the accompanying illustration, is made by the National



"POKE BONNET" REFLECTOR FOR WINDOW LIGHTING.

X-ray Reflector Company of Chicago. It is a trough reflector, constructed in sections, each 1[illegible] inches in length and complete in itself. These units can be combined to give any desired length required, but the light from them is sufficient for them to be erected at intervals instead of being used as a continuous trough, thus making a saving of one or more lights every three feet.

It is said for this reflector that it will give double the light with the same current, or as much light with half the current now used. Each section, being separate and independent, can be adjusted to any desired angle to throw the rays of light where they are most needed. When used in the window they can be placed in the front, back, top or end. Where only a few are needed, each reflector may be used as a separate lighting fixture and easily installed by anyone. The adjuster on the stem furnished with each reflector is such that any desired angle may be obtained.

While these reflectors were intended primarily for window reflectors, they have met with favor for picture lighting and for illuminating art displays. Where a considerable number are necessary for a large window or around the sides of an art room they are attached to one-inch tubing, through which the wires run. This tubing is suspended from the ceiling by chain supports or by a flange on the end attached to the wall.

The reflector is made of heavy glass, with a spiral corrugated surface, plated with sterling silver. Sterling silver provides the highest reflective surface known on account of its whiteness and brilliancy, superior even to quicksilver or German silver plating. The spiral corrugations break the rays of light and there is no shadow thrown by the filament of the lamp.

Each "poke-bonnet" section is furnished with

[illegible]

Chicago Street-railway Situation.

[illegible] week it [illegible]

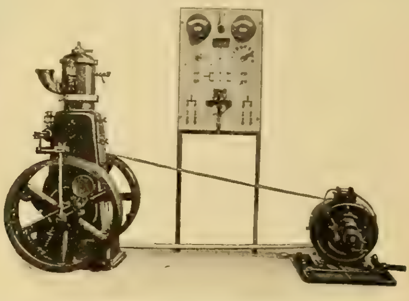
[illegible] the [illegible] by the local transportation committee and were reported to the council, they were ordered deferred and published.

Arguments in the 99-year case were scheduled to commence before the Supreme Court at Washington, D. C., this week. Attorneys for the traction companies and for the city are at the national capital in full force, prepared to present the claims of their clients.

John M. Harlan, recently named by Judge Grosscup as his special counsel in traction affairs, has issued a report to the judge on the street-railway situation, dealing chiefly with the changes he would recommend, in the interest of the public, to the franchise ordinances drawn by the local transportation committee. Mr. Harlan was a candidate for mayor in the last city election, and announced himself as favoring municipal ownership, but not immediate municipal ownership.

Richardson Lighting Outfit.

The Richardson Engineering Company of Hartford, Conn., makes a complete line of standard electric-light outfits, adapted to the needs of resi-



RICHARDSON LIGHTING OUTFIT.

dences, clubs and country estates, launches, yachts, etc. These equipments are complete with all of the necessary apparatus required; they range from 10 to 500 16-candlepower lights. But it is possible for a purchaser to use his own engine if preferred. The sets are particularly well adapted for export trade. It is possible to buy the entire plant of one concern, which holds itself responsible for every detail of it.

The company is prepared to furnish over 130 standard equipments, ranging in price from $35 to $5,000. Some of these equipments include a storage battery, giving the advantage of electric lights at any time during the 24 hours. Thus these equipments are of special interest to isolated places, such as residences, country estates, mountain and shore cottages, ranches, etc. The power used with these equipments is also available for pumping water, sawing wood, refrigeration, etc.

Universal Space-telegraph Intercepter for Signal Service.

According to the Brooklyn Eagle of December 30th, General A. W. Greeley, chief signal officer of the United States Army, announces that the Signal Corps of the army has perfected the invention of space-telegraph receivers which will enable the army to intercept and read the messages of every system of space-telegraphy in use.

"The new army receivers," General Greely is reported to have said, "invented by the Signal Corps, intercept and record the messages of all known systems." Asked for further explanation of the inventions, General Greely dismissed his interviewer with the statement: "The Signal Corps system is absolutely secret, and will remain so."

Westinghouse 1906 Electric Fans.

For the season of 1906 the Westinghouse Electric and Manufacturing Company presents a largely increased assortment of electric fans, designed with great care and embodying the results of skill and experience. The fans are simple to install, easy to operate, efficient in service, strong and reliable, and are constructed to sell at the lowest price compatible with high-grade workmanship. They are made for both direct and alternating-current service, and in forms known as the desk type, the bracket type, the ceiling type, the floor-column type and the counter type.

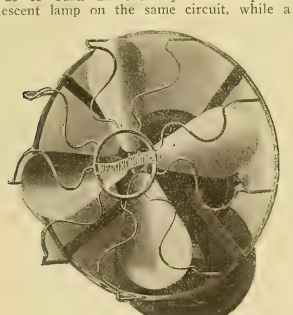
Desk and Bracket Fans.—The 1906 desk and bracket fans are substantially designed and are of attractive appearance. The body and base present smooth surfaces, which prevent the accumulation of dirt. They are finished in polished black enamel, with guards and fans of buffed and lacquered brass. The best material and workmanship is evidenced in the construction of every part.

The blades are a departure from the ordinary design formerly employed, and are the result of the careful study and investigation which have been given to this question by the Westinghouse company. They are constructed upon exact mathematical principles, and their angles are theoretically correct, with the result that the fan will give an even breeze across its entire front, as there is an absence of that tendency to project a hollow cone of air, which is found in all fans whose blades have not been correctly designed. The breeze is sent out from the fan in the shape of a solid cylinder of air, and there is little tendency to set up eddy currents, with their attendant losses. The determination of this correct blade angle has resulted in an extremely high air delivery, while the total watt consumption has been decreased, though the volume of air has been increased.

The fan blades are protected by a guard of graceful design, pleasing appearance and substantial construction, which is secured in position by arms so rigid that the entire weight of the motor may be supported by the guard without injury.

The motor is mounted upon trunnions whose line of support passes through its center of gravity and is therefore balanced at any angle. There is therefore no tendency to turn over when the thumb-screw is loosened, a point of great advantage. The motor is secured in any position by two thumb-screws; one holds at any angle in a horizontal plane and the other at any angle in a vertical plane. The thumb-screw which secures the motor in a vertical position passes through the trunnion support a little below the axis and bears against a boss on the side of the motor, affording a rigid and secure means of clamping the fan in any position. The thumb-screw which retains the fan at any angle in a horizontal plane is a recent modification, greatly superior to former methods, in which friction washers were employed. All fan motors have, when running, a tendency to shift from the position in which they are adjusted, but these clamping screws hold it secure when once adjustment has been made.

But a small amount of power is consumed by this fan, as is illustrated by the fact that it costs only about three-fourths as much to run a 12-inch fan as to burn an ordinary 16-candlepower incandescent lamp on the same circuit, while a 16-



DIRECT-CURRENT BRACKET FAN.

inch fan can be operated at less than the cost of burning two such lamps.

By means of a simple adapter, the 12 and 16-inch desk and bracket types of Westinghouse fans are interchangeable. This provision makes it unnecessary for dealers to carry two types in stock and also makes it possible for the user to attach the fan to the most convenient location without disconnecting lead wires, giving him all the advantages of the two styles of mounting.

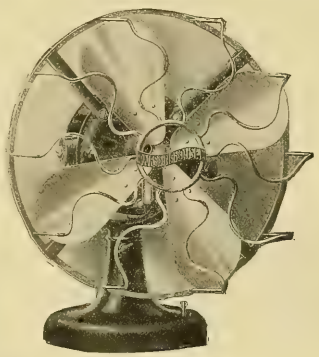
Alternating-current Service.—The motor used in the alternating-current desk and bracket fans is of the induction type, with stationary primary and rotating secondary, and has a winding made up of solid rods of copper inserted through the partially closed slots of a laminated core and short-circuited by metallic end rings. There are no moving contacts and no electrical connection between the rotating part and the outside line. The motor has accordingly no wearing parts except the bearings, and is durable and exceedingly simple both in construction and operation. The primary is wound for either 110 or 220 volts and for 7,200 or 16,000 alternations per minute.

The 7,200-alternation motor is made with two bearings which are of ample dimensions and automatically lubricated. In the 16,000-alternation motor the shaft carries the fan at one end, and the secondary of the motor at the other, the two parts nicely balancing each other on one bearing.

Simple in design and substantial in construction is the switch employed. It is made of molded insulating material, of such form that it cannot easily be damaged or thrown out of alignment. The handle projects through a slot in the motor base at the most convenient and accessible point.

One of the most important characteristics of the alternating-current fan is the ease and quickness with which it starts. The start is made as readily when the switch is in the slow position as it does when in the high-speed position, so that there is no danger of burnout because of failure and sudden restoration of power when the switch is set on the slow-speed contact. These excellent starting qualities have been secured by careful design of the motor, combined with the use of a centrifugal device which cuts out the starting winding as soon as the fan has attained sufficient speed, and by means of which a large amount of energy is saved which would otherwise be wasted.

The 1906 alternating-current fans are arranged for operation at two speeds of approximately 1,625 and 1,300 revolutions per minute. The slow speed is obtained by the insertion of a choke coil connected to the switch contacts and in series with the motor—an ideal arrangement, as it eliminates un-



ALTERNATING-CURRENT DESK FAN.

necessary losses of energy and complication of switch mechanism.

Direct-current Service.—The field coils of the direct-current motor are rectangular in shape, are machine wound, and are insulated by special treatment which reduces to a minimum liability of breakdown. The armature is of the drum type with slotted laminated core and carefully insulated winding. The commutator is so constructed and protected that wear is inappreciable, and the troubles so often found in this, the most vulnerable portion of a fan motor, are practically eliminated. It is completely enclosed, but an easily removable dust shield makes inspection possible. The brushes are of carbon, of the highest quality, and do not "chatter" or cut the commutator. The brush holders maintain an even pressure and perfect contact. The shaft is of the best hardened steel and runs in bushings of fine bearing metal, which give a long service, but can be easily renewed. There are two bearings provided, with an automatic oil return, which insures abundant lubrication at every point and prevents throwing of the oil.

The switch is skilfully designed and strongly constructed, so that it will withstand considerable hard usage without getting out of alignment. A handle of insulating material molded to the end of the blade projects through the base. The switch and contacts are covered with an insulating disk which prevents danger of short circuit when the fan is placed on a radiator or any uneven conducting surface. The regulating resistance is made of wire of a low temperature coefficient wound on the outer edge of the enclosed porcelain switch base and afterward enameled—a construction which gives a large radiating surface with consequent minimum rise in temperature.

Three different positions of the switch handle give three different operating speeds, with a maximum of 1,650 revolutions per minute, a medium of 1,300 revolutions per minute and a minimu of 1,000 revolutions per minute.

Ceiling, Floor-column and Counter Fans.—The Westinghouse fans for 1906 for ceiling and floor mounting have many distinctive features of great value. The cases are of graceful design and ornamental appearance, with a standard finish of black enamel and mottled copper, though other finishes may be furnished if desired.

The fan is made with four blades, which are set at angles calculated to give the highest possible movement of air for the lowest possible consumption of energy. The blades are securely attached to the moving element by screws which effectually prevent them from turning from their normal position. The fans are designed for operation at three speeds, controlled by means of resistance wound about the bearing cup; 200, 150 and 100 revolutions per minute may be obtained. The switch is placed centrally on the under side of the fan body. As

ALTERNATING CURRENT CEILING FAN.

there are no live parts outside of the case there is no danger of shock from handling or cleaning.

Fans of this type are made for operation from either alternating-current, 60-cycle, or direct-current circuits. The alternating-current motor is of the single-phase induction type with stationary primary and short-circuited secondary, which has no connection with the outside line. It therefore possesses no moving contacts or wearing parts except the bearings.

The direct-current motor is substantially constructed with rectangular field coils and a drum-type armature. The commutator is especially well made, embodying, as it does, all the high-grade features of other Westinghouse motors. The brushes are of the finest quality of carbon and are so mounted that perfect contact and good commutation are maintained at all times. These motors are strong and reliable and are noiseless in operation.

The rotating element is supported upon noiseless ball bearings which reduce friction to a minimum. A stationary shaft is provided with a spiral groove through which oil from the reservoir is forced upward by the rotation of the armature.

Counter type fans are exactly similar to those designed for floor-column mounting, with the exception that the shaft is made short.

Following are tabulated data:

ALTERNATING-CURRENT DESK FANS.

Size of Fan.	Alternations.	Volts.	Speed.	Watts Full Speed.
12-inch	7,200	110—220	1,300 1,625	45
16-inch	7,200	110—220	1,300 1,625	80
12-inch	16,000	110—220	1,300 1,625	65
16-inch	16,000	110—220	1,300 1,625	120

ALTERNATING-CURRENT BRACKET FANS.

Size of Fan.	Alternations.	Volts.	Speed.	Watts Full Speed.
12-inch	7,200	110—220	1,300 1,625	45
16-inch	7,200	110—220	1,300 1,625	80
12-inch	16,000	110—220	1,300 1,625	65
16-inch	16,000	110—220	1,300 1,625	120

ALTERNATING-CURRENT CEILING, FLOOR-COLUMN AND COUNTER FANS.

Alternations.	Volts.	Speed.	Watts Full Speed.
7,200	110—220	100 150 200	135

DIRECT-CURRENT DESK FANS.

Size of Fan.	Volts.	Speed.	Watts Full Speed.
12-inch	115—220	1,000 1,300 1,650	40
16-inch	115—220	1,000 1,300 1,650	85

DIRECT-CURRENT BRACKET FANS.

Size of Fan.	Volts.	Speed.	Watts Full Speed.
12-inch	115—220	1,000 1,300 1,650	40
16-inch	115—220	1,000 1,300 1,650	85

DIRECT-CURRENT CEILING, FLOOR-COLUMN AND COUNTER FANS.

Volts.	Speed.	Watts Full Speed.
115—220	100 150 200	120

The steamer Miowera, which arrived at Victoria, B. C., a few days ago from Australia, reported that when it arrived at Fanning Islands the cable staff was without provisions and the men were living on cocoanuts.

Heating and Lighting Plant at Parkville, Mo.

Park College, at Parkville, Mo., about 10 miles north of Kansas City, has just installed a heating and lighting plant, which has a few unique features which are the result of meeting peculiar conditions in the heating end of the equipment.

A plan view of the campus (Fig. 1) presents a novel scheme in a carefully outlined system of terraces on the side of a huge tree-covered mound, with the Missouri River at its base. The group of college buildings, 12 in number, is located upon these terraces, and ranges from 15 feet below to 150 feet above power house level. At several places it became necessary to blast the solid ledge to gain a footing for the steam heating pipe line, and there are not a few instances where the pipe is inclined upward at an angle of 45 degrees to reach the higher terraces.

The system of heating here installed may be termed a regulated vacuum system, in which the condensation is returned by gravity to the plant, except from two buildings, which lie below the power-house level. From these buildings the condensation is dropped into the sewer.

Fig. 2 shows a cross section of the special insulation built up to accommodate the return line. On account of the corrosive action of condensation

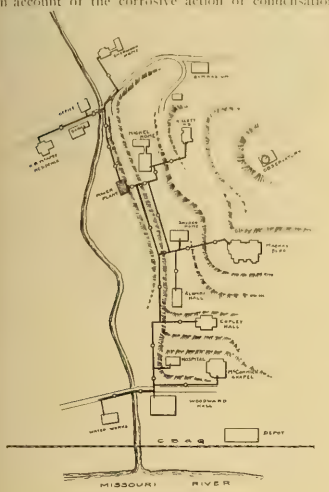


FIG. 1. PLAT OF CAMPUS OF PARK COLLEGE, PARKVILLE, MO.

on wrought-iron pipe, when not always filled with water, it was decided to use cast-iron pipe on return lines. This is known as universal pipe, and is manufactured by the Central Foundry Company of New York. The steam lines are of standard wrought pipe, with all the necessary expansion joints and specials used in standard practice. The small line on the outside supplies 15 pounds of air for the operation of thermostats.

Fig. 3 shows a general view of that part of the system which operates under vacuum. An automatic controlling valve at the steam inlet, a trap and check valve at the outlet and an automatic

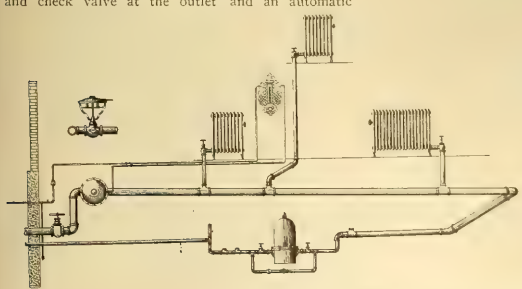


Fig. 3. Arrangement with Return Main.

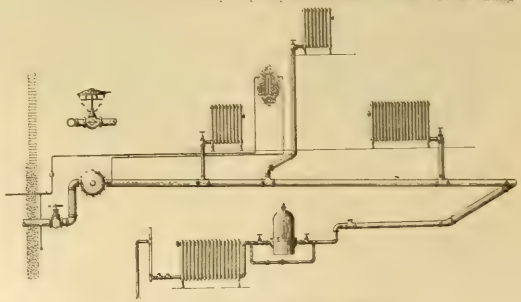


Fig. 4. Arrangement with Cooling Coil and Drain

CONNECTIONS FOR HEATING SYSTEM AT PARKVILLE, MO.

air vent at the radiator tell the entire story. The result is that the average temperature in the radiator is, under normal conditions, reduced to about 180 degrees, and thereby a considerable amount of the sensible heat in the condensation is extracted. A closer regulation of temperature in the building is also secured, with its consequent saving of steam. Furthermore, from the facts that steam is being drawn into the building intermittently and that all the buildings never take steam at the same time, the capacity of the line is increased very materially.

Fig. 4 [illegible]

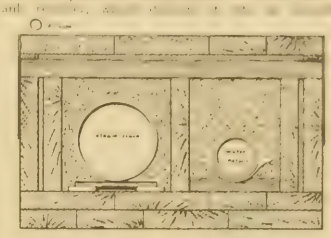


FIG. 2 [illegible]

tank. Into the tank is also connected the [illegible] water, which is controlled with a float valve. The feed-water heater receives its water through an automatic valve from the tank above. The entire system is thus designed for extreme simplicity, but to work automatically throughout.

The lighting system is a standard two wire, 220 volt system, readily convertible into a three wire system, if desired, when additional generators are required.

This plant, as just put into operation, was installed for H. B. McAfee, business manager of the Park College interests, by W. H. Schott, the well known heating engineer and contractor of the Marquette Building, Chicago.

Ohio and Indiana Interurban Associations May Be Merged.

Perhaps the most interesting topic discussed at the monthly meeting of the Ohio Interurban Railway Association, held at Columbus on December 28th, was the question of merging the Ohio and Indiana associations. After discussing the matter the president appointed E. C. Spring, J. R. Harrigan, F. D. Carpenter and J. O. Wilson as a committee to take up the matter with a committee of the Indiana association. A meeting of the joint committee will be held at Indianapolis on January 10th and a report of the results will be made at the annual meeting of the Ohio association in Dayton on January 25th.

In case the merger is made it is thought that Columbus may be selected as the headquarters with a salaried secretary in charge of the business. Should this be done an effort would be made to have the states of Ohio, Indiana, Illinois, Michigan and Kentucky come into the organization under the proposed name of the Central States Interurban Association.

Other topics for addresses at the meeting were as follows: "The Proper Method of Advertising," "Shop Records" and "Transportation of Employes and Their Dependents." An invitation was extended to the members to attend the ceremonies incident to the completion of the western Ohio extension at Findlay on Saturday, and an explanation of the importance of the event was made.

It is expected that many of the foremost traction men of the country will attend the annual meeting and banquet of the Ohio association at Dayton on January 25th. Among them will be President Vreeland of the New York city lines. President Ely of the American Street and Interurban Railway Association and T. E. Mitten of the Chicago lines.

The annual meeting of the Indiana Electric Railway Association will be held in the Claypool Hotel, Indianapolis, on January 11th. On the programme are the annual address of President Henry, informal discussion of miscellaneous subjects, and the question box. In the evening there will be a banquet. On January 10th the committee from the Ohio association, headed by E. C. Spring, and the committee from the Indiana association, headed by

Labor-saving Receptacle for Signs.

[illegible] metal,

Side

tion from the front. The [illegible] serves as a means [illegible] in place, but gives a [illegible] of the sign. In case of [illegible] damaged after the sign is [illegible] removed and a new one inserted. The turning of the receptacle after [illegible] is made impossible by the providing of [illegible] part proper, which serves as a locking device. The manufacturers say that they are prepared to furnish at cost the die necessary for punching out the holes.

Coming Exhibition of Balloons and Air Ships.

An exhibition of spherical and other drifting balloons, dirigible airships, aeroplanes, parachutes, kites, etc., will be held under the auspices of the recently organized Aero Club of America in the Sixty-ninth Regiment Armory, New York city, on January 13th to 20th, in connection with the annual show of the Automobile Club of America. The main drill room floor of the Armory will be given over to the automobiles, but suspended overhead will be a number of large balloons, airships, aeroplanes, etc., while the gymnasium upstairs will be entirely devoted to an exhibition of aeronautical models and appurtenances, signal systems, meteorological apparatus, files of periodicals, patents, books, photographs, etc., relating to aeronautics. The exhibition will have a scientific, an engineering, as well as a popular and sporting interest. The following-named gentlemen have been invited to act in an advisory capacity to the club: Prof. S. P. Langley, Thomas A. Edison, Prof. Alexander Graham Bell and Peter Cooper Hewitt.

A remarkable collection of aeronautical pictures will be shown, embracing several private collections, the largest of which, numbering about 150 subjects, will be loaned by William J. Hammer, the well-known consulting electrical engineer of New York city. Nearly all his pictures consist of photographs taken by himself while abroad of various notable ascents, together with photographs presented to him by Prof. Langley, Sir Hiram Maxim, Santos-Dumont and others. Mr. Hammer will

also contribute some material relating to signaling from war balloons.

A system of signaling from war balloons by means of colored incandescent lamps attached to captive balloons, with the code signals operated from a keyboard, will also be demonstrated, this being the first system of the kind, it having been devised by Mr. Hammer in 1880 at Mr. Edison's laboratory at Menlo Park, N. J. This system is the substantial basis of the methods which have been employed on war balloons and on shipboard subsequently both here and abroad.

"International" Switchboard Instruments and Their Makers.

The "International" switchboard instrument, which the accompanying cuts well illustrate, is the improved type of the instrument which, although manufactured but a few years, has been received with a degree of favor flattering to the manufacturer. It is manufactured by the International Electric Meter Company of Chicago, and makes use of the well-known principle developed by the noted pioneers, Deprez and d'Arsonval, and is said to be the first gravity meter making practical application of this principle.

The salient features in this type of instrument are the evenly divided scale and the positive "dead-beat" action of the moving parts. These effects are attained by the use of a very light coil and metal frame, mounted on a suitable suspension, which is free to turn in the uniform field of a strong permanent magnet.

These general and primary facts are well known to all versed in the electrical field. This fundamental principle has been applied to a variety of mechanical designs, which were developed in the following order:

Originally the coil was suspended on ordinary torsional filar supports, which served the purpose of opposing the electromotive force of the coil and also to convey the current through the coil. Later, the torsional springs were replaced by spiral springs and pivots, which are essential for portable instruments, but not necessary for instruments that are mounted permanently in a certain position, as is the case with switchboard apparatus.

The latest and best instrument for use on switchboards is the "Gravity" type, so named because of the use of small weights, properly adjusted to control the movement of the coil. It is, of course, evident that when the weights are properly secured, the resisting force will always be the same and zero trouble will be eliminated. Zero trouble, that is, the trouble due to setting of the springs, when heated, causing the index to point in a position other than on the zero mark, is often experienced by users of the spring-type instruments. When this occurs it is necessary to recalibrate the instrument. The advantage of the gravity type of meter is its constancy; it is only necessary to place the instrument in such a position that the index points at zero, and the readings will be and will always remain correct.

There are many details in the construction of the International meter which are new and seem to be improvements over the usual construction. Prominent among these is the riveting of the jewel stud or pivot directly into the aluminum-coil frame, making the construction both rigid and permanent, and the winding of the coil upon the inside of the frame, which acts as a protection to the coil. The usual method is to wind the wire upon the frame and stick the pivots to the outside of the wire.

The construction of the needle and its support is of the highest grade of mechanical design. It is rigid and strong and of minimum weight. The needle is a solid aluminum wire, instead of a fragile tubing, and, although having sufficient stiffness, can be severely deformed without breaking.

On account of the unavoidable variance in the machining of the pole-pieces and core, it is said to be impossible for any meter manufacturer to obtain a perfect air gap between these parts, and unless extreme care is applied to the balancing or poising of the needle and coil, a scale drawn in perfectly even divisions is unsatisfactory, as a meter adjusted to full-scale reading on an evenly printed scale is likely not to give true intermediate readings. The method used by the International company is to "step off" the main divisions with the current and draw in the lines by hand. This method, it is declared, should always be used where accuracy is essential.

Tungsten steel of the best grade is used in the magnets, and the best kind of imported sapphire jewels are used in the bearings. All parts, except those actually necessary to carry current, are "dead." The voltmeters are high in resistance, and can be used for ground-resistance readings. The ammeters are used in connection with a shunt of low temperature coefficient, and are operated on 0.04 of a volt. The shunt is composed of a metal which has the lowest possible temperature coefficient and is of a design which is most convenient for switchboard use. It is clamped to the surface of the bus-bar, eliminating the fitting of the bus-bar into slots. All sizes of shunts are rigid and self-contained and do not need a block of wood to support them.

As will be noted, these instruments are of the round-pattern design, and are made in two sizes, measuring in diameter 9⅜ and 7¾ inches, respectively, in both flush and standard mounting and in all standard capacities and finishes. The case is composed of cast iron, and acts as a shield to the meter in case it is placed in a magnetic field. All instruments carried in stock are assembled, but not calibrated. The meter is calibrated just before shipment, to insure a more accurate product.

The International Electric Meter Company is a corporation organized under the laws of the state of Illinois, with headquarters in Chicago. The present management, of which Mr. W. W. Cheney, Jr., is president and treasurer, took charge of the business about a year ago, and since that time the company has made material advances. Mr. Cheney is a native of Chicago, and was educated at the St. John's Military School of Manlius, N. Y. While devoting his time largely to the interests of this company, he is also interested in several other successful enterprises, to which he gives his attention.

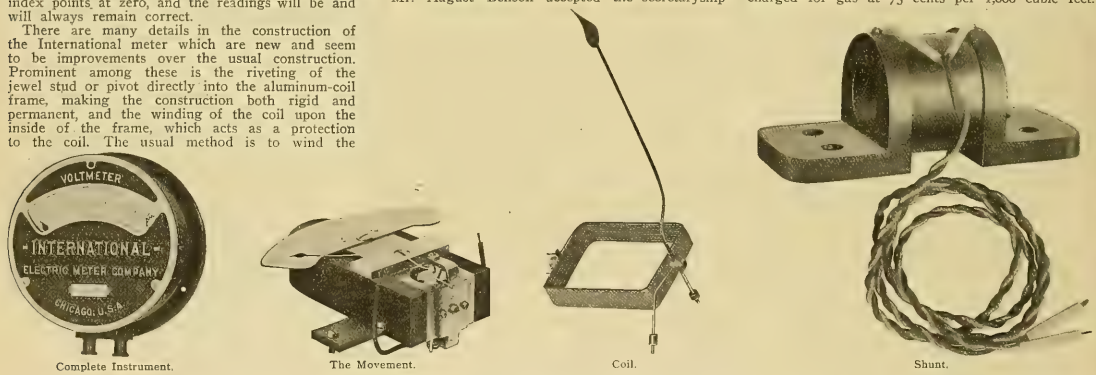
Mr. August Benson accepted the secretaryship of this company at the time Mr. Cheney secured control. He has been connected with several of the large commercial houses of Chicago, in different capacities, and this gives him the necessary business experience to perform the duties of his office most acceptably.

Mr. John M. Lea, who is the electrical engineer of the company, is an engineering graduate of the University of Wisconsin. He has had several years of experience in the different departments of the Western Electric Company, and to him should be given the credit for the excellent instruments the company has placed upon the market.

Mr. Julian S. Jackson, sales manager, was connected for several years with the sales department of the Western Electric Company, and was later sales agent at Chicago for Pass & Seymour, during which time he traveled the larger portion of the United States. This wide acquaintance in the electrical field, and a pleasing personality, will prove of much value in advancing the interests of his company.

W. W. Cheney, Jr., President. A. Benson, Secretary. John M. Lea, Electrical Engineer. Julian S. Jackson, Sales Manager

OFFICERS OF THE INTERNATIONAL ELECTRIC METER COMPANY.



Complete Instrument. The Movement. Coil. Shunt.

THE INTERNATIONAL SWITCHBOARD INSTRUMENT, WITH DETAILS.

Mayor Dunne's Views on Pending Municipal Problems.

In a sort of New Year's message Mayor Dunne reviews the municipal situation in Chicago from his own point of view. Here is part of what he says about traction, lighting and telephone interests:

I am confident that the people will vote this April as decisively in favor of municipalization of the street-car lines as they did last April. I have done everything in my power to carry out the will of the people of Chicago in the way of bringing about municipal ownership of the city's traction lines, but the members of the City Council, in the face of the expression of the people's will, have voted by an overwhelming majority against any move in that direction that I have made. As a consequence the wheels of legislation for the time being are effectively blocked. It is for the people to determine whether my course or that of the council shall be approved and sustained. This question the people will face at the polls next April. Their will must stand supreme, and I am not doubtful of what will be their verdict.

With other citizens who believe that the existing gas companies of Chicago have been charging exorbitant rates for gas, I went to Springfield shortly after my election and urged upon the General Assembly the passage of an act enabling the City Council of the city of Chicago to fix reasonable rates for gas and electric light. The State Legislature passed such an act in response to this demand, and the same has been adopted by the citizens of Chicago upon a referendum vote.

Immediately upon the adoption of this act, by referendum last November, I addressed a message to the City Council calling the attention of that body to this fact and urging the council to pass an ordinance, which I submitted, fixing the price to be charged for gas at 75 cents per 1,000 cubic feet. This price, in my judgment, is a reasonable one, in view of the fact that gas has been sold within recent years in the city of Chicago by one of the present constituent corporate members of the Peoples Gas Light and Coke Company for 75 cents per 1,000 cubic feet, and in view of the further fact that gas now is sold in several American cities for 75 cents and less. The matter of my message has been referred to the council committee on gas, oil and electric light. I earnestly hope that that committee soon will recommend to the City Council for passage an ordinance fixing the price of gas in this city at 75 cents per 1,000 cubic feet.

It is my intention at an early date, as soon as I procure sufficient reliable data, to recommend to the City Council the passage of an ordinance materially reducing the price of electric light in this city, as I am confident that the present rates charged by private companies are both exorbitant and unjustly discriminative between different classes of citizens.

I have communicated and held several interviews

with the officials of the Chicago Telephone Company, and have urged upon this corporation the adoption of a more reasonable schedule of rates for telephone service. In response to these suggestions the company has addressed a communication to the mayor and the City Council requesting the opening of negotiations with reference to the future dealings of the company and the city and citizens of Chicago. This communication, too, has been referred to the council committee on gas, oil and electric light, where the matter now is pending. I am pleased to state that the officers of the telephone company have informed me that they are prepared to consider:

1. A reduction of charges to telephone users.
2. The incorporation in any agreement that may be made with the municipality of a provision under which the city of Chicago shall be empowered to take over and operate the telephone plant of this company as a municipal plant when the state Legislature enacts a law enabling the city so to do.

New Stromberg-Carlson Transmitter.

Telephone apparatus capable of being used indiscriminately over long or short distances has become almost a necessity. One of the most difficult parts of the apparatus to adjust to this condition is the transmitter, which should give soft and pleasing transmission over the short distances and still be capable of transmitting speech over long lines with the least possible exertion on the part of the speaker. The volume of transmission depends upon the change of distance between the electrodes, brought about by the vibration of the diaphragm. In the usual form of transmitter one electrode takes up the same amplitude of vibration as the central point of the diaphragm. In a new form of the Stromberg-Carlson transmitter, however, both electrodes are attached to the central point of the diaphragm, thus producing a variation of distance between the electrodes of twice the amplitude of vibration of the central point of the main diaphragm.

The mechanical construction of the transmitter follows out the practice that has been found to be the most satisfactory for high-class apparatus—that is, the use of highly polished carbon electrodes and irregularly formed carbon granules enclosed in a practically moisture-proof case, using no absorbent material whatever, so that the transmitter when once assembled should be entirely free from any bad effects due to atmospheric changes, and should be equally as efficient in any climate. The transmitter is made more durable, particularly in damp climates, by the use of an auxiliary moisture-proof diaphragm over the main diaphragm, thus preventing any chemical action of the main diaphragm, due to moisture or alkali from the breath.

Figs. 1, 2 and 3 clearly show the construction of the instrument. What corresponds to the front electrode in the ordinary transmitter is divided into two halves, each forming a terminal. The back disk with highly polished carbon is used only as an electrical connection between the two halves of the transmitter. Fig. 4 shows the diaphragm with the connectors and cup attached. Fig. 1 shows the front [illegible] the diaphragm removed [illegible] connectors to the electrodes [illegible] cup dismounted [illegible] removed. In this figure [illegible] cup with the [illegible] mica diaphragm, and [illegible] black carbon disk. Fig. 3 [illegible] cup, (c) being the [illegible] (d) the cup, (e) the separating ring, (f) the electrode and mica diaphragm, and (g) the clamping ring. Fig. 5 shows the transmitter complete.

Carbon for the electrodes used in the transmitter is manufactured by the company of a special grade of dense carbon properly treated, so that it is of exceedingly low resistance, and is soldered to the connecting disks without the use of any salts or acid. The surfaces of the carbon buttons are highly polished, which lessens the danger of the transmitter packing and prevents arcing. The company also manufactures its own granular carbon.

The diaphragm is made of extra hard aluminum and is carefully straightened in a powerful machine. It is protected by a celluloid disk. The auxiliary diaphragm for sealing the carbon cup is made of selected India mica carefully gauged to thickness, so that each transmitter will be alike, and it is securely held in place by the clamping ring. The minor parts of the instrument are also constructed with particular care and from specially selected material.

Each transmitter bears a serial number followed either by the letter C or the letter L, C being for central-energy transmitters and L for local-battery transmitters. Each transmitter is accurately measured for resistance and given a practical test on both short and long lines in comparison with other instruments, thus assuring that each has been properly assembled and received an accurate adjustment by the manufacturer, the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y.

A cardholder of neat design, held in place by two of the transmitter mounting screws, is furnished with each instrument. It is provided with a transparent celluloid disk and white-paper back, on which may be printed the telephone number.

Attention is called to the fact that no metal whatever is used in the construction of this transmitter excepting brass, thus insuring sufficient weight and freedom from warping, which is more than liable to occur if any composition parts are used, as it is evident that the slightest movement on the part of the framework would throw the transmitter completely out of adjustment and render it practically worthless. Neither is any exposed part of the transmitter connected with the telephone circuit, thus insuring the subscriber freedom from any disagreeable shocks or injury.

FIG. 1. FRONT VIEW OF TRANSMITTER CUP WITH DIAPHRAGM REMOVED.

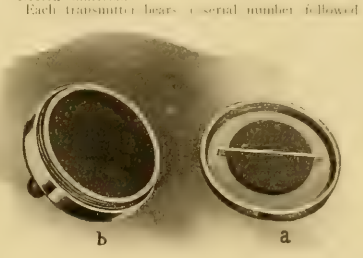


FIG. 2. STROMBERG-CARLSON TRANSMITTER CUP.

FIG. 3. PARTS OF STROMBERG-CARLSON TRANSMITTER CUP.

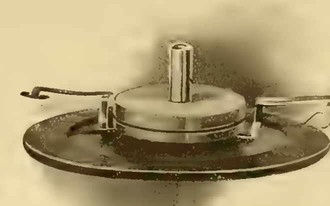


FIG. 4. DIAPHRAGM OF TRANSMITTER WITH CONNECTORS AND CUP ATTACHED.

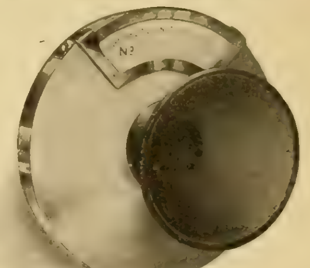


FIG. 5. NEW STROMBERG-CARLSON TRANSMITTER.

City Electrician Carroll, before the committee investigating the cost of gas in Chicago, was asked as to the damage done to pipes by electrolysis in Chicago. He replied that while it was considerable it could not be measured. It was greater to water than to gas pipes.

GENERAL TELEPHONE NEWS.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Among the recently incorporated [illegible] Telephone Company [illegible] Valley Telephone Company [illegible] Telephone Company [illegible] Home Telephone Company [illegible] Dayton Telephone Company [illegible] Medo Telephone Company [illegible] Falls Rock Telephone Company [illegible] Independent Telephone Company [illegible] N. Y.; Reliance Telephone and Telegraph Company, Jersey City, N. J.; [illegible] Company, Ringwood, Okla.; [illegible] Company, Hay [illegible] Kan.; [illegible] Company, Peru, Kan.

MANUFACTURERS AND DEALERS.

The Swedish American Telephone Company has removed to 1760 East Ravenswood Park, Chicago, which is its address for mail and express. Freight shipments should be made to Summerdale, Ill.

Of much value to the practical telephone man is the new bulletin of the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., upon private-branch telephone exchanges. All the details of the apparatus are first described in the bulletin after which the various styles of switchboards are illustrated. A few pages are also devoted to the power board and its accessories. The bulletin is built upon the loose-leaf principle, the cover being of a simple but appropriate design.

The Western Electric Company of Chicago and other large cities has taken over the supply department of the Central Union Telephone Company at Indianapolis and has established a branch house at that place for the sale of telephone apparatus and supplies. Mr. Edward S. Holmes of Chicago has been appointed manager. The former employes of the Central Union Telephone Company's supply department have been taken over by the Western Electric Company. It is understood that the Indianapolis branch will not attempt to do any manufacturing but will depend for its source of supply on the company's large factories at Chicago and New York.

The Automatic Electric Company of Chicago is well pleased with its yeear's work, as the list of exchanges, which it has equipped in the last 12 months is a long one. Twenty-one public exchanges were installed aggregating about 25,000 lines. The largest of these was the Citizens' Telephone Company's exchange at Columbus, Ohio, with 8,000 lines. West Exchange of the Home Telephone Company of Los Angeles, Cal., coming second with 4,000 lines. Private exchanges aggregating 413 lines were installed during the year, the largest being for the Brooklyn Heights Railway Company. Additions to 15 public exchanges and six private exchanges were made. At the beginning of the year the company had on hand contracts for nine public exchanges aggregating 19,800 lines, and for three private exchanges, some of which have already been partially built.

CORRESPONDENCE.

Great Britain.

London, December 20.—I have previously mentioned that in all likelihood the contract for the electrical equipment of a portion of the London, Brighton and South Coast Railway Company's suburban lines on the single-phase system would go to Germany. It is now definitely announced that the contract has been given to the Allgemeine Elektricitäts Gesellschaft of Berlin, but that considerable subletting will be done, and in this a number of British firms will participate. The line to be converted runs from Victoria in the southwest of London out to several suburban neighborhoods in the south, and, taking the shape of a semicircle, returns to London Bridge in the city. It is stated that the Winter-Eichberg system will be adopted and that the German firm has secured the contract by virtue of higher guarantees. In view of the proposals to supply electric power in London it is interesting to note that the railway company does not intend to erect a generating station, being apparently convinced that, there being so many competitors, suitable terms will be easy to obtain.

With the natural progress of engineering, greater attention is being paid to the economical burning of fuel in generating stations. Closely allied with this, of course, is the question of smoke abatement, and the general motto in large works nowadays is, More steam and less smoke. In the past one of the nightmares of the central-station and factory engineer was the "outlooks" of the Smoke Abatement Society, a body formed with the very laudable object of enforcing the law in the interests of public health, with the object of bringing home to factory and other owners the commercial as well as the hygienic advantages arising from the smokeless combustion of fuel. Identified with the society are many well-known engineers, and the result has been a binding together of the society and the fuel burners, so that there will undoubtedly be greater co-operation in the future than in the past. A proposal is on foot to organize some department whose function it should be to hire out skilled advice on the question of scientific stoking, etc. One of the biggest drawbacks which the society encounters is the fact that government factories are exempt from the general law relating to the question, and curiously enough they set the exceedingly bad example of, apparently, emitting the maximum quantity of black smoke that their furnaces are capable of.

A few further details are now available regarding the London County Council's electric power scheme. At the meeting last week a resolution that a bill be promoted was carried, and so the council stands committed. The total area of supply is 117 square miles inside London and 270 square miles outside. Powers are sought to supply only to authorized distributors and to railways, tramways and the like. In addition to the large traction power house at Greenwich a new station will be erected further up the River Thames at Battersea. Roughly, power will be asked for at first to borrow $12,500,000, spread over seven years. Of this it is estimated that nearly $7,500,000 will be expended during the years 1907, 1908 and 1909. Through it all the finance committee repeatedly warns the council of the insecure character of the business and of the fact that a loss is inevitable during the first years.

The National Telephone Company and the Swansea corporation are still fighting in the law courts as to the rights which the latter claims to have concerning intercommunication between the municipal telephone system and that of the company under the terms of the Telegraph Act of 1899. Already the case has been tried in the lower courts and the verdict went against the company. It is now in the Appeal Court and the contention of the company is that, while under the act in question it cannot refuse to grant intercommunication, it required a clear definition of the law as to the extent of the intercommunication. Its contention was that the scheme of the Swansea corporation was impracticable, inasmuch as it did not provide for a go and return line between all the sub-exchanges on the two systems. If this were not done the service would be dislocated Eventually the case was adjourned for the court to send down an independent expert to report upon the amount of intercommunication demanded by the exigencies of the two services.

The makers of the Nernst lamp have announced that in consequence of the continued rise in the raw materials used in the manufacture of their goods an extra charge of five per cent. is necessary on the list prices upon most orders received in the future.

A company called the Egyptian Engineering Company has recently been formed, having for its function the representation in Egypt of a large number of British electrical and other engineering firms. G.

New York.

New York city, December 30.—Colonel George B. McClellan was officially declared to be elected mayor of Greater New York on Wednesday and has taken the oath of office. The demand of the municipal-ownership candidate, William Randolph Hearst, that the ballots should be recounted has not been acceded to, but the revised returns reduce the plurality to 3,472 votes. The Hearst lawyers will probably continue the fight by initiating quo-warranto proceedings, when the mayor will be called upon to justify his position.

Mayor McClellan has appointed William B. Ellison as commissioner of water supply, gas and electricity.

An official inspection of the subway extension to Kingsbridge was made this afternoon, and the line will be opened for passenger traffic at midnight, January 1st. This completes the Manhattan portion of the subway scheme.

Following the merging of the subway, elevated and surface lines the traction representatives have given out a statement relative to the financial side of the amalgamation and announce the formation of a new company with a capital of $222,000,000 to hold the shares and stocks of the various companies as detailed in the Western Electrician last week. Traction stock declined several points on this announcement, for the scheme provides for the replacing of the seven-per cent. guaranteed Metropolitan stock with new five-per cent. cumulative preferred stock. The Rapid Transit Commission, which supervises the electric traction of Greater New York, has discussed the combination, and individual members expressed the view that the Belmont financiers would ultimately have to come to terms with the city. Controller Edward H. Grout immediately prophesied that within a few weeks competition would be forthcoming for the construction of new subways, and this morning it was made public that a new $100,000,000 syndicate was being formed by J. Edward Swanstrom, who was president of the borough of Brooklyn under Mayor Low. The syndicate proposes to bid for the Brooklyn subway extensions.

The employes of the Interborough Rapid Transit Company—that is, the subway and elevated guards, conductors and switchmen—will receive increases of pay as from January 1st, and the trainmen, clerks and starters who work 12 hours a day will be allowed two days off each month, with pay. This is the second increase of wages since the strike of last spring and affects about 10,000 men.

The Kings County Electric Light and Power Company will increase its capital from $5,000,000 to $8,200,000, and is planning to spend the additional money on a scheme of extensions calculated to meet the needs of several years to come.

A criminal charge for installing devices for tampering with electric meters has been heard this week, when the New York Edison Company failed to prove its case. To assist the court an exhibit consisting of a switchboard, meters, cut-offs and lamps was produced in evidence.

At the new Wanamaker store on Broadway an electrically operated floor-polishing machine is to be seen in operation. This is in the form of a miniature road-roller, with additional rollers revolving at a high speed to polish the flooring. The mechanism is operated by a small Crocker-Wheeler motor and power is supplied from the nearest available lamp circuit.

The Western Electric Company has leased for a long term of years a building at 17 Murray Street.

William H. Houston and associates of Washington, N. J., have incorporated the Washington Electric Company with a capital of $50,000.

Fire-alarm telegraph devices are to be installed in a number of public schools in Brooklyn. The whole work must be done on one contract in 60 days, and bids are receivable at the Board of Education till the morning of January 8th.

D. W. W.

Dominion of Canada.

Ottawa, Ont., December 30.—It is believed that the United States government will appoint three commissioners from Maine to act with the Canadian commissioners in the adjustment of the dispute as to the diversion of water from the river St. John, N. B. Upon the return of the minister of public works to Ottawa the Dominion government will probably decide upon the subject of co-operation with the United States authorities in the protection of Niagara Falls.

The City Council of St. John, New Brunswick, will place at the disposal of an expert engineer a sufficient sum of money to investigate the subject of the development of power at the Reversible Falls at the mouth of the river St. John. It is estimated that 20,000 horsepower, now going to waste, could be developed at these falls.

Dr. Haanel, Dominion superintendent of mines, has received a sample of the first pig iron turned out at the government's experimental electric smelter at Sault Ste. Marie, Ont. The iron is of a very superior quality. The object of the experiments now being made is to determine whether the electric process is applicable to the economical smelting of Canadian hematite ores.

T. W. McKenzie of the Canadian Pacific railway has perfected an automatic device for calling telegraph offices in railway work, which, it is said, will do the work of a man.

The North Shore Power Company of Three Rivers, Que., has sold out its electric power plant and privileges to the Shawinigan Power Company. The consideration for this valuable franchise is $300,000. The North Shore Company has been in operation for many years and furnishes all the electric light used by the city, and power is also furnished manufacturers. The power house is situated on the Batiscan River, 18 miles from the city. The city gave this company the exclusive right for 20 years to furnish electric light and power to Three Rivers. Ten years of the franchise have expired. The Shawinigan company will bring its power from Shawinigan Falls, about 21 miles distant. W.

Pacific Slope.

San Francisco, December 29.—The Oro Water, Light and Power Company's stockholders held a special meeting in San Francisco on December 28th and authorized the increase of the bonded indebtedness by $150,000, making a total of $750,000. The machinery which is being installed for a 20-mile transmission to Oroville, Cal., was purchased by the proceeds of the original bond issue of $600,000. About 4,000 horsepower will be developed, most of which will be used for commercial lighting and operating gold dredges.

The City Council of Alameda, Cal., has rejected all of the bids for additional generators for the municipal electric-light plant. The city clerk was ordered to readvertise, as the bids were considered too high.

The Pacific Portland Cement Company of San Francisco has closed contracts for two additional Westinghouse 400-kilowatt induction motors for its new plant at Cement, Cal.

The Wave Power and Electric Company, incorporated under the laws of Arizona, has filed a copy of its papers in San Francisco, with the intention of manufacturing and installing the motors. The principal place of business is Phœnix, Ariz. Fred Starr, John C. Beach and W. T. Hashagan are interested.

The Miller-Cahoon Company has taken the Utah agency for the Pope-Waverley electric automobile. A large building will be erected in Salt Lake City to be used as a garage and charging station. The company contemplates installing charging stations also in Ogden, Murray, Garfield, American Fork, Springville, Provo and other towns.

The North Shore Railroad Company has awarded the complete contract for the enlargement of the electric power house at Alto to Hunt, Mirk & Co. of San Francisco. A 1,000-kilowatt Westinghouse-Parsons turbo-generator, Keeler water-tube boilers, condensing plant and auxiliaries are included.

I. N. Enright and Raymond Benjamin have asked the Board of Trustees of St. Helena, Cal., for a franchise for an electric-light and power system. Bids for the franchise will be opened in February.

The Northern Electric Company, which is building an electric road from Chico to Oroville, Cal., and contemplates building on to Sacramento, proposes to issue $6,000,000 bonds for the purpose of construction. Henry A. Butters of San Francisco is president of the company.

An interurban electric-railway scheme, backed by the Canadian Pacific railway, embracing a continuous line from Seattle to Portland, Ore., making Olympia the upper Sound central point, with operation of a local street-car system, is reported from railway news sources on the Sound. The plan also contemplates taking over the power plant and street-car and lighting systems of the Olympia Light and Power Company. It is designed to connect all principal cities of the Sound and along the route to Portland.

The town trustees of San Diego, Cal., have sold an electric-light franchise to Hugh T. Duff for $25. He will immediately commence the erection of a $30,000 plant. It is stated that the proposition may mean power for an electric line later on.

The Los Angeles and Redondo electric line is to be made a four-track road as part of the Huntington system.

The Shasta Power Company, which is constructing an electric power plant near Hot Creek, Shasta County, Cal., has closed a contract with the Allis-Chalmers Company of two 750-kilowatt three-phase 60-cycle generators, which are to be direct connected to two Doble impulse wheels. Power will be transmitted to mines and smelters. The pipe line has been completed. A.

Ohio.

Cleveland, December 30.—Within a short time a new gasoline motor car will be completed at the Kuhlman shops at Collinwood for the Lake Shore Railroad Company, with which experiments will be made in the way of doing a suburban business.

It is said that Dan R. Hanna has made a proposition to the Northern Ohio Traction and Light Company that if it will extend its Akron and Ravenna line east to Warren he will pay for the construction of the 2½ miles between Ravenna and his farm, known as Cottage Hill farm.

The Erie Railway Company, it is said, is planning to inaugurate some kind of suburban service between Cleveland and Youngstown and that a third track may be built for the purpose. It is also said that plans have been thought over for a service of the same kind east of Alamanca.

The Wheeling Traction Company has obtained the right-of-way for the extension of its track up

the Ohio River in the vicinity of Portland, this state.

The Lima Eastern Interurban Company has been granted a franchise to enter Marion. The company will operate with gasoline cars, it is said.

The Springfield, South Charleston, Washington C. H. and Chillicothe line was purchased at receivers sale a few days ago by a syndicate headed by E. W. Christie of Cleveland for $60,000. The creditors of the company have agreed to take gold bonds for their indebtedness. It is the intention to complete the road according to the original plans.

A mortgage for $3,000,000 in favor of the Union Trust Company of Pittsburg has been filed by the East Liverpool Traction Company to secure an issue of 20-year bonds of that amount. The money from the sale of $600,000 of these bonds, which will be disposed of as needed, will be used for future acquisitions and betterments. The officers of the company are as follows: President, Van Horn Ely, Buffalo; vice president, C. A. Smith, East Liverpool; secretary and treasurer, Edward McDonald.

Some fears are entertained that the Legislature may make an attack upon the use of the third rail. One bill has been prepared prohibiting the use of the system, it is said, and another provides that guards shall be used the entire distance.

Superintendent Wilcox of the municipal-light plant at Columbus has informed the board of service that the plant is being overworked and that a new turbo-generator will be needed to bring it up to proper condition. This would necessitate the outlay of $83,000.

The Cleveland Electric Illuminating Company has made a bid of $69.72 per arc light to the city for the ensuing year. The price the last year was $73.56.

The Cincinnati and Columbus Traction Company is completing the survey from Hillsboro to Chillicothe.

It is said that a bill will be introduced in the Legislature this winter making the capital stock of steam and electric railways taxable, as well as the physical property, and raising the valuation from 20 to 50 per cent.

Samuel F. George of Dayton in an interview a few days ago said that he had arranged for the financing of the Cincinnati, Dayton and Fort Wayne Traction Company by English and French capitalists. It will cost about $12,500,000 to construct the road. It will be built on the steam-road basis, and will be operated on the third-rail system. The line will be 192 miles long. The Brighton steam road may be purchased to gain an entrance to Cincinnati.

The Cleveland Electric Railway Company has given notice that the Central Avenue franchise case will be appealed from the United States District Court to the United States Supreme Court. Judge Taylor decided that the company's franchise expired last spring, and the company contends that it does not expire until 1914.

The receivership of the Miami and Erie Canal Transportation Company has been transferred from the Superior Court at Cincinnati to the Common Pleas Court. W. Kelsey Schoepf withdrew as receiver and W. C. Shephard of Dayton was appointed in his place. The receivers have realized $51,608.57 from the sale of some of the chattels, and the fees for attorneys, receivers and the expenses amount to $38,972.

The Coshocton council has granted a franchise to the Zanesville, Coshocton and New Philadelphia Traction Company. O. M. C.

PERSONAL.

George W. Lloyd has been appointed superintendent of the second district, southern division, of the Western Union Telegraph Company, in place of J. M. Stephens, who has resigned.

Henry V. Miller of Bloomington, Ill., died on December 27th in Chicago. He was for 15 years superintendent of telegraphs for the Chicago and Alton railroad, and recently retired to promote an electric block signal of which he was the inventor.

J. D. Flynn, well known in telegraphic circles through his connection with the Baltimore & Ohio, and the Western Union Telegraph Companies, died at his home in Pittsburg on December 25th. Mr. Flynn was born in Cleveland on December 25, 1846. For twelve years he was superintendent of the Western Union in the Pittsburg district, but for the past two years had been president of the Pittsburg Stock Quotation Company.

The Chicago Daily Tribune of January 1st contained the following: "S. Frank, 4740 Calumet Avenue, is seeking his son, Samuel J. Frank, who disappeared last Thursday afternoon. The father is a member of the firm of M. J. Berkson & Co., wholesale clothing merchants, 235 Jackson Boulevard. S. J. Frank is 32 years of age. For two years he was general manager of the Mexican Telephone Company with headquarters in Mexico City."

J. C. Barclay of New York, assistant general manager, Theodore P. Cook of Chicago, general superintendent of western division, and Charles H. Bristol of New York, general superintendent of construction of the [illegible] Company, inspected the [illegible] company [illegible] themselves [illegible] the company's property [illegible] city.

J. G. Prouty, [illegible] department of the Memphis [illegible] Electric Company of Memphis, [illegible] a position as manager of the J[illegible] way and Electric Company of Jackson, Miss. Mr. Prouty has been with the Memphis company for nine years. On leaving, the employes [illegible] with a valuable chest of [illegible] and a gold watch, chain and charm was a gift from the electrical contractors of Memphis.

W. G. William[illegible], who for [illegible] years represented the [illegible] Lamp Company in Pennsylvania and other territory farther west and who was previously connected with the Manhattan Electrical Supply Company of New York city, has accepted a position with the Columbia Incandescent Lamp Company of St. Louis, and will be connected with the New York and Philadelphia branch offices of that company, covering northern Pennsylvania and New York state.

John F. Gilchrist has resigned his position as general contract agent of the Chicago Edison Company to become assistant to the president of the same company. Mr. Gilchrist is a good engineer as well as a business man of first rate capacity, and Mr. Insull, the president, whose sagacious and broad gauged policy has done so much to bring the company to its present eminence, will find in him a worthy helper in overseeing the details incident to the responsibilities and cares of the executive office.

Vinton A. Sears of Boston, Mass., who some months ago resigned from the various automatic telephone companies in Massachusetts, has moved to the Sears Building, Boston, where he will continue to be interested in Independent telephone work and securities. Mr. Sears organized the automatic telephone companies at New Bedford and Fall River, Mass., which were the first to demonstrate the practicability of the automatic system. He is the author of a well-known book, "Telephone Development: Scope and Effect of Competition."

Henry C. Ebert, assistant to the third vice-president of the Westinghouse Electric and Manufacturing Company of Pittsburg, Pa., has resigned his position to become the president of the Cincinnati Car Company and vice-president of the Ohio Traction Company. Mr. Ebert's connection with the Westinghouse company dates back about 15 years. After having been promoted to the position of superintendent of construction, which he occupied for some years, he was made chief of the correspondence department, later assistant to the manager of works, and lastly assistant to the third vice-president. It was while Mr. Ebert occupied the position of superintendent of construction that the 10 5,000-horsepower revolving-field generators made by the Westinghouse company were installed and put in operation in the power plant of the Niagara Falls Power Company. The officers of the Westinghouse company gave a dinner in his honor at the Hotel Schenley just before he left, and as a token of the esteem in which he had been held during his long association with the company he was presented a beautiful bronze electric stand lamp.

ELECTRIC LIGHTING

A new electric plant is being installed in the Mt. Carmel Academy at Wichita, Kan.

The Grand Island (Neb.) Electric Light Company is about to put in an entirely new plant.

The Colorado Salt Company of Colorado, Tex., will install a small electric light equipment in its plant.

The capacity of the local electric-light plant at Atoka, I. T., is to be increased and new machinery installed.

The Forrest City Ice and Power Company of Forrest City, Ark., will enlarge its plant and install machinery.

W. M. Dunn has purchased the business of the Canadian Valley Electric and Refrigerator Company at Holdenville, I. T.

The Citizens' Electric Light, Power and Manufacturing Company will erect an electric-light plant in Fort Collins, Colo.

A building to cost $10,000 is to be erected and equipped for furnishing light and power to the Brazos Hotel in Houston, Tex.

The New Century Hotel Company of Dawson Springs, Ky., will enlarge its electric-light plant and furnish the town with lights, both arc and incandescent.

The Algiers Railway and Lighting Company of New Orleans has absorbed the interests of the Algiers Waterworks and Electric Company of Algiers, La., and will arrange at once for making extensive improvements to electric-light and power [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

The O'Neil Engineering Company of Dallas, Texas, has secured the contract for constructing waterworks and an electric-light plant in Argenta, Ark. Bids for material, etc., will be received until January 15th by C. J. Humphreys, secretary, Board of Improvement, Argenta.

There is said to be an opening at Kirbyville, Texas, for the installation of an electric-light plant. The town has a population of 2,500. Information will be given by Wesley Merritt, industrial commissioner of the Atchison, Topeka and Santa Fe Railway, 9 Jackson Boulevard, Chicago.

The city of South Pittsburg, Tenn., has voted affirmatively on the proposed $3,000 bond issue for the purchase of the plant of the South Pittsburg Electric Light and Power Company. Arrangements will be made at once for making the necessary repairs and placing the plant in operation.

ELECTRIC RAILWAYS

Traffic on the new electric railway between Galesburg and Monmouth, Ill., has been opened by the Galesburg, Monmouth and Rock Island Railway Company.

Materials for use on the Elgin-Belvidere (Ill.) electric railway are being shipped to Belvidere by the carload. Seven cars of horses and grading equipments have already been received there and other material is arriving in frequent shipments.

An ordinance granting the Chicago and Southern Electric Traction Company a 35-year franchise to operate a street railway in Blue Island, Ill., has been passed by the council. The North Shore Electric Company will furnish the current for the operation of the cars pending a decision by the railway company as to the location of a powerhouse.

The bridge at Berrien Springs, Mich., owned by the South Bend and Southern Michigan Railway Company, is probably the largest and most costly bridge devoted to interurban traffic in the state. It is 1,200 feet long and cost about $45,000. There are eight spans, each of which is 150 feet long. Four of these spans cross the river itself, but the building of a new dam will overflow the river, so that the others are necessary. The road extends from South Bend, Ind., to Niles, Mich., and is being extended to St. Joseph, 22½ miles, at a cost of $550,000.

PUBLICATIONS.

The Schott Specialty Company of Chicago is sending out some attractive wall calendars. W. H. Schott, engineer of the Schott systems, Marquette Building, Chicago, is also distributing some beautiful calendars.

A tasteful calendar for the month of January has been issued by the Madison Gas and Electric Company of Madison, Wis. It bears a pretty picture of one of the most picturesque spots along the Yahara River, south of Madison.

A quantity of revised bulletins prepared for filing purposes by the Cutler-Hammer Manufacturing Company of Milwaukee, relate to rheostats, drums, machine-tool controllers and resistances. They are numbered 24, 25, 67, 75, 76, 77, 78 and 79, and give descriptions, dimensions, prices and other information about the various appliances, besides a number of illustrations.

Fans, blowers and exhausters for heating and ventilating, mechanical draft and other purposes are described in a booklet issued by the Green Fuel Economizer Company of Matteawan, N. Y. This company has for many years installed fans and exhausters for mechanical draft in connection with the Green fuel economizer and has long been aware that important improvements could be introduced in air-moving apparatus. The Green company does not contract for the engineering of plants nor for the installation of heating and

ventilating plants in competition with the heating and ventilating contractors. It has recently added large shops to its plant at Matteawan to handle this branch of the business.

The new catalogue of the International Electric Meter Company of 330 West Randolph Street, Chicago, has just been distributed, and it illustrates and describes comprehensively, and in concise terms, the leading facts concerning International meters, described elsewhere. Dimensions and drilling data for both meters and external shunts are contained in the catalogue and will prove useful in mounting the instruments.

A neat little booklet with a pretty winter scene on the cover gives details of construction, prices, and instructions for using Westinghouse pipe-thawing apparatus. It is designated as folder No. 4051 and will be of interest to central-station men and others. Circular No. 1107, also from the Westinghouse Electric and Manufacturing Company, gives illustrations, descriptions and full information about the various types and styles of Westinghouse circuit breakers.

"Industrial Opportunities Not Yet Realized in Massachusetts" is the title of Part IV of the annual report of the Massachusetts Bureau of Statistics, of which Mr. Charles F. Pidgin is chief. The report takes up one by one the towns and cities of Massachusetts and points out the chances for new industries. Not a few of these opportunities are afforded by undeveloped water-powers which might be turned to good advantage in the production of electrical power.

In commenoration of the victory which it won at the Louisiana Purchase Exposition, the Abner Doble Company of San Francisco, is sending to its friends a fine photogravure which bears a figure typifying Victory poised upon a Doble waterwheel. The figure is a photographic reproduction of a bronze by Mr. Debut, the original being in the private office of Mr. William A. Doble. The company has refrained from putting any printing on the face of the photogravure, so that it is suitable for framing.

C. R. Underhill, electromagnet specialist, 55 Liberty Street, New York, has issued a new illustrated catalogue showing the various types of plunger electromagnets, solenoids and other coils designed and supplied by him, and he has also revised and published a new edition of his booklet, "Facts About Electromagnets." This little booklet gives much information regarding electromagnets and solenoids and contains an interesting table of magnet windings. Both the catalogue and booklet will be sent free to any address upon request.

Everybody interested in alternating-current gentrators will find Bulletin No. 147, issued by the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass., entitled "The Inductor Alternator," not only of interest, but of value. The S. K. C. inductor alternator was, it is declared, the first successful and commercial revolving-field machine built. Its field consists of a revolving spider carrying the poles, which are energized by a single stationary field coil. As the armature is also stationary there are absolutely no revolving wires, collector rings or brushes, the revolving element being merely a mass of metal. The machine needs a minimum amount of attention in operation. The Chicago office of the company in the Monadnock Block reports a steadily increasing demand for the S. K. C. inductor alternator in the Middle West. Central-station managers and consulting engineers will find this bulletin, which can be obtained from the Chicago or other offices, an acquisition to their technical library.

MISCELLANEOUS

Mr. F. E. Bell has been appointed assistant general passenger agent of the Chicago, Burlington and Quincy Railway Company, with offices in the passenger-department headquarters at Chicago. Mr. H. A. Cherrier has been appointed city passenger agent at Chicago, with headquarters at 211 Clark Street, to succeed Mr. F. E. Bell. These changes took effect on January 1st.

The Chicago electrical show, to be held in the Coliseum from January 15th to 27th, promises to be a most interesting and successful affair. There will be the most complete and varied display ever put together, it is said. The leading electrical concerns and many of the smaller ones will have exhibits, and besides there will be unique and spectacular features. During the show there will be special days for telephone men, for technical classes of schools and colleges, Ben Franklin day, etc.

The performance of the turbine engines on the new Cunard steamer Carmania has attracted wide attention. The turbine is of the Parsons marine type, which has recently been adopted by the British Admiralty. The rights to build Parsons marine turbines in the United States are held by the Allis-Chalmers Company of Milwaukee, William Cramp & Sons of Philadelphia, the W. A. Fletcher Company of Hoboken, N. J., the Quintard Iron Works of New York and the Bath Iron Works of Bath, Maine. The Allis-Chalmers Company is not only licensee under the Parsons marine-turbine patents, but also holds the rights for manufacturing the Parsons turbine blowers and compressors, and has recently formed an alliance with Hon. Charles A. Parsons, the eminent turbine inventor, for a full co-operation and interchange of data on steam turbines for land operations. It is at the present time practically doubling its large plant at West Allis, Milwaukee, Wis., the greater part of the new shops being intended for an extension of the steam-turbine work and the electric generators to be driven by them.

TRADE NEWS

The Woods Electric Company of Houston, Tex., has been incorporated to deal in electric supplies. R. C. Woods, D. F. Woods and F. C. Jones comprise the new firm.

The Robb-Mumford Boiler Company, successor to Edward Kendall & Sons, has moved from Cambridge, Mass., to its new plant at South Framingham, Mass., which will be its address in the future.

The J. W. Smith Electric Company of Norfolk, Va., has been incorporated with $10,000 capital stock to engage in a general electric construction business. J. W. Smith is president and R. N. Scott, secretary-treasurer.

The Haller Machine Company of Chicago is turning out of its sign works a lot of electric signs for the electrical exhibition which will be opened in the Coliseum on January 15th. Bulletin No. 15, issued by the company, gives information about its signs and electric metal letters, and illustrates some of the signs which it has installed for hundreds of merchants.

The electrical fraternity will be interested to learn that the Central Electric Company, Chicago, will again be housed in its old location at 264-266-268 and 270 Fifth Avenue, where it will have twice as much floor space as at any previous time in its history. It will be remembered that the company's offices and salesrooms were totally destroyed by fire last January, since which time it has been located at 207 and 209 East Jackson Boulevard.

Oscar Claussen, Edward P. Burch and Charles L. Pillsbury have entered into a partnership under the firm name of Claussen, Burch & Pillsbury, with headquarters at 1208-10 Guaranty Building, Minneapolis, Minn., and 514-15 German American Bank Building, St. Paul. They will do a hydraulic, steam and electrical engineering business, and are prepared to make reports, tests and examinations on the management and operation of power plants, and also to plan and supervise their construction.

Sealed proposals are being invited by the Bureau of Supplies and Accounts, Navy Department, until January 16th, for furnishing eastern navy yards with the following supplies: Schedule 303, arc lamps, panel board, conduit, cable, miscellaneous electrical supplies; schedule 306, electric hoist. On January 23d the bureau will open bids for furnishing southern naval stations with arc-lamp carbons, incandescent lamps, wire and electrical supplies, embraced in schedule 309. Proposal blanks can be obtained upon application to the bureau and to the navy pay office in New York for eastern yards.

The Standard Underground Cable Company has leased the exclusive use of an all-copper line to connect its general office and factories at Pittsburg, branch offices at New York and Philadelphia and its eastern factories at Perth Amboy, N. J. This private line will be available for either telegraph or telephone service. There could be no better evidence of the large aggregate volume of business and the growing condition of this important manufacturing company, for, so far as known, this will be the longest exclusive wire owned or operated by any company confining itself to the manufacture of copper wire and cables. The service was put in effect January 1, 1906, and while without doubt of great convenience and value to the company in facilitating communication between its offices and factories and the important market centers of New York, Philadelphia and Pittsburg, it is installed primarily to enable it to place itself in closer touch with its customers and to give these customers the same quick service that would be possible if its general offices were located in each of these cities instead of in one.

A. Eugene Michel has recently entered the employment of the George H. Gibson Company, advertising engineers of New York city, having resigned as assistant advertising manager of the Standard Paint Company. Mr. Michel is a graduate of Rose Polytechnic Institute and his professional experience includes two years in the engineering department of the Diamond Chain Works of the Federal Manufacturing Company, charge of the testing department of the Ewart Manufacturing Company and assistant managership of the department of publicity of the International Steam Pump Company under Mr. Gibson.

Among the important manufacturing enterprises beginning their existence in the new year, the officers of the Standard Electrical Manufacturing Company of Niles, Ohio, announce the organization of a new company, the Star Electric Company. The Star Electric Company will be located in Niles, Ohio, and it is the intention to finance this company by the stockholders of the Standard Electrical Manufacturing Company. Mr. James P. Gilbert, who is secretary of the Standard company, will occupy a like position with the new organization. Mr. H. H. Albert, sales manager of the Standard company, will also occupy a like position with the Star Electric Company. It is the intention of the new concern to engage in the manufacture of dry batteries and fan motors. After spending several years in experimenting, Mr. Gilbert has perfected a dry battery which, it is thought, will soon command a leading position in the market. With the assemblage of especially high-grade ingredients heretofore unused in work of this kind and the employing of the celebrated Henrion carbon, a battery of exceptionally long life, high amperage and recuperative powers has been perfected. It is intended that two types will be put on the market, one for gas engines and automobiles and the other for telephone and bell work. Exhaustive tests have demonstrated, it is said, that the Star Electric Company will be able "to deliver the goods." The fan-motor line will consist of the regular type of direct-current motors. A swivel, swivel and trunnion and oscillating fan in 12-inch and 16-inch sizes will be marketed.

BUSINESS.

The Columbia Battery Company of Milwaukee has already experienced such a large demand for its goods that it is unable to meet it. This battery is expected to give twice the mileage that the ordinary batteries now on the market give, and the outlook for the coming season is bright, so much so that the company is making great preparations to meet the demands that may be made upon it. The company's specialty is manufacturing batteries for electric vehicles and trucks.

The Westinghouse Electric and Manufacturing Company has recently renewed an annual contract covering the requirements of the Moline Elevator Company of Moline, Ill., so far as its motor needs are concerned. Highly satisfactory performance by these elevator motors under the most trying conditions are reported. The Westinghouse company is also finding an extensive field for its motor equipments in the marble-finishing industry. It lately completed the equipment of a large marble yard in the South. The operation of this plant by means of electric drive has been entirely satisfactory both as to convenience and operating cost.

The Peru Electric Manufacturing Company of Peru, Ind., reports one of the most successful years in its history, the demand for Peru goods having been greater than ever before. Within the last year this company has placed on the market a new line of National Electrical Code standard specialties embodying a number of new and novel features, and the success of this material, the company says, has been gratifying. With a number of new articles just added to its line the Peru company will start the new year with a full line of standard porcelain and National Code wiring devices.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 26, 1905.

808,064. Commutator Motor. Engelbert Arnold, Karlsruhe, Germany, and Jens L. la Cour, Edinburgh, Scotland. Application filed December 16, 1904.

A compensated single-phase alternating-current commutator motor with three brushes, in a bi-polar scheme, which are set relatively to each other at angles of 120 degrees and of which three brushes two short-circuited brushes are used for introducing and the third brush for taking off the magnetizing current.

808,065. Electric Switch. Samuel H. Beck, New York, N. Y. Application filed April 22, 1905.

The combination, with stationary electrodes, consists of a movable member pivoted at one end, a reciprocating fluid-actuated member, a bell crank for operating the movable member loosely pivoted, a spring connected at one end with the movable member and at its other end with the bell crank at a point beyond the pivotal center of the movable member, pins on the bell crank and a pin carried by the fluid-actuated member adapted to contact with the pins on the bell crank to move it.

808,066. Process for the Production of Metallic Calcium. Wilhelm Borchers and Lorenz Stockem, Aachen, Germany. Application filed October 24, 1902.

A process for the production of metallic calcium consists in the fusion of anhydrous calcium salts, electrolyzing the salts and maintaining the small cathode cool enough to prevent the depositing calcium from melting and to cause the deposition thereof in a spongy state.

808,085. Electric Glow Lamp. Gustave K. Hartung, New York, N. Y. Application filed March 10, 1904.

An electrical glow lamp having a number of light giving elements of secondary conductivity and electrical circuits and controlling devices therefor. There is a common heater and an electrical resistance for the light giving elements. In combination with the resistance and the heater is an expansive liquid thermostatic cut out, adapted to be actuated by energy dissipated from the resistance for cutting out the heater upon the maturity of a secondary conductor. (See cut on next page.)

808,086. Thermo electric Battery. Albrecht Heil, Frankfort on the Main, Germany, assignor to A. Wolf, Jr., & Co., Frankfort-on-the-Main, Germany. Application filed October 31, 1904.

In a thermo-electric battery are combined a heating plate arranged to be heated from the source of heat and having a projecting end, a thermo-electric couple comprising a positive rod-shaped component and a negative wire-shaped component, whose warm ends are united with the projecting end of the heating plate in narrow or small contact faces.

808,087. Electric Signaling Apparatus Circuit. Felix B. Herzog, Edward P. Hopkins and Charles Herrmann, New York, N. Y.; said Herrmann and Hopkins assignors to said Herzog. Application filed August 8, 1888.

Means are provided in a street signal box for controlling the main circuit to a receiving station by an operator at the box; adjuncts at the box also control the main circuit from a substation, together with one or more points of connection to the main circuit adapted and arranged to be used with the adjuncts and for the sub-station control only. There is a sub-station line entirely distinct from the main line.

808,095. Manufacture of Organic Compounds by Oxidation. Walther Lang, Salbke-on-the-Elbe, Germany. Application filed August 28, 1902.

The process for the production of organic compounds obtainable by the oxidation of other organic substance consists in oxidizing manganous oxide salts by electrolysis, so as to obtain manganic oxide salts and causing the latter to act on the organic substance to be oxidized.

808,096. Detachable Electrical Connection. Augustine N. Lawrence, Jr., New York, N. Y. Application filed October 3, 1903.

In combination are a plug of insulating material adapted to enter a socket, and a spring member projecting beyond the outer surface of the plug and compressible toward the surface thereof and adapted to engage the inside of a socket and having helically arranged contact surfaces whereby the helically arranged contact surfaces may be rotated within a socket or longitudinally withdrawn therefrom. A central contact upon the member forms one terminal and the contact surface another terminal.

808,097. Detachable Electrical Connection. Augustine N. Lawrence, Jr., Philadelphia, Pa. Application filed April 15, 1905.

An attachment plug includes a body of non-conducting material having a portion shaped to enter a socket, the portion being provided with a recess. A resilient piece of metal in the recess and normally projecting therefrom has a portion formed to engage screw threads. There is a central contact on the plug, a terminal connected to the contact and a second terminal connected to the resilient piece.

808,103. Art of Galvanizing Metals. Guy L. Meaker, Evanston, Ill., assignor to the American Steel and Wire Company of New Jersey. Application filed June 18, 1902.

This method consists in subjecting the metal to the action of an electric current in an electroplating apparatus in the presence of an electrolyte composed of a combined solution of zinc chloride, zinc sulphate and a small proportion of a vegetable acid.

808,115. Electrical Meter. Henry W. Sayles, Peoria, Ill., assignor to the Diamond Meter Company, Peoria, Ill. Application filed March 13, 1905.

The combination, with an armature secured to a spindle, consists of a series field for the armature, a damping disk secured to the spindle, an electromagnetic damping magnet for the disk, the windings on the electromagnet being included serially in circuit with the armature windings, and a permanent magnet associated with the electromagnet. The combined effect of the damping and electromagnets is to cause the speed of rotation of the spindle to be proportional to current changes independent of pressure changes.

808,139. Electric Trolley Head. John T. Cherry and Edward H. Clive, Plymouth, England. Application filed March 28, 1905.

Details are described.

808,159. Electric Signal for Railways. Burton A. Karr, Omaha, Neb. Application filed August 28, 1905.

An electrical railway signal comprises a battery, an alarm bell, two contacting members having electrically conducting surfaces and non-conducting electrical surfaces, a rock bar adapted to have a radial movement and two arms, the arms being radially mounted and making contact with the contacting members.

808,162. Electric Trolley Wheel. John Miller, Jr., Amesbury, Mass., assignor to William E. Biddle, Amesbury, Mass. Application filed March 17, 1905.

A trolley wheel comprising a stationary axle and a stationary hollow perforate hub-like bearing is adapted to contain a lubricant.

808,163. Trolley Harp for Electric Railways. John Miller, Jr., Amesbury, Mass., assignor to William E. Biddle, Amesbury, Mass. Application filed April 10, 1905.

A trolley harp has widely branching arms, a stationary shaft fast in the upper ends of the arms, a trolley wheel mounted on the stationary shaft and having a heavy grooved periphery and light conical imperforate walls extending out laterally in opposite directions.

808,182. Electric Signal System for Electric Cars. Edwin J. Adams, Waco, Texas. Application filed March 6, 1905.

The combination, with a feed conductor, a return conductor and a signal conductor, consists of cars each hav- [illegible] being divided [illegible]

808,187. Metallurgical Furnace. George H. [illegible], New York, N. Y. Application filed April 27, 1903.

A metallurgical furnace embraces [illegible]

808,198. Valve Governor for Trolley-pole Controllers. Martin O. Dobson, Los Angeles, Cal. Application filed February 20, 1905.

Supporting means, a trolley pole mounted [illegible] means on the supporting means for turning the trolley pole and an internally controlled [illegible] operatively connected with the trolley [illegible] and operated by a quick movement thereof for governing the moving means are the features.

808,200. Fuse. John E. Graybill, York, Pa. Application filed March 22, 1905.

Details are described.

808,213. Contact Shoe for Third-rail Electric Railways. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, New York, N. Y. Application filed July 25, 1903.

A collector shoe is made up of one or more than scraping runners set upon edge on the upper face of the third rail and approximately in the plane of the face. Means for maintaining the runners yieldingly in contact with the rail are provided.

808,220. Power-transmission Mechanism for Automobiles. Charles G. Simonds, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 22, 1904.

In a power transmission mechanism are included a driving shaft, a gear carried thereby, a driven shaft, a gear carried thereby, a dynamo-electric machine, a shaft carried thereby, two gears carried by the shaft and engaging the first two gears respectively, and a second dynamo-electric machine connected in circuit with the first.

808,222. Third-rail Insulator. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 23, 1903.

A rail insulator comprises a cap composed of two integral parts, each of which consists of a rail retaining ear and a plug portion and an insulating support having a socket for receiving the plug portions.

808,223. Railway Signaling. Samuel D. Strohm, Philadelphia, Pa. Application filed August 29, 1891.

Combined with a railroad switch or drawbridge are an electric switch in circuit with a contact plate and a ground connection, station magnetic devices, partial circuits and contact plates and an engine or train having a partial circuit, including magnetic devices and contacts, power-controlling mechanism, operating means therefor and appliances in engagement with the contacts automatically actuated by the forward-and-backward movement of the engine or train for changing the position of the engine contacts.

808,226. Controller for Magnetic Clutches. Edward H. Anderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 20, 1904.

With a variable-speed transmission mechanism, comprising a number of electromagnetic clutches, are combined a controller for the clutches, having a number of running positions arranged to connect the clutches for the several speeds, and intermediate positions arranged to reverse momentarily the circuit connections of each clutch when breaking the circuit connections in passing from one running position to another. (See cut on next page.)

808,232. Electrolytic Meter. Alvarado L. R. Ellis, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 22, 1904.

An electrolytic meter has an anode, a cathode, a receptacle for the electrodeposited material having a small opening at the lower end thereof, a second receptacle below the opening and means to indicate the amount of electrodeposited material in each of the receptacles.

808,237. Tachometer. Caryl D. Haskins, Brookline, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 29, 1900.

A magnetic speed indicator comprises a field magnet, a movable armature and a movable low-resistance part in separated parts of the field of force of the magnet, one of the movable elements being revoluble and the other being oscillatory but biased to a normal position of rest.

808,241. End Connection for Dynamo-electric Machines. Frank H. Jeannin, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 25, 1904.

In a dynamo-electric machine are conductors slotted at their ends, rivets adapted to enter the slots, and end connections for the conductors engaged by the rivets.

808,258. Method of Making Switch Clips. Walter J. Rickey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 28, 1902.

The method of making switch clips consists in cutting off sections of an I-bar and cutting the web of each section transversely and longitudinally in opposite directions from the ends of the transverse cut.

808,263. Power-transmitting Mechanism. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 26, 1902. Renewed August 22, 1904.

[illegible]

[illegible] Company, Schenectady, N. Y. Application filed June 24, 1904.

[illegible]

808,275. Apparatus for [illegible] filed April 20, 1905.

[illegible] energy.

808,277. Electric Bell or Gong. George E. Dunton, New York, N. Y. Application filed March 15, 1904.

Details are described.

808,279. Multi-rate Meter. Walter C. Fish, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 23, 1904.

A multi-rate meter has a clock mechanism to effect the change from one rate to another. Means are provided for causing the meter to operate at the high rate on failure to rewind the mechanism.

808,350. Apparatus for Purifying and Filtering Water. Léon Dion, New York, N. Y., assignor to the Americus Electrohermetic Company, Wilkesbarre, Pa. Application filed July 20, 1904.

The combination, with a closed tank or reservoir, comprises two chambers mounted upon it and connected with its interior, an insulating lining arranged within each of these chambers and made up from independent sections and parts, and a filter arranged within the other of such chambers. A group of electrodes is arranged within the compartment formed by such insulating lining. There are means by which a current of electricity may be supplied to these electrodes, means by which water or other liquid may be supplied to and the purified portion thereof withdrawn from the apparatus, and devices by which this flow of water or other liquid to and from the apparatus may be controlled.

808,351. Device for Controlling the Flow of Fluids and Other Materials. Léon Dion, Wilkesbarre, Pa., assignor to the Americus Electrohermetic Company, Wilkesbarre, Pa. Application filed March 25, 1905.

A device for controlling the flow of fluids and electric currents consists of a casing which is provided with a number of pairs of co-operating induction and eduction ports, a movable member arranged in connection with the casing and provided with ports that are adapted to be brought one after another into, and, in a reverse order, carried one after another out of operative relationship to the ports in the casing as the movable member is moved in the required direction, and an electric circuit maker and breaker arranged in connection with the casing and the movable member, whereby to permit of both the flow of the fluid or other material and of the electric current through the device and of the interruption of the flow as may be desired.

808,364. Electric Switch. William S. Horry, Niagara Falls, N. Y. Application filed March 20, 1905.

In combination are a main circuit containing an inductance, a shunt circuit containing an electrolytic cell, the anode of the cell consisting of a material which offers an abnormally high resistance to the flow of current therefrom and a switch to successively open the main and shunt circuits but directly close the main circuit.

808,366. Telegraph Transmitter. Benjyman P. Hayes and Sigel H. Gill, Topeka, Kan. Application filed June 17, 1905.

In a telegraph transmitter are included a driving shaft and a symbol disk, friction brushes on opposite sides of the disk and secured to the shaft and a key and key lever for controlling the disk.

808,371. Protective Shunt for Electric Circuits of High Inductance. William S. Horry, Niagara Falls, N. Y. Application filed January 26, 1905.

A main circuit contains an inductance and a switch, and a shunt circuit contains an electrolytic cell which resists the normal working pressure but yields to the induced pressure when the switch is opened.

808,381. Electric Lamp-shade Holder. Theodore H. Joseph and James J. Ehrenreich, New York, N. Y. Application filed March 8, 1904.

Details are described.

808,383. Recording Apparatus for Measured Telephone Service. James A. Kenny, Chicago, Ill. Application filed March 1, 1902.

A recording apparatus comprises a registering device located at an outlying station upon which temporary records are adapted to be severally made. An electrically actuated recording device is located at a central station.

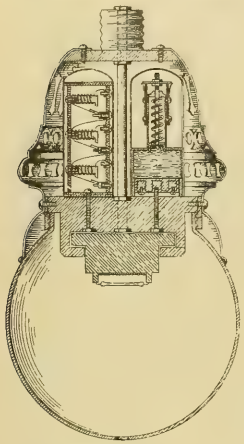
and electrical connections between the registering and recording devices, which are set in operation solely from the central station to transfer all of the temporary records from the outlying register to the recording device at the central station.

808,386. Telephony. Isidor Kitsee, Philadelphia, Pa. Application filed October 14, 1905.

A line of transmission, a series of stations connected to the line in multiple arc, each station provided with a telegraphic transmitting key, a telegraphic receiver, a switching device, a source of current and telephonic transmitting and receiving devices, the source of current of the different stations connected normally in opposition as to each other, and means whereby, through the switching device, the source of current of the station calling is connected in series as to the sources of current of the remaining stations, are the features.

808,392. Electric Switch. William W. Lathrop, Bridgeport, Conn. Application filed August 31, 1904.

Mechanical features are described.



NO. 808,085.—GLOW LAMP.

808,416. Electric Stop-motion Mechanism for Looms. Joseph B. Whitney, Brooklyn, N. Y. Application filed February 28, 1905.

In a loom are combined means for maintaining a lease in the warp, an electric circuit and circuit-closing means having the moving part thereof projecting into and transversely of the space occupied by the lease.

808,417. Electric Stop-motion Mechanism for Looms. Joseph B. Whitney, Brooklyn, N. Y. Application filed February 28, 1905.

A faller for stop-motion mechanisms for textile machinery having a thread aperture formed therein, the aperture having its surface at one side thereof and in the thread-line inclined to one face of the faller where it proximates the latter.

808,418. Electric Stop-motion Mechanism for Looms. Joseph B. Whitney, Brooklyn, N. Y. Application filed February 28, 1905.

In an electric stop-motion mechanism for textile machinery are two sets of terminals representing different poles in the circuit, the terminals being taut attenuated devices, circuit-closers movable to bridge terminals of both sets, and detached means, interposed between the sets of terminals, intermediate their ends, for maintaining the terminals of one set in fixed relation to those of the other.

808,438. Telephony. Albert G. Davis, Washington, D. C. Application filed April 22, 1897.

A multiplex telephone system includes a number of sources of alternating current of different frequencies, a number of tuned circuits, including capacity and inductance, the inductance of each circuit being provided by a variable-inductance transmitter, and a number of receiving circuits each adapted to respond to its own transmitter.

808,451. Signaling System. Maynard W. Hamblin, New York, N. Y., assignor to the American District Telegraph Company, New York, N. Y. Application filed May 31, 1904.

The combination with a normally closed circuit comprises metallic outgoing and return lines and a number of signaling devices having contact mechanism for controlling the circuit and also for connecting it to ground, and means for supplying current. There are a number of signal-receiving devices and a switch comprising a single operating device and contact members operated thereby, the switch interposed between one of the lines, and means for supplying current and adapted when operated to produce separate ground return circuits independently connected to means for supplying current.

808,454. Telephone Attachment. Paul Kammerer, Pittsburg, Pa. Application filed February 24, 1905.

Combined are a standard having a substantially inverted U-shaped bracket at its lower end adapted to be clamped to a part of a telephone, a casing adapted to close a registering mechanism and having exterior lugs secured to the standard and provided with interior lugs to which the registering mechanism is secured, and a lever for actuating the mechanism extending through a slot in the wall of the casing.

808,475. Electric Stop-motion for Knitting Machines. Arthur L. Patterson, Albemarle, N. C. Application filed February 10, 1905.

An electric stop-motion for knitting machines comprises a vertical standard with two sets of radial arms arranged one above the other, a set of circuit closers mounted on the lower arms, each arranged to have the thread pass through it from below to a point above and to operate by a break in the yarn, and a second set of circuit-closers mounted on the upper arms and arranged to hold a loop of the yarn coming from the lower circuit-closers and to operate by an undue tension on the arms.

808,525. Electric Water Heater. James P. Erie, Los Angeles, Cal., assignor to Benjamin Stern. Application filed September 8, 1898.

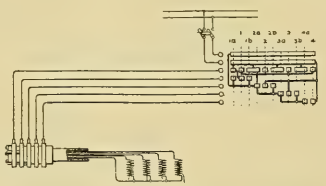
A casing having inlet and outlet water pipes, a tortuous water pipe comprising duplicate sections having a connecting chamber between the adjacent ends of the sections and extending through the casing, one section connecting the inlet and another the outlet pipes, a sectional water heater within the casing, the sections of the heater being connected and arranged intermediate the adjacent walls of the waterpipe, and means for directing an electric current through the heater, are the features.

808,532. Induction Meter. Alphonse J. Frager, Paris, France, assignor to Compagnie pour la Fabrication des Compteurs and Matériel d'Usines à Gaz, Paris, France. Application filed October 31, 1903.

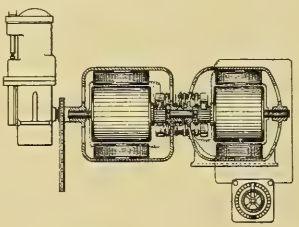
The combination with an alternating-current circuit consists of means for measuring the true energy therein, comprising a coil connected in shunt, and a coil connected in series with the circuit having a secondary coil in inductive relation therewith and co-operating to produce a number of dephased fluxes, and a rotating member arranged within the influence of the shunt and series fluxes. (See cut.)

808,545. Electric Railway System. William G. Keeler, Philadelphia, Pa. Application filed June June 16, 1905.

In an electric-railway system are a series of contacts located in the roadbed an equal distance apart, the distance being less than the length of the car, each contact connected to a line wire, a flexible or pliable endless metallic cable or belt arranged underneath each car and passing over pulleys journaled at each end of the car, the lower run of the cable or belt adapted to lie upon the contacts by its own weight and remain stationary with the contacts as the car travels forward, and a slotted shell arranged over each of the contact blacks, the walls of the slot being curved in such a manner as to act as a guide for the cable.



NO. 808,226.—CONTROLLER FOR MAGNETIC CLUTCHES.



NO. 808,263.—POWER TRANSMISSION.

808,551. Ignition Device. Leon J. Le Pontois, New Rochelle, N. Y., assignor to the Polyphase Ignition System Company of New York. Application filed November 7, 1903.

A sparking system comprises two or more insulated electrodes located in the ignition chamber of an internal-combustion engine, ground connections for the electrodes and means to simultaneously disconnect the electrodes from their ground connections so that the respective circuits of a polyphase-current generator leading to the electrodes may be simultaneously interrupted.

808,552. Magneto Alternator. Leon J. Le Pontois, New Rochelle, N. Y., assignor to the Polyphase Ignition System Company of New York. Application filed September 24, 1904.

A polyphase alternator comprises a rotor consisting of a permanent magnet having a number of separately magnetized steel laminæ substantially annular in shape and so magnetized that two consequent poles are formed at opposite ends of the same diameter.

808,553. Method of Igniting Combustible Mixtures. Leon J. Le Pontois, New Rochelle, N. Y., assignor to the Polyphase Ignition System Company of New York. Application filed September 24, 1904.

The method of producing sparks suitable for igniting combustible mixtures consisting in continuously converting two alternating currents differing in phase from each other by 90 degrees, into interrupted alternating currents having at all times a sufficient intensity to ignite a combustible mixture by short-circuiting one of the currents near the period of its minimum intensity and simultaneously rapidly interrupting the other of the currents at or near the period of its maximum intensity.

808,554. Apparatus for Generating and Utilizing Polyphase Alternating Currents for the Ignition of Explosive Mixtures. Leon J. Le Pontois, New Rochelle, N. Y., assignor to the Polyphase Ignition System Company of New York. Application filed October 7, 1904.

A system for igniting combustible mixtures in internal-combustion engines comprises a polyphase alternating-current generator having its rotor driven at a speed proportional to that of the engine shaft, and means for varying the time of operation of the sparking device constructed to connect electrically the device to the generator at the time of generation of either of the alternating currents or of both of them jointly, according to their respective intensities.

808,555. Self-exciting Alternator. Leon J. Le Pontois, New Rochelle, N. Y., assignor to Polyphase Ignition System Company of New York. Application filed February 3, 1905.

A partially self-exciting alternator of the inductor type comprises a permanent magnet field, polar projections adjacent to the magnetic poles developed by the field, stationary windings surrounding the polar projections, and a dissymmetric inductor rotor having such form that the waves of the alternating current generated, which have a magnetizing effect on the permanent magnet field, reach a higher value than those which have a demagnetizing effect on the field.

808,562. Electric Water Meter. Richard H. Milton, Reidsville, N. C. Application filed February 14, 1905.

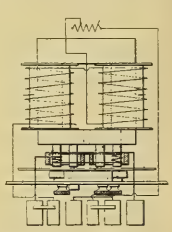
A water meter comprising an electrically operated register located at a distance from the water taker is combined with circuit wires, an electric generator, a circuit closer and a hydraulic moving device for the circuit closer consisting of a casing with an enlarged end arranged in the water-supply pipe of the water taker and a longitudinally moving rod with differential pistons arranged in the case and operated automatically by the discharge of the water through the service pipes.

808,571. Electric Signaling System. Charles G. Otwell and Ira H. Melvin, Laurel, Del. Application filed February 24, 1905.

In the system are track rails arranged in blocks, a conductor rail separate from the track rails, a switch, the terminals of which are electrically connected with track rails composing a block, an electrically operated device in series with the switch, a telephone and a circuit controller in series with each other and electrically connected with the conductor rail and one of the track rails composing the block, and a movable mounted member arranged for operation by the electrically operated device, the two constituting an index or indicator.

808,589. Trolley Finder. James Wilhelm, Philadelphia, Pa. Application filed June 20, 1905.

Two bars are arranged one on each side and pivoted intermediate of their ends upon the same pivot as the trolley wheel, the lower portion of the bars being heavier than the upper portion, so that the tendency of the bars is to remain upright, with the upper portion extending a distance above the trolley wire.



NO. 808,532.—INDUCTION METER

808,594. Apparatus for the Transmission of Energy Through Space. Alessandro Artom, Turin, Italy. Application filed February 20, 1905.

In an apparatus for transmitting electrical energy the combination with a suitable main electric circuit, a source of electric current and a circuit-breaker therein consists of a discharge circuit in inductive relation to the main circuit, discharge conductors therein and a branch circuit therefrom. Means are provided in the branch circuit to throw the current therein out of phase with that in the discharge circuit, and grounded aerials are in inductive relation to the branch circuit.

808,600. Telephony. Albert G. Davis, Schenectady, N. Y. Original application filed April 22, 1897. Divided and this application filed May 15, 1903.

Creating a telephonic current is accomplished by impressing an alternating electromotive force on a circuit and varying the reactance of the circuit around a point near but not at the resonance point in substantial accordance with the sound to be transmitted.

808,602. Desk Bracket. Alan R. Fergusson, New York, N. Y., assignor to the Warren Ball Bearing Fixture Company, New York, N. Y. Application filed March 3, 1903. Renewed November 15, 1905.

Mechanical features of a bracket for adjusting the position of electric lamps are described.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on January 1, 1906.

395,315. Electric Signaling Apparatus. John P. Coleman, Swissvale, Pa.

395,317. Sign for Electric Lights. Edward A. Dubey, Brooklyn, N. Y.

395,421. Safety Device for Use in Electric Circuits. Arthur C. Cockburn, London, England.

395,442. Conduit Electric Railway. Byron Jennings, San Cal.

395,524. Electrically Operated Cutting Device. Russell Thayer, Philadelphia, Pa.

395,546. Electric Cable. William A. Conner, Pittsburg, Pa.

395,575. Electromagnetic Rock Drill. Harry N. Marvin, Syracuse, N. Y.

395,584. Conduit for Electric Wires or Cables. Edward H. Phipps, New Haven, Conn.

395,606. Electrical Switch. Paul H. Brangs, Newark, N. J.

395,613. Electroharmonic Telegraphy. Mark W. Dewey, Syracuse, N. Y.

395,622. Dynamo-electric Machine. John F. Kelley, New York, N. Y.

395,667. Electric-railway Signal. Daniel S. Smith, Pocatello, Idaho.

395,377, 395,378, 395,379. Secondary Battery Charging. Granville T. Brush, Cleveland, O.

395,427. Automatic Telegraphy. Patrick B. Delany, New York, N. Y.

395,476. Speaking Telephone. Francis Blake, Weston, Mass.

395,508, 395,509, 395,510. Multiplex Telegraphy. Francis J. Patten, New York, N. Y.

395,532. Automatic Safety Cut-out for Electric Circuits. Granville T. Woods, Cincinnati, O.

395,556. Vibratory Multiplex Telegraphy. Stephen D. Field, Stockbridge, Mass.

395,614. Printing Telegraph. Mark W. Dewey, Syracuse, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Three-conductor Direct-current Railway in Bohemia.

By C. Smith.

An interesting direct-current electric railway which possesses some features which are radically different from American practice has recently been installed between Tabor and Bechin, in Bohemia, by the well-known electrical establishment of F. Krizik of Prag-Karolinenthal. The line is 24.24 kilometers in length and has five stations, those of Tabor, Slapy, Malsice, Sudomerige and Bechin. The road is fairly level, the steepest grade being 3.5 per cent., and but one river, the Luschnitz, is crossed, being spanned by a bridge 174 meters in length.

Steel rails weighing 21.75 kilograms per meter are laid on pine ties one meter apart. The trains consist of two or three motor cars which travel at from 15 kilometers per hour on the steepest grades to 30 kilometers per hour on the level.

The power-generating station, which is seen in the accompanying illustration, Fig. 1, is located near Tabor, on the Luschnitz River at one end of the line, and generates direct current at 1,400 volts pressure, also supplying the city of Tabor with light and electric power. The station contains three Tischbein boilers of 80 square meters heating surface, constructed for a pressure of 11 atmospheres, superheaters being provided for raising the temperature of the steam to 300° C.

Three steam engines are the prime movers in this station, and they are of the compound condensing type, developing 120 horsepower each. They are connected by belting to direct-current generators, as seen in Fig. 3, which shows the interior of the power house. Two of the engines run at 180 revolutions per minute, while the third, which, together with the storage battery, is able to operate two 50-ton trains, has a speed of 220 revolutions per minute. Two belt-driven boosters have also been installed, as well as other sets to be used in case of emergency.

The storage battery consists of 700 Tudor elements, having a capacity of 123 ampere-hours at a discharge rate of one hour, and 171 ampere-hours at a discharge rate of three hours.

A three-wire system has been installed, with 700 volts on each side, and the rails as a neutral. In this respect the system is unique, and it posesses some advantages. With this system, under no circumstances can a motor receive more than 700 volts, this being an important advantage over a straight line. Two bow collectors are used for taking the current, and this is said to be a great advantage, especially in winter, when the rails are covered with sleet. The two overhead conductors consist of copper wire, eight millimeters in diameter, placed 5.5 meters above the rails and 1.2 meters apart. Fig 2 is an illustration showing a car with bow trolleys, and the line construction.

Fig. 1. Power House on Luschnitz River near Tabor.
Fig. 2. Car, Showing Bow Trolleys and Overhead Construction.
Fig. 3. Direct-current Generators in Power House.

THREE-CONDUCTOR DIRECT-CURRENT RAILWAY IN BOHEMIA.

Each motor car has two trucks and four [illegible] polar motors of 30 horsepower each, connected either in series or two in parallel, and having a speed of 550 revolutions per minute with a pressure of 650 volts. The gear ratio is [illegible] and each motor, including gearing, etc., weighs [illegible] kilograms.

The cars, which are heated by electricity, are divided into two compartments of the second and third class, and hold in all 40 passengers. The general outlines are well shown in Fig. 2.

This novel system has been in operation since June and has given excellent satisfaction. It is stated that F. Krizik proposes to install a new and similar line operating at a pressure of 3,000 volts and utilizing 800-horsepower motor cars.

Electric Light and Power Service in Chicago and Vicinity.

[illegible] central portion [illegible] the North Shore [illegible] tributes its light and power.

Eleven years ago the Chicago Edison Company had connected a light and power load equivalent to 238,124 16-candlepower lamps. On March 31, 1905, its light and power output was equivalent to 1,475,699 16-candlepower lamps. In the last four years the business of the company has almost doubled. During the year just closed the company has added to its list of customers several of the large State Street department stores. Sub-stations have been installed in several new buildings and one was built in Plymouth Place. The plant represented an investment on March 31, 1905, of $18,532,753.

The Commonwealth Electric Company has developed, and is still adding to, one of the most interesting central-station plants in the world. The Fisk Street station of this company, with its large steam turbines, and contemplated ultimate capacity of 156,000 kilowatts, was illustrated and described in detail in the Western Electrician of last week. The connected business of this company on March 31, 1905, was the equivalent of 727,075 16-candlepower lamps. Among the notable additions to the company's service in 1905 may be mentioned its contract with the Chicago City Railway Company to supply current for operating cars. This, with similar service for other street-railway and elevated lines, makes a demand upon the company for 20,000 horsepower.

The North Shore Electric Company in 1902 began a light and power service for the towns along the North Shore of Lake Michigan, acquiring the lighting plants at Waukegan and Highland Park. Its territory now extends clear around Chicago to the south. More than thirty cities and villages are served by the company. A number of independent and municipal plants have been bought by the company, and in 1905 it acquired the Calumet Lighting Company, which served towns south and southwest of the city, including Chicago Heights and Harvey. The business of the North Shore company has been largely lighting, but arrange-

ments are being made for an extensive power business. A power house in course of construction in the Blue Island district will furnish the current for the Chicago and Southern Traction Company and also to factories in the district. Stations are also being constructed at Maywood and Waukegan, with transmission lines to substations intervening.

Single-phase Locomotives for Sarnia Tunnel.

After about two years' study and investigation of the problem, the Grand Trunk Railway Company has awarded the contract for the electrification of the Sarnia tunnel, and, on the recommendation of its consulting and supervising electrical engineer, Mr. Bion J. Arnold, has chosen the single-phase

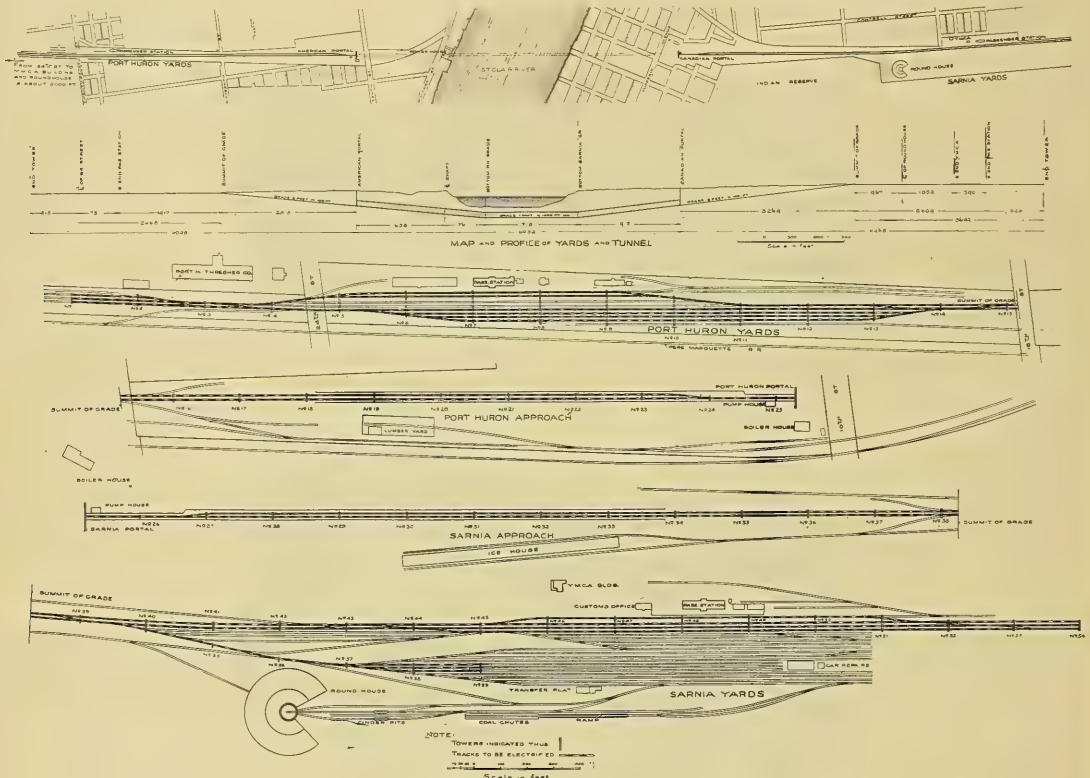
end of the tunnel, and the total distance to be electrically equipped is 19,348 feet from terminal to terminal. The accompanying drawing is a general map and profile. Specially designed steam locomotives have been used to haul both freight and passenger trains through the tunnel, freight trains being usually divided.

The new electric power house will be placed on the surface of the ground on the American bank of the river, over the tunnel, to which cables will run down a shaft. The locomotive load will be variable, requiring 1,200 kilowatts during the seven or eight minutes required to pull the train up grade and practically nothing during the remaining six or seven minutes of the proposed 15-minute run. There will also be a lighting load and a pumping load, so that the maximum load will be something like 2,000 kilowatts, for which three

through the tunnel by the electrical equipment other than that imposed by the limited mechanical strength of the coupling from car to car.

These locomotives are of the rigid-frame type, with driving axle boxes and draft gear mounted on the same frame. Each unit will have three pairs of 62-inch driving wheels with a motor on each axle connected with a gear reduction of 18 to 95. It will weigh approximately 62 tons, all of which is on the driving wheels. Equalizer beams similar to those used in standard steam-locomotive practice will distribute the weight among the six drivers. The frames will be made of cast-steel and will be placed outside the wheels. The locomotives will be equipped with the Westinghouse friction draft gear.

The power equipment of each unit comprises three 250-horsepower single-phase series-wound mo-



GENERAL MAP AND PROFILE OF YARDS AND TUNNEL AT PORT HURON, MICH., AND SARNIA, ONT.

locomotive system, placing the order for the whole equipment with the Westinghouse Electric and Manufacturing Company. Mr. Arnold was retained by the railroad company in April of last year. His first impression was in favor of direct current for the tunnel equipment, but, after a thorough analysis, he decided that the single-phase motor would meet the conditions encountered in this installation better than the direct-current motor, owing to the elimination of the third rail from the extensive yards at each end of the tunnel, the better speed characteristics and more uniform drawbar pull of the single-phase motor, and the probable saving in first cost and operating expenses.

Mr. E. H. Fitzhugh of Montreal, third vice-president of the Grand Trunk, handled the matter for the railroad company, and received the various proposals which were submitted. Mr. Frank H. Shepard was active in the matter on behalf of the Westinghouse interests.

The Sarnia or St. Clair tunnel of the Grand Trunk railroad extends between Port Huron, Mich., and Sarnia, Ont., under the St. Clair River, connecting the Canadian and American portions of the railroad. The tunnel proper is 6,032 feet long, 1,718 feet of which is under the river, with two per cent. grades on each side. It is of iron, circular in shape, with space for a single track. As has been said, there are extensive yards at each

800-kilowatt 3,300-volt three-phase 25-cycle turbo-generators will be installed. The contract also provides for the power station itself and the boilers, stokers, coal and ash-handling machinery, feed pumps, feed-water heaters, condensers, water supply, fire protection and heating systems, piping, electric crane, engine-driven exciting unit, motor-driven exciting unit, switchboard, feeder and distributing system, bridge and pole lines for catenary trolley construction, overhead work, bonding, transformers for power and light, light and power distributing systems, lightning protective apparatus, arc and incandescent lamps, roundhouse motors, motor-driven pumps, drainage and sewer systems for buildings and yards and electric locomotives.

Interest centers in the locomotives, which are to be equipped with the series-wound single-phase motors developed by the Westinghouse company. There are to be six single or three double locomotive units, designed to meet the requirements of the tunnel service of the Grand Trunk Railway. Each single unit will exert a drawbar pull of 25,000 pounds on a two per cent. grade at a speed of 10 miles an hour. The locomotives may be operated from either end, and two or more may be coupled together and controlled in multiple from a single unit, so that there is practically no limit to the size of train which may be taken

tors of the same general type as those recently adopted by the New York, New Haven and Hartford Railroad for its terminal operations in New York. Pneumatically operated trolleys of the pantagraph type will collect the current from the overhead-trolley line outside the tunnel. In the tunnel itself side contacts will probably be used.

Alternating current at 25 cycles and 3,000 to 3,300 volts will be delivered to the locomotives. Outside the tunnel the current will be fed through a No. 0000 grooved trolley wire and trolley to the locomotive equipment. The trolley wire will be hung by a catenary suspension from steel towers which span the track, or from bracket arms mounted on lattice-work poles of steel.

Tunnel operations are conspicuous fields for the electrical propulsion of heavy trains, avoiding the smoke and gases of steam locomotives, and the application of the single-phase alternating-current system to the St. Clair problem provides a most effective solution of the difficulties encountered. By its adoption the tunnel company is enabled to utilize the safe and simple catenary line construction rather than the third rail, to eliminate electrolytic troubles and to secure a close and efficient speed control, with economical starting and rapid acceleration. It is expected that the electric locomotives will greatly relieve the present congestion at the terminal yards.

Northwestern Electrical Convention.

The convention of the Northwestern Electrical Association will be held in the Great Northern Hotel on January 17th and 18th, and Thursday the 18th has been set aside by the management of the Electric Trades Exposition as "Northwestern Electrical Association Day."

An unusually promising literary programme has been prepared for the convention and includes the following papers: "The Proper Handling of Consumers' Meters," by George H. Barrett; "Modern Underground Construction," by W. D. Bafford; "Suggestions for Increasing the Power Output of Central Stations," by P. H. Korst; "Government Tests of Fuel," by C. J. Davidson; "The Organization and Development of New Business Departments," by George Williams; "Successful Applications of New Business Methods," by John S. Allen; "The Economics of Combined Railway and Power Plants," by E. Gonzenbach; "The Effects of Load Factor on Station Costs," by R. N. Kimball.

On the night of the 18th the delegates of the Northwestern association will visit the Electrical Show in a body, after which a banquet will be given. The president of the association is E. H. Williams of Lacrosse, Wis., and Thomas R. Mercein is the secretary and treasurer.

Generous Contributions to Engineering Building Fund.

In view of the importance and utility of the United Engineering Building, as a home and center for the engineering professions and arts, the General Electric Company has made a contribution of $25,000 to the land and building fund of the American Institute of Electrical Engineers. President C. A. Coffin, who takes a warm personal interest in the matter, has also sent his own check for $5,000. The committee, which has already received gifts and pledges amounting to nearly $70,000, is greatly encouraged by this generous support of its work. The fund is now, with other new contributions, well over $100,000, and with renewed energy the committee has begun its canvass of the field, with the object of securing the second necessary $100,000. About 600 members have already subscribed to the fund, and the committee expects to have no difficulty in at least doubling this number. It has just issued to the whole membership a handsome pamphlet, illustrating and describing the new building in course of erection in New York city, and detailing the steps that have been taken by the associated engineering bodies to give effect to Mr. Carnegie's original gift.

American Electrical Salesmen's Convention.

The first regular meeting of the American Electrical Salesmen's Association will be held in the Grand Pacific Hotel January 20th. The president of the new association is Vincent Gray and the secretary is R. A. Cavanaugh, Masonic Temple, Chicago. A comprehensive programme has been prepared, including the following papers and addresses: "Our Purpose," by President Gray; "Illustrated Address," by J. Robert Crouse; "Modern American Meter Practice," by R. C. Lamphier; also five-minute addresses by members present on salesmanship.

Two questions of importance will be discussed at the meeting—as to whether the association shall publish an official paper of its own, and as to what shall be done toward establishing headquarters for the association.

Delegates to the convention will take the opportunity presented by this gathering to visit the Electrical Show, and on the evening of the 20th they will meet at the Coliseum, where the ladies' tea-room will be placed at their disposal.

The Chicago Electrical Show.

[illegible] on January 15th in the [illegible] Trade Exposition Company, [illegible] Monadnock Building. The [illegible] are President, Samuel [illegible] Clark J. Geraghty and Harold B. [illegible] treasurer, John Jay [illegible]

POSTER FOR THE CHICAGO ELECTRICAL SHOW.

Spalding; general manager, Thomas R. Mercein. The directors are Mr. Insull, Mr. Overshiner, Mr. Spalding, Mr. Gregory, T. P. Gaylord, James Wolff, A. L. Waterbury, H. B. McMeal, C. E. Mitchell, Homer E. Niesz, G. H. Atkin, G. Edward Kohler and George B. Foster.

The exposition company has issued a handsome poster advertising the show, which by its appropriate design and pleasing colors is attracting no little attention. The poster was designed by Mr. Edward A. Wilson, a student at the Art institute in Chicago, and not unknown to the electrical fraternity. One of the accompanying illustrations is a reproduction of the poster, the picture, however, lacking the delicate tints, which is one of the striking features of the original.

The electrical show promises to be a success, and the various attractions offered by the management, such as excellent music, together with the interesting nature of the exhibits themselves, will no doubt prove enjoyable and instructive not only to those directly interested in electrical things, but to the general public as well.

One of the unique exhibits will be the electric clock, nearly eight feet in height, and made of 15,000

[illegible] Armour Institute [illegible] dred or more students by [illegible] [illegible] and the University of [illegible] [illegible] one of the departments of [illegible] meeting to Chicago at the time of the [illegible] each of the [illegible] to the [illegible] be decorated in the college colors, and will be used [illegible] visiting headquarters for the [illegible] various institutions.

On the opening night the [illegible] electrical field will be present by invitation, and the show will at the same time be formally opened to the public. It has been [illegible] that President Roosevelt will send his greetings in a wireless telegram on the opening night of the show. Dr. De Forest of the De Forest Wireless Telegraph Company of America arrived in Chicago from Washington a few days ago, where he has made complete arrangements for the flashing of the message to the Coliseum.

The man or woman who wishes to keep informed on the subject of electricity in the household will find much of interest in this department of the exhibition. Complete kitchen equipments, including every variety of electrically heated utensil from a teakettle to a griddle, will be shown. The Chicago Edison Company and the Simplex Electric Heating Company will exhibit complete cooking outfits, with which demonstrations will be made for the benefit of the public. The Simplex company will do much of the cooking for the restaurant, as well as the larger part of the laundry work for this department. The household devices also cover a great number of novelties, ranging from sad irons, milk warmers and curling irons to electric heating pads, which are used in place of hot-water bags. In contrast to these heating devices may be mentioned the small ice-making plants which are operated by electric motors. They are suitable for small stores which carry perishable goods. Medical appliances will be shown, such as vibrators and the like.

E. B. Overshiner, Vice-president.

Thomas R. Mercein. General Manager.

H. E. Niesz, Chairman of Committee on Publicity

THREE OF THE "HUSTLERS" FOR THE ELECTRICAL SHOW.

THE COLISEUM, WHERE CHICAGO ELECTRICAL SHOW WILL BE HELD

The Chicago Edison Company will print a daily edition of The Electric City in the building throughout the exposition.

Among the most interesting of the many demonstrations to be made will be the "stunts" that G. H. Thordarson of Chicago will produce with 600,000 volts of electricity, producing an electric spark nearly 10 feet long. For these experiments Mr. Thordarson has had specially made a sheet of plate glass weighing 700 pounds.

During the two weeks of the Electrical Show there will be three conventions in Chicago of

associations in the electrical field. These are the Northwestern Electrical Association, January 17th and 18th; the American Electrical Salesmen's Association, January 20th, and the Allied Electrical Trades Association.

Wednesday, January 17th, will be known as "Benjamin Franklin Day" and some special electrical feature is contemplated for that occasion, although definite arrangements have not yet been made. On that day bronze medallions will be distributed as souvenirs of the occasion.

January 22d, 23d and 24th will be of more special interest to telephone men, and a day will also be set aside for the different colleges, many of which will send delegations to the show.

Weil's band of St. Louis will give afternoon and evening concerts. It has never before been heard in Chicago, although many will remember it as one of the bands at the St. Louis Exposition.

The accompanying plan shows the arrangement of the exhibit spaces on the main floor of the Coliseum, and the list of exhibits indicates the location of each by section letter and number.

Ackerman & Boland Company, C 3.
Acorn Reflector Company, E 23.
Adams-Bagnall Electric Company, A 4.
Allis-Chalmers Company, D 5, 6.
American Circular Loom Company, F 6.
American Conduit Company, I 3.
American Electric Fuse Company, J 1.
Gorman & Co., Sam J., C 16.
Grier, Thomas G., J 5.
Guarantee Electric Company, A 11.
Haller Machine Company, J. 6.
Holcombe & Co., D 16.
India Rubber and Gutta Percha Insulating Company, C 7.
Indiana Rubber and Insulated Wire Company, E 16, 8.
Krantz Manufacturing Company, F 3.
Lang Electric Company, J., A 6.
Larsen-Baker Ice Machine Company, F 22.
Lincoln Electric Manufacturing Company, E 15.
Manhattan Electric Supply Company, C 15.
Mark Manufacturing Company, F 8.
Metropolitan Electric Supply Company, C 3.
Miller Anchor Company, H 5.
Monarch Electric and Wire Company, C 24.
McRoy Clay Works, C 4.
McFell Electric Company, C 5.
National Carbon Company, C 14.
National Wire Corporation Company, D 22.
New York and Ohio Company, E 16, 8.
New York Insulated Wire Company, J 4.
Niagara Tachometer and Instrument Company, J 5.
North Shore Electric Company, F 11.
Nungesser Electric Battery Company, J 5.
Oliver Manufacturing Company, E 2.
Osburn Flexible Conduit Company, E 7.
Overbagh & Ayers, J 2.
Packard Electric Company, E 16, 8.
Paiste Compuany, H. T., J 4.
Peabody Coal Company, C 22.
Peru Electric Manufacturing Company, J 3.
Peterson Mfg. Co., H., A 9.
Phillips Insulated Wire Company, E 16, 8.
Phœnix Glass Company, E 23.
Porter & Berg, A 4.
Purdue University, G 1.
Reynolds Dull Flasher Company, J 6, 7.
Reynolds Electric Flasher Manufacturing Company, E 23.
Rock Island Battery Company, B 2.
Roeblings Sons Company, John A., B 4.
Roth Bros. & Co., D 24.

American Association for the Advancement of Science.

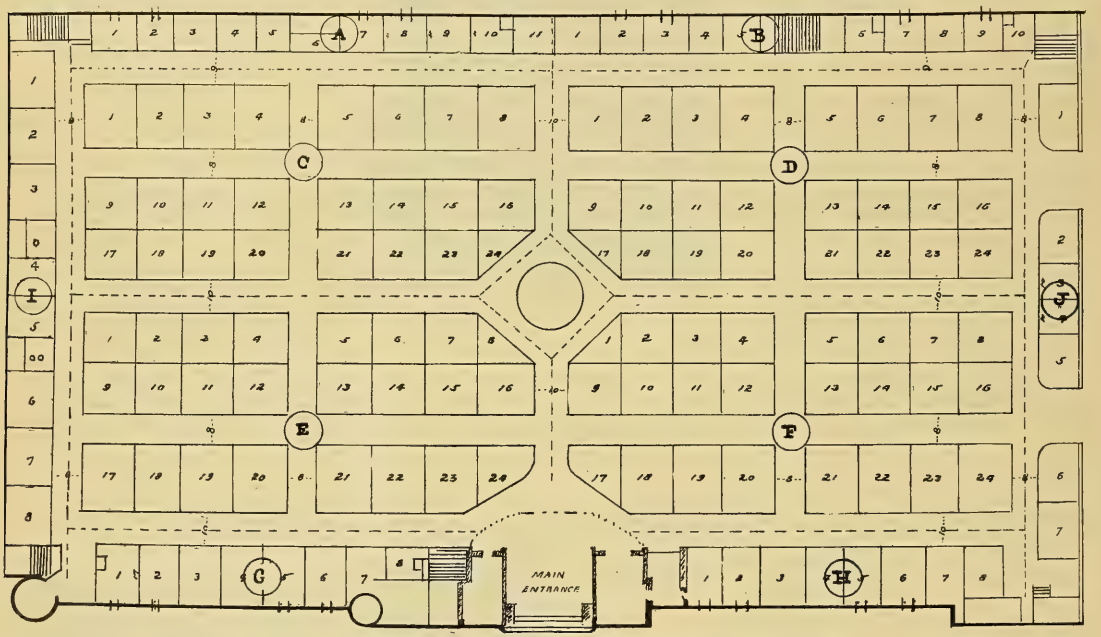
In the Western Electrician last week a synopsis was given of the proceedings of the American Association for the Advancement of Science in New Orleans. The concluding sessions were held on January 1st, 2d, 3d and 4th, and the importance of the meeting grew on each succeeding day.

Delegates to the convention enjoyed themselves in various ways, on Sunday, the 31st, taking advantage of the many pleasure trips which may be enjoyed in the vicinity of New Orleans during this season of the year.

One of the interesting papers read before the engineering section on Monday was by Prof. F. W. McNair, vice-president of the section and head of the Michigan College of Mines at Houghton. He described some experiments performed in a deep mine shaft to prove the theory of the diurnal rotation of the earth.

On Monday evening, at the general session, the officers for the ensuing year were chosen, and the following-named gentlemen were honored by election to office:

President, Dr. William H. Welch of Johns-Hopkins; vice-presidents, mathematics and astronomy, Edward Kasner, Columbia, physics, W. S. Sabine, Harvard, chemistry, Clifford Richardson, New York city, mechanical science and engineering, W. R. Warner, Cleveland geology and geography, A. C. Lane, Lansing, zoology, E. G. Conklin,



PLAN OF MAIN FLOOR OF COLISEUM SHOWING LOCATION OF EXHIBIT SPACES FOR ELECTRICAL SHOW.

American Electrical Novelty Company, E 11.
American Electric Sign Company, I 0.
American Electric Supply Company, G 7.
American Steel and Wire Company, D 17 and 18.
American Telephone Journal, B 8.
Ansonia Electrical Company, E 16, 8.
Armour Institute, G 4, 5.
Arthur, Adam, I 6.
Austin & Co., M. B., D 22.
Automatic Electric Company, C 20.
Belden Maufacturing Company, E 23.
Benedict & Burnham, D 22.
Benjamin Electric Manufacturing Company, J 1.
Bennett, I. A., E 7.
Bryan-Marsh Company, C 23.
Camp Company, H. B., E 24.
Central Electric Company, D 9.
Central Electric Manufacturing Company, C 6.
Chicago Battery Company, B 3.
Chicago Compound Battery Company, I 00.
Chicago Edison Company, F 1, 2, 3, 4, 9.
Chicago Lamp and Reflector Company, F 24.
Chicago Pneumatic Tool Company, F 10.
Chicago Solder Company, H 4.
Chicago Telephone Company, D 11, 19.
Colonial Electric Company, C 24.
Conover, G. W., & Co., B 2.
Cook, Frank B., E 4.
Crane Company, D 1.
Crescent Insulated Wire Company, C 24.
Crockett Company, William P., A 3.
Crocker-Wheeler Company, C 21.
De Forest Wireless Telegraph Company, D 2.
Edwards Headlight Company, A 1.
Electric Appliance Company, E 8, 16.
Electric Clock Company, H 4.
Electro-Dynamic Company, F 5.
Electric Storage Battery Company, D 21.
Engineering World, I 1.
Federal Electric Company, F 12.
Fort Wayne Electric Works, C 13.
Freed, A. L., C 4.
General Electric Company, F 17, 18, 19, 20, A 2.
General Incandescent Lamp Company, D 22.
General Storage Battery Company, C 8.
Safety Armorite Company, D 22.
Safety Insulated Wire Company, D 22.
Sangamo Electric Company, E 16, 8.
Scheidel Company, W., B 5.
Schott, W. H., A 7, 8.
Schureman Company, J. L., B 1.
Simplex Electric Heating Company, F 21.
Sound Waves, B 9.
Stanley G.-I. Electric Manufacturing Company, F 16.
Stromberg-Carlson Telephone Manufacturing Co., E 13, 5.
Swedish-American Telephone Company, E 12.
Sturtevant Company, B. F., C 1.
Telephony Publishing Company, B 6.
Thomas-Betts Company, D 22.
Thorardson, G. H., I 4, 5.
Universal Electric Storage Battery Company, D 13.
University of Colorado, G 2.
University of Illinois, G 3.
University of Wisconsin, G 6, 7.
Vesta Accumulator Company, A 10.
Western Electric Company, D 12, 20.
Western Electrician, B 7.
Western Union Telegraph Company, H 3.
Westinghouse Electric and Manufacturing Co., D 3, 4.
Whitney Electrical Instrument Company, E 16, 8.

Chicago Gas Inquiry.

Alexander C. Humphreys, president of Stevens Institute of Technology, Hoboken, N. J., said before the investigating committee that it would not be practicable to sell gas at 75 cents in Chicago. The company that undertakes it, he said, would be bankrupt in a short time. Mr. Humphreys is a member of the firm of Humphreys & Glasgow, manufacturers of gas-making apparatus. In his opinion the People's Gas Light and Coke Company should charge 95.53 cents per thousand feet for its product to earn a fair profit, provide for depreciation, and meet all possible contingencies.

University of Pennsylvania, botany, Daniel T. MacDougal, Carnegie Institute, anthropology, Hugo Munsterberg, Harvard, social and economic science, C. A. Conant, New York, physiology and experimental medicine, Simon Flexner, Rockefeller Institute; general secretary, John F. Hayford, Washington, D. C.; secretary of the council, Frank W. McNair, Michigan College of Mines.

The permanent secretary, Dr. L. O. Howard, and the secretaries of the sections were elected for five-year terms at the Philadelphia meeting. Dr. Howard is serving his second term now.

The special summer meeting will be held in Ithaca, N. Y., on June 28th, and the regular winter meeting in New York on December 27th

Of particular interest to engineers was the paper by Prof. W. R. Warner on the Panama Canal. Professor Warner is convinced that the sea-level canal is the only one that should be built. He said in part:

"Twenty-five years ago the control of the Chagres River was considered the difficult problem, but in accordance with the information I have gained from several of the best authorities, this river is now considered only 10 or 15 per cent. of the problem.

"When we consider that the maximum height at the beginning was less than the height of some of our modern buildings, and that the French company reduced that height to 150 feet above sea level, which is practically the height of our nine or 10-story buildings, and, further, that this height extends only for less than 10 miles, I am confident that if the present Congress does not direct a

sea-level canal to be built, that the next one will, for our government engineering works in the past have not been conducted on the penny wise and pound-foolish plan.

"One other argument ought to be mentioned, and that is that without exception the great engineering works of the present generation have proven themselves too small and too limited. This is illustrated by the Soo Canal, the first locks of which were discarded years ago and larger ones built, which are soon to be replaced by other still larger. If the Panama Canal is built on the sea level plan, it can be enlarged without interfering with traffic and without difficulty. On the other hand, if a lock system is used, it is limited and cannot be enlarged without being rebuilt."

Professor Fullerton Waldo also spoke upon the subject of the canal and gave some figures as to the amount of work already accomplished.

On Wednesday most of the sections had concluded their work and the day was largely given over to pleasure and sightseeing. The chemical section visited the Kenilworth plantation. The engineering section, under the auspices of the Sewer and Water Board, visited some of the pumping plants, and a portion of the party also visited the central power plant. Several social entertainments were given in the evening.

The meeting of the association was brought to a close on Thursday forenoon at the general session held in Gibson Hall, which was little more than a formality and but few members were present

New Massie Space-telegraph System.

The United States government is installing a chain of space-telegraph stations along the coast and is preparing to send out weather reports, storm warnings and time signals, and it is stated that commercial messages are also to be sent and received, so that one of the most necessary equipments of every sea-going vessel is a space-telegraph installation. The accompanying illustrations show the details of construction and the electrical apparatus of the Massie system of space telegraphy to be used by the government, including

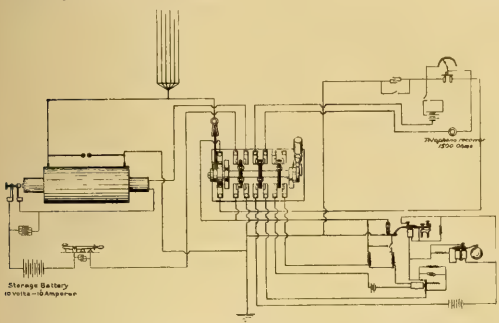


FIG. 1. CIRCUIT DIAGRAM OF PORTABLE MASSIE SPACE-TELEGRAPH SET.

the oscillaphone, the bell-alarm and switch-controlling devices.

This apparatus was designed by Walter W. Massie of the Massie Wireless Telegraph Company of Providence, R. I. For transmitting signals up to 100 miles with this system a special type of induction coil or transformer is employed to change the low potential of the lighting circuit to the high-potential current required to charge the

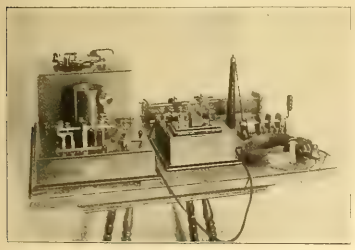


FIG. 1. MASSIE OSCILLAPHONE RECEIVER, SWITCH CONTROLLING DEVICE AND ALARM BELL.

Leyden jars, the oscillatory discharge of which passes across a spark-gap and through an adjustable inductance. The connecting link between the ground and the vertical wires is this inductance, and it is used to adjust the discharge of the Leyden jars to the natural frequency of the vertical system. A suitable muffler is utilized to enclose the spark-gap to deaden the sound of the discharge, thus overcoming what is frequently a disagreeable feature of [illegible] transmitters. The speed in sending messages is said to be limited only by the dexterity of the operator in sending dots and dashes, a [illegible] being used making very long [illegible]

An alternating current [illegible]

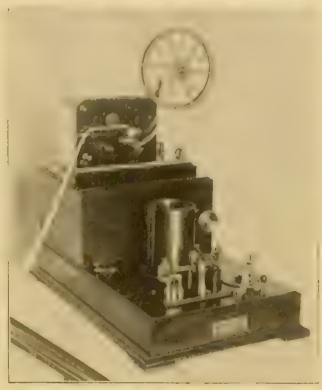


FIG. 3. MASSIE SPACE-TELEGRAPH RECORDER.

tances of over 100 miles, the amount of power required being, it is stated, approximately in proportion to the square of the distance. If it takes one-quarter of a horsepower to cover 100 miles, it will be necessary to use four horsepower, or 16 times the former amount to cover 400 miles, according to the observations made by Mr. Massie in the practical application of his system.

Fig 1 shows the electrical connections of the transmitters, receivers, etc., as well as the bell alarm, which is a prominent feature of the Massie system. This bell alarm is in circuit when the wireless installation is not in operation and is ready to respond to any signal received, thus notifying the operator when called, and by its use the operator is relieved of the strain and confining task of "listening" to the telephone receivers.

The oscillaphone, as shown in Fig. 2, is used as a receiver for the Massie system, and is a form of microphone used to detect the oscillatory current set up in the vertical wire by the passing ether wave. There are two knife-edge terminals made of a carbon compound, which are held in place by two resilient metal-conducting strips, bridged with a small steel needle. The needle is held in place against two stops by magnetism to counteract the motion of the boat. Vibrations of the engines on board ship are overcome by placing the box containing the instruments on a pneumatic cushion. It is stated that the entire system is controlled and operated by a single switching device arranged so that a single motion is all that is required to change the connection for sending or receiving, and in this manner it is asserted that the speed in operating is as rapid as that of the land telegraph in making the change from receiving to sending, or vice-versa. Fig. 3 shows the recording device.

Transmission of wireless signals is due according to Mr. Massie, to a wave-like disturbance in the magnetic forces of the earth, and he is not an advocate of the free inter-wave theory, having claimed to have discovered the discrepancy between the accepted theory and the results brought out by practical work. P.

At the recent convention of the International Brotherhood of Electrical Workers, held in Louisville, Ky., the question of moving the headquarters from Washington, D. C., to a more central location was discussed, and it was decided to choose a location by referendum vote. Twelve cities were nominated and Springfield, Ill., was selected by a vote of 5,769 against 3,317 for Indianapolis, the next highest competitor. W. N. Chiles, assistant city electrician of Springfield, assisted by the Business Men's Association and city officials, was instrumental in locating the headquarters.

Thomson's Power-transmitting Device.

[illegible]

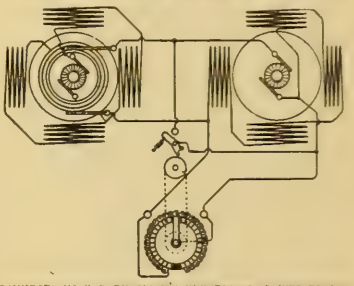
trolling [illegible]

[illegible]

machine, thereby varying the [illegible] amount of current flowing through [illegible] adjustable arrangement the [illegible] prime mover and driven machine [illegible] so that the power delivered by the [illegible] may be transmitted to the driven machine with the speed-torque factors altered in any desired manner – that is, with increased torque and [illegible] or vice versa. This result is accomplished without the use of batteries or other external sources of electromotive force or current whatever.

The accompanying illustration is a diagram of the connections of one form of the device, the generator and motor being coupled together.

When the apparatus is in operation, a variation



CONNECTIONS FOR THOMSON'S ELECTRICAL POWER-TRANSMITTING DEVICE.

of the field strength of motor occasioned by manipulation of the rheostat varies the counter-electromotive force of the motor, and this electromotive force being developed in a circuit in series with the generator varies the current developed by the generator. If the counter-electromotive force be increased by strengthening the field of the motor, the current flowing in the generator circuit is decreased, thereby decreasing the torque exerted between the two members of the generator. The torque exeerted upon and the speed transmitted to the driven mechanism through the sprocket chain therefore decrease. On the other hand, if the field strength of the motor be weakened by diverting current from the field winding or otherewise, more current flows in the generator circuit, thereby increasing the torque between the members of the generator. This may result in a speeding up of the mechanism driven through the sprocket chain or other power-transmitting device, the power developed in the generator in the form of electrical energy through the medium of which the torque is transmitted to the driven mechanism being returned to the power-supply system through the instrumentality of the motor. The mechanism is in condition for transmitting maximum torque when the short-circuiting switch is closed, thereby short-circuiting the generator directly upon itself. The short-circuiting of the motor has no effect, since as soon as it commences to develop current the direction of the current is such as to reduce the field magnetism to zero, thus immediately preventing the generation of current.

At St. Paul, Minn., an ordinance has just been adopted by the City Council requiring that electric-light and power wires in churches, theaters and other places used for public gatherings, also wires in unfinished basements, to be placed in suitable metal conduits.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

Three-conductor Direct-current Railway in Bohemia. By C. Smith. Illustrated 31
Electric Light and Power Service in Chicago and Vicinity 32
Single-phase Locomotives for Sarnia Tunnel. Illustrated 32
Northwestern Electrical Convention 33
Generous Contributions to Engineering Building Fund 33
American Electrical Salesmen's Convention 33
The Chicago Electrical Show. Illustrated 33, 34
Chicago Gas Inquiry 34
American Association for the Advancement of Science. (Conclusion of report of New Orleans meeting.) 34, 35
New Massie Space-telegraph System. Illustrated 35
Thomson's Power-transmitting Device. Illustrated 35
Editorial 36
Possible Municipal Uses of Drainage Canal Power 37, 38
A Wireless Printing Telegraph 38
Waterpower Development at Sewalls Falls, N. H. Illustrated. 38
Books Received 38
Electricity in a Large Paper Mill. By F. M. Feiker. Illustrated 39
Chicago Street-railway Situation 39, 40
Westinghouse Electrostatic Voltmeter. Illustrated 40
The "Hold-fast" Lamp Guard. Illustrated 40
Inter-pole Variable-speed Motor for Machine-tool Work. Illustrated 41
Dinner to Indiana Traction Men 41
Michigan Traction Consolidation 41
Yerkes' Successors Named 41
Efficiencies. By James Swinburne. Illustrated 42
California Electric Power Consolidation Completed 42
Growth of the Wright Demand Indicator Business in the United States. Illustrated 43
The New Philadelphia Subway 43
Engineering Features of the Jhelum Power Installation in India 43
Oscillographic Researches on Surging in High-tension Lines. By C. David. Illustrated 43, 44
Central Illinois Independent Telephone Meeting 44
Telephone Men 44
Indiana Telephone Items 45
Telephone News from the Northwest 45
Ohio Telephone Notes 45
Indiana District Telephone Meeting 45
Modern Telephone Exchange for Manila 45
General Telephone News 45

DEPARTMENTS.

Correspondence 46, 47
Great Britain 46
Dominion of Canada 46
New York 46
Ohio 46, 47
Indiana 47
Southeastern States 47
Northwestern States 47
Pacific Slope 47
Personal 47, 48
Electric Lighting 48
Electric Railways 48
Publications 48
Societies and Schools 48
Miscellaneous 48, 49
Trade News 49
Business 49
Illustrated Electrical Patent Record 49, 50

DATES AHEAD.

Chicago Electrical Show (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

Northwestern Electrical Association (annual convention), Great Northern Hotel, Chicago, January 17th and 18th.

American Electrical Salesmen's Association (first annual meeting), Grand Pacific Hotel, Chicago, January 20th, 9 a. m.

Nebraska Independent Telephone Association (annual convention), Lindell Hotel, Lincoln, Neb., January 23d and 24th.

Ohio Interurban Railway Association (annual meeting), Algonquin Hotel, Dayton, Ohio, January 25th.

IN A RECENT issue of one of our contemporaries there appears a description of what is asserted to be the largest private electric-light plant in the world. The plant described is that in the Mutual Life Building in New York city, having four 350-kilowatt generators, or a total rated capacity of 1,400 kilowatts. The writer of this article, however, is somewhat in error on the point of its being the largest private plant in the world. As a matter of fact, the New York plant falls considerably short of being a record-breaker in size. The private electric plant in Chicago which furnishes current for the Auditorium and Auditorium Annex hotels contains seven units, having an aggregate rated capacity of 2,000 kilowatts. We do not recall any other private lighting plant as large in size as that at the Auditorium, and it is possible that it holds the record as to size. It at least considerably outstrips the one described in New York.

IN VIEW of the recent controversy that has arisen over the relative merits of direct and alternating currents for traction purposes, additional interest is attached to the article which appears elsewhere in this issue under the title "Three-conductor Direct-current Railway System in Bohemia." The system described makes use of direct current generated at 1,400 volts and distributed on the three-wire system, with the rails for the neutral, and 700 volts between them and each of the two overhead conductors. This system of operation has been suggested, but has never met with favor in this country, or elsewhere for that matter, and it will be interesting to note what the outcome will be. Mr. Frank J. Sprague, who is an advocate of direct-current operation, believes that the working voltage of direct-current railways may be as high as 1,500 volts or more, with attendant advantages. In the Bohemian railway under consideration we are able to discern a tendency in this direction. Of course in this case only 700-volt motors are used, which are connected in parallel between the neutral and the two outside conductors, or in series between the outside conductors, but still 700 volts is a distinct rise in motor voltage over the 500 or 550 volts now customary in direct-current railway practice.

ALDERMAN POTTER of the Sixth Ward, Chicago—may his tribe increase!—deserves credit and thanks for his resolution in the City Council demanding the electrification of the suburban service of the Illinois Central Railroad in Chicago, even if nothing further comes of it. What a pleasing morsel of truth is this, one of Mr. Potter's "whereases": "The noise and smoke of the locomotives of said railway are an intolerable nuisance to the residents along its right-of-way, and the smoke and dirt are most destructive to personal and public property and will be most destructive to the valuable collections of the Field Museum and the Crerar Library, and to the lawns, shrubs and trees at the Lake Front Park." The man who has struggled along an Illinois Central platform in a cloud of smoke and cinders, with an energetic live coal nestling between his neck and his shirt-collar will indorse this from the bottom of his heart. And the next "whereas," how true: "It has been amply demonstrated that electricity is a practicable and economical motive power for the operation of railways, as is witnessed by the elevated roads of this city and great numbers of interurban railways, and notably by its adoption by the New York Central and Pennsylvania railways for their New York city terminals."

Of course the suburban service of the Illinois Central should be electrified. It is entirely practicable, as the Western Electrician has faithfully borne witness on former occasions. It is obviously equally practicable to electrically equip the suburban services of all other steam-railroad companies doing this class of business in Chicago. But the case of the Illinois Central is more glaring, because it happens that in no other instance are the steam locomotives such a nuisance as here. Perhaps the company is delaying in making the change on the score of expense, but it has been demonstrated that the electrically equipped trains can be operated at least as cheaply and with recent improvements probably considerably cheaper than the steam locomotive. The improvement is bound to come some time, and the sooner the railroad company takes a step which is inevitable the greater will be its credit.

SOME INTERESTING comparisons between the standards observed in the East and in the West for inside wiring were made recently by an electrical inspector for the Western Association of Fire Underwriters. The inspector visited some of the best municipal electrical inspection departments in eastern cities during a recent trip, and from the general character of the work open for inspection at that time he concludes that the standard for inside wiring maintained by the average municipal department in the West is fully up to the best eastern requirements.

Eastern departments, he reports, maintain more complete records of work done and are more aggressive in supervising outside wiring than the average department in the West. This was found particularly true in Massachusetts, where the statutes require each municipality to regulate both inside and outside wiring. It is thought, on the other hand, that municipal departments in the western territory have made greater progress in securing improvements in old and defective wiring.

It is always to be remembered that inspectors for the underwriters are employed for the purpose of making the insurance business more remunerative, not to advance electrical interests as such. But, while some of their criticisms are academic rather than practical, it is of couse true that electrical apparatus should be installed and maintained with careful regard for the fire hazard. It is to be noted, however, that this hazard is greatly overrated by the general public, due, largely, to the carelessness of daily newspapers in giving currency to the well-worn phrases, "The fire was due to crossed wires," or "The fire was apparently of electrical origin." In nearly all cases where investigation is possible, it is shown that the electrical equipment was not at fault. But sometimes the men in charge of the equipment become careless or impatient or indifferent, and there is trouble. More rarely, the contractor skimped the job in the first instance, neglecting to install the work properly, to make a little more money. Correctly installed, we think that all are agreed that electrical devices for generating, transmitting and utilizing power are the safest known.

In a recent report Mr. Frank Daniel, electrical inspector for the Indiana State Board of Fire Underwriters, makes some interesting observations on this important subject. He says that in the smaller cities in that state the electrical conditions are the outcome of a haphazard development. Only in rare cases have the electric-light and power systems in these cities had the advantage of intelligent direction from the start, with provision for growth, expansion and betterment. This is probably true, but it doesn't necessarily follow that the fire risk is greater. Mr. Daniel has most fault to find, however, with honest but unskilled workmen, "to whom the National Electrical Code is all Greek." He cites some "horrible examples." In one town he visited a dry-goods store where the conditions were particularly bad. "By all the rules of the game," he says, "this place should have burned out at least 10 times a day"—but it didn't. Electrical construction, even at its worst, has a way of muddling through somehow that elicits a degree of admiration, even if it does not command respect. But it is safest not to take chances.

Mr. Daniel's main point is that better workmen are needed. The gist of what he says may be stated as follows: "Conditions which are common in Indiana and many other states show conclusively that most of the defects in wiring are due to ignorance on the part of local workmen. Where faults are called to the attention of the insured, it is generally the case that they are as anxious as the insurance companies to have them corrected. The trouble comes in making corrections, for when the property owner turns the matter over to local workmen, it is often the case that they are unacquainted with the National Code requirements. There is need for more technical knowledge among electrical inspectors and workers to bring conditions up to standard. Those who are engaged in the work are anxious to improve their knowledge in the majority of cases and are making use of such opportunities as come their way." The last sentence shows, what apparently Mr. Daniel does not say directly, that the standard of electrical construction work everywhere is constantly being improved, in some places more rapidly than in others, but in all places to some extent. It is true that there are incompetent electrical workmen, but often, where defective work exists, the owner is at fault in insisting on a low-priced job at any cost.

Possible Municipal Uses of Drainage Canal Power.

William Carroll, city electrician; John Ericson, city engineer, and Joseph M. Patterson, commissioner of public works, have prepared jointly a report to the mayor and City Council of Chicago on the most advantageous municipal uses of power from the hydro-electric development of the Chicago Drainage Canal, for which construction work is now in progress. This power is being developed by the Sanitary District (a territory largely made up of the city of Chicago), and an influential party believes that the energy should be used for municipal purposes, at cost, inasmuch as the Drainage Canal was built with public money.

After reciting the council order for the making of the report, its authors continue:

Power Development.

The waterpower now being developed by the Sanitary District below Lockport, Ill., is expected to be partially available on or before January, 1907. With the first installment of the plant and with the present allowable flow through the Chicago River, in addition to the flow that in the near future is to be delivered through the Thirty-ninth Street conduit, it is estimated there will be generated sufficient power to make available at a proposed terminal station to be located somewhere near Forty-eighth Avenue and the Drainage Canal, after losses in waterwheels, generators, transformers, transmission lines, etc., shall have been deducted, about 15,730 horsepower. From this should be deducted a further loss of an average of five per cent. in transmission from the terminal station to points of application, leaving a net number of horsepower for actual use of about 15,000.

Having been unable to obtain definite data from which to determine this probable available power, we have for the purpose of this report accepted the estimate as furnished us by officials of the Sanitary District, without either approving or rejecting the same.

After the proposed Calumet District Channel shall have been completed, which no doubt will require quite a number of years, the available commercial power at the terminal station referred to will probably be increased to 21,000 or 22,000 horsepower at low lake level. This estimate is somewhat of an approximation until more definite data as regards the hydraulic elements of the Sanitary District Canal can be obtained.

The Santary District also has waterpower rights south of Joliet, which, when developed, will add considerably to the above estimate.

Utilization of This Power for Municipal Purposes.

The municipal purposes for which power is required are principally as follows:

- Electric lighting.
- Waterworks.
- Sewage pumping stations.
- Bridges.
- Street railways (when municipally operated).
- Miscellaneous.

Under the most favorable conditions water-driven electric power plants have a great advantage over steam-driven, especially in their low operating cost.

If the investment per horsepower developed is high and the power thus generated has to be transmitted long distances, this advantage disappears, however, especially where the cost of fuel is low. The improvements that in the last few years have been made in the construction and operation of steam-driven plants, make it necessary to carefully consider all phases of the subject of power, before determining whether the water-driven or the steam-driven power is the most economical and desirable

We have given the matter considerable attention in connection with a consideration of the uses to which the Lockport power may be put for municipal purposes.

The cost at which the power developed by the Sanitary District may be obtained by the city of Chicago has not been ascertained. If the city can obtain this power at cost of development and transmission, including all charges, there will be a saving to the city in its utilization for municipal purposes.

Electric Lighting.

There are at present about 6,700 electric street lamps in the city of Chicago, and as soon as necessary power is obtained it is contemplated to place a lamp at practically every street intersection and in the middle of very long blocks in the city. This would add about 22,000 lamps, making a total of some 29,000 lamps.

To operate these lamps there would be required about 21,000 horsepower for an average of 11 hours per day, being a maximum of 14 hours in the winter for about two months and a minimum of 8½ hours in the summer for about three months. When such a system shall have been completed nearly all the ultimate power to be developed at Lockport would be required for this purpose and for the lighting of municipal buildings for a certain portion of the 24-hour day.

As the cost of power [illegible] decreases, it would be necessary to make pro[illegible] for the use of this power, when not required for lighting purposes, in order to [illegible]. This is even more necessary in the case of a water-driven plant than in the case of a steam-driven, since the operating expenses are quite [illegible] in the former as compared with the latter [illegible] the fixed charges in a water-driven plant are [illegible].

Waterworks.

In order to determine approximately the amount of power that would be required for the operation of the waterworks of the city of Chicago, the present work of the stations has been used as a basis.

The average daily pumpage for the year 1905 was at the rate of about 410,000,000 gallons against a head averaging 100 feet. This is equivalent to about 7,200 pump-horsepower. The maximum pumpage in any certain time of the year is about 20 per cent. over and above the average, or say 8,600 horsepower. If electrically driven pumps should be installed, there would be required at the motors to perform this work about 14,400 horsepower at the time of maximum pumpage.

Owing to additional pump installations during the coming year there will probably be required in 1907 for electrically operated pumps about 16,000 horsepower for peak loads. The minimum would then be about 13,000 horsepower.

The comparatively slight variation in and the constancy of the power required during all hours for this purpose would make the utilization of the waterpower quite desirable, but there are objections which outweigh these apparent advantages, and which must not be lost sight of.

It is, in our opinion, impracticable to apply electric power to the present vertical triple-expansion and horizontal compound pumping engines without an entire reconstruction of the various plants. This reconstruction, even with the maintaining of the present pump ends, would be so costly and the results so unsatisfactory, that it would be preferable to install entirely new plants with modern turbine pumps.

The power for waterworks purposes must be constant and absolutely reliable. Failure at any time of the power operating such plants would involve the city into difficulties not to be countenanced for a moment. It is almost a certainty that at times there will be an unavoidable shutdown of the waterpower plant, caused by anchor ice, accidents at the power house or to the transmission lines or from other causes. This has occurred both at Niagara Falls and at the Economic plant at Joliet, at the latter place for hours at a time, so that an auxiliary steam-turbine installation has been made at the power plant to meet such emergencies. There is certainly no guarantee that such accidents will not occur at the Lockport plant.

It would, therefore, be necessary to install entirely new plants, suitable for electric power equipment, and also to maintain the present plants as auxiliaries to be brought into use in cases of emergency, at least for some time. The difficulty and cost of installing duplicate plants of equal capacity with the present ones at each station, to be operated electrically and without dismantling the present plants, is too great to be contemplated.

Proposed New Works.—In the plans now being prepared to provide for the future development of the Chicago waterworks system there are contemplated four additional pumping stations, each of a capacity of about 100,000,000 gallons daily. One of these will be in operation in about four years, and the others as soon as the demands will require and the finances will permit.

Recent developments in turbine or centrifugal pumps which are specially adapted to be operated electrically, makes it advisable to consider such installations at the new proposed stations, provided that the power can be obtained at a sufficiently low cost. The low cost of installation and of operation, exclusive of power, of such plants brings the cost of pumping water below the cost of operating with steam-driven plants, provided the power can be obtained at a price that it costs to generate same at the proposed power plant and to transmit it to the point of application. In case of such installation, however, supplementary power should be available in cases of emergency. This could be provided by storage batteries or from one or more steam-driven plants, which the municipality in the near future may install for municipal street railways or other purposes, whether the Sanitary District waterpower is made use of or not.

The average power that will be required at the motors for each one of these stations, when fully equipped, is about 2,500 horsepower, with peak loads at certain times during the warmest and coldest months of 4,700 horsepower.

High-pressure Water System.—A high-pressure water system has for some time been under consideration by this community. One system for the central district with a total capacity of 30,000 gallons per minute and one for the south section of the city with a capacity of 10,000 gallons per minute. Assuming maximum pressures at 200 [illegible]

[illegible]

[illegible] not be considered.

[illegible] pumping stations [illegible] the average power required [illegible] under [illegible] 20 horsepower. During [illegible] be increased to 80 horsepower [illegible] furnished by the railroad company, [illegible]

The Kensington pumping [illegible] two centrifugal pumps, each driven by [illegible] power compound [illegible] could readily be changed [illegible] electrically without [illegible] cost. The power required will vary from [illegible] nary dry flow conditions to [illegible].

Pullman Station, located at One Hundred [illegible] ninth Street and the Illinois Central Railroad, contains two direct-acting compound [illegible] engines of 60 horsepower each. Electrically driven centrifugal pumps can be substituted for the present machinery.

The Jackson Park Avenue pumping station contains four steam-driven centrifugal pumps. The plant is just about completed, but a change so as to provide for electrical operation could be made without excessive cost. The average power required will for some years probably not exceed 80 horsepower. The maximum probably not to exceed 300 horsepower. Ultimately the maximum power required may be as much as 800 horsepower.

Contract is about to be let for a sewage-pumping station at Ninety-fifth Street and Erie Avenue. This will practically be a duplicate of the Jackson Park station, and will require about equal power.

At the Fullerton Avenue pumping station a maximum of 100 horsepower at the motors would be required if electrically operated. The load at this station may be kept uniform, making the station especially suitable for the application of electric power.

The Thirty-ninth Street and the Lawrence Avenue sewage-pumping stations are both to be equipped with steam-driven centrifugal and screw pumps. As they both are to be operated by the Sanitary District, they need not be further considered in connection with the subject under discussion.

What has been said as regards reserve power for the operation of the waterworks pumping stations applies also to the sewage-pumping stations, although generally not with equal force, as the stopping of the latter for a few hours would generally not have the same disastrous effect as the stopping of the waterworks pumps.

Bridges.

There are 50 movable municipal bridges in the city, all of which eventually will be electrically operated. The average maximum power required for each bridge, including lights, signals, pumps and operation, is about 125 horsepower. There is, however, only a part of this number that are operated simultaneously, and the power required will vary considerably for different seasons and different hours of the day. Since a number of railway cars have to stop running when bridges are operated, and the power can be obtained at very reasonable cost, there would probably be very little if any gain, in changing the power from the railway service, where it is now mostly obtained. The power would vary from about 300 to 1,200 horsepower for the whole city when all bridges shall have been electrically equipped.

Street Railways.

Until the question as to whether the city of Chicago is to operate railway systems of its own is settled, it cannot, of course, make any provision for the power that will be necessary for this purpose.

The pending ordinances now before the City Council call for 1,582 double-truck cars and 851 single-truck cars to be in use within a period of three years. Allowing for a certain proportion of these cars to be out of service and undergoing repairs, there would be required for the peak loads from 5:30 to about 6 p. m. about 95,000 horsepower, basing our conclusions on a load diagram furnished by the Chicago City Railway Company. All the power that can be developed at both the power plants that the Sanitary District proposes to install can be utilized for 19 or 20 hours out of 24. The surplus power developed the remaining four or five hours could be stored, and thus reduce the capacity of the steam-driven plants that would be necessary to take care of the loads that the water-driven power could not handle. The

power produced by the water-driven plants could therefore be used more advantageously for this purpose than for any other mentioned.

RECAPITULATION.

At the present rate of installing electric street lamps, the city will require during the year 1907 about 7,000 horsepower for an average of 11 hours per day. Additional power for this purpose will be required in proportion to the number of street lamps installed yearly. For the disposal of power when not used for electric-lighting purposes, there remain the following municipal utilities:

Average constant power required for sewage-pumping stations is about 300 horsepower. The requirements for this purpose may at any time, day or night, be increased to about 1,000 horsepower. The power required for the operation, lighting, signaling, pumping, etc., at the present electric bridges will vary from about 200 to a maximum of about 1,000 horsepower. This maximum requirement of power may be made at any time, night or day.

In addition to the lighting of municipal buildings, there are a few small municipal shops where electric power may take the place of steam power. As before stated, it is not practicable or advisable to introduce electric power for the operation of the present waterworks plants. Assuming then that sufficient power be purchased to operate our present electric-light system, there would be 7,000 horsepower to be disposed of during the day. The average requirements, day or night, for the operation of the sewage-pumping stations, bridges and shops would not exceed 1,000 horsepower, which at times may be increased to 2,000 horsepower. The maximum requirements are liable to occur at night, when the power is required for electric-lighting purposes, as well as in daytime. If the city of Chicago can dispose of its surplus power for commercial uses, when not required for electric lighting or other purposes, satisfactory arrangements could undoubtedly be made whereby the electric lighting as well as the other mentioned municipal works could be economically operated by power generated at Lockport.

Assuming that the power from the proposed waterpower plant will be obtained at a price that will bring the cost below that of power generated by steam-driven plants, and sufficient funds for necessary installations are appropriated, we beg to emphasize the following:

First—The most desirable use for municipal purposes of the power now being developed at Lockport by the Sanitary District would be for the operation of municipal street railways, which can use all the power that the Sanitary District can furnish for 24 hours each day.

Second—For the lighting of the city's streets and municipal buildings, provided a disposition can be made of the power during such hours when lighting is not required. This may be done if the city is given the right to dispose of power for commercial purposes during the day.

Third—Sewage-pumping stations, bridges and other minor utilities may be equipped for electrical operation, but would not to any appreciable extent serve to utilize during the daytime the released power used for electric lighting during the night.

Fourth—It is not economical or practicable to change the present waterworks plants to electrical operation. New proposed plants may be electrically operated, and careful consideration should be given to this matter before new designs are decided upon.

A Wireless Printing Telegraph.

An Indiana correspondent sends the following: "Elmer A. Burlingame, a young electrician and inventor of Laporte, Indiana, says that he has perfected an apparatus that will revolutionize present methods of telegraph communication and news dissemination. The invention is a printing wireless telegraph. The operator who sends messages writes or prints them on an ordinary typewriter. This prints in the usual way, but in addition flashes a message through space to a receiving station, where the copy is reprinted on a similar machine, exactly like the first. The receiving station must be attuned to the incoming Hertzian waves, this giving secrecy and making it possible to have several sets of instruments working at once without interference. This non-interference is said to be so complete that all sending instruments may be connected to the same sending wire, and all receiving instruments to another wire. Mr. Burlingame says messages may be sent by his printing system about five times as fast as with the Morse code, and the necessity of waiting for an idle line is done away with. It is said that by connecting linotypes in offices within a radius of 500 miles it will be possible to operate them simultaneously from one sending station. The cost of equipping the receiving station will be about $1,000, while the cost of the sending station will be about $2,000. Laporte capitalists, it is declared, are preparing to build a factory to manufacture the apparatus."

This is certainly interesting. But more detailed information will be needed to supplement these general statements before it can be taken for granted that the gentleman named has made an invention of great practical importance, which will, of course, be the case if the foregoing assertions prove true.

Waterpower Development at Sewalls Falls, N. H.

An interesting problem in the utilization of a waterpower with a small fall and large variation of head for the production of electric current has been skillfully solved in the design of two 900-horsepower turbines which have been built and are now being installed at Sewalls Falls, N. H., for the Concord Electric Company. The first installation will consist of two complete hydro-electric units, each composed of a triplex turbine waterwheel and a direct-connected alternating-current Bullock generator, a motor-driven exciter set, turbine governors and electrical synchronizers. As the current is to be used chiefly for lighting purposes and possibly in connection with other sources of power generation, it is necessary to have the speed of revolution for the wheels and generators constant, even though the amount of developed power might differ under different heads.

Ordinarily the stream produces a fall which gives a net working head of 16 feet. In times of flood, however, the water backs up in the lower channel so as to reduce the working head to 12 feet.

To secure the desired results two turbines have been designed, each with three sets of runners and gates complete, the three sets being arranged one above the other on a vertical shaft, as illustrated in horizontal position in Fig. 1. The runners are all connected to the tailrace by means of draft tubes so as to derive the full energy of the water, due to its actual head, from each of the runners, no matter what its relative or actual position may be upon the shaft. The lower runner of each wheel has a draft tube by itself, while a single tube of larger dimensions carries off the discharge water from the two upper runners. The turbines are of the Francis central-discharge type. The three runners on each wheel are each of equal size, form and capacity; but they do not all discharge in the same direction. The lower one discharges downward into an individual concrete draft tube. The upper runner discharges downward and the middle one upward, both into a separate concrete draft tube, which joins the lower one at the bottom of the tail-race. The reactions from these two runners practically balance one another, while the reaction from the discharge of the lower runner, being upward, tends to lift a portion of the load on the turbine shaft. This effect is considered negligible in the turbine design, but provision is made for using the pressure due to the head of water to actually carry a considerable part of the weight of the turbines and the generators at all times. This is done by admitting the water of the flume into a space directly under the second runner of each turbine, where it exerts its pressure upward against a circular plate, which forms a revolving piston. The water will carry about one-third the weight of the rotating parts. The other two-thirds is carried by a thrust bearing supported by the castings of the turbine.

FIG. 1. ROTATING ELEMENT OF TRIPLEX TURBINE FOR SEWALLS FALLS.

Lubrication is provided for in an ingenious manner. A well is formed outside the bearing rings, and this is filled to a suitable height with oil. The oil flows to the inner part of the bearing through suitable holes, passes through the bearing, guided by proper grooves, and is returned through holes to the well. The circulating action is continuous as long as the wheel is in action, and it is automatic.

The shaft is in two parts coupled together just below the generator. The rumors are of non-corrosive bronze, each cast in one piece. They are 55 inches in diameter. Surrounding each runner are the gates which admit the water to it and control its speed. Outside the gates of each runner and reaching all around it so as to admit water to all parts of the periphery of the wheel at once is a space ample for that purpose. The gates are composed of movable guide vanes and so constructed that when open they admit a full head of water with but little interference, and when closed totally exclude the water. They are all connected by links to a common gate ring and arranged so that a minimum of power is required to operate them. Operation is through two countershafts standing parallel to the main shaft. These are each provided with a crank at each set of gates, and the cranks are connected to the gate rings by links. One-eighth of a turn of the shaft completely closes the gates. An energy of not more than 12,000 foot-pounds is all that is required for this operation. This power is supplied by the governor for each wheel.

The governors are placed on the generator floor beside the generators. They are of the Allis-Chalmers standard, self-contained oil-pressure hydraulic type. The design of this governor is such that no changes in arrangement will need to be made should three or more units be added to the plant. Such additions are not unlikely after two or three years.

The wheels will each produce 900 horsepower with a 16-foot head on a consumption of 620 cubic feet of water per second, or 625 horsepower at 12-foot head with a flow of 650 cubic feet per second. Working at full gate they are expected to economize 78 per cent. of the power of the water or more, and to give 80 per cent. return at three-fourths gate. At half-gate they are expected to economize 75 per cent. of the power of the water. They operate at 100 revolutions per minute.

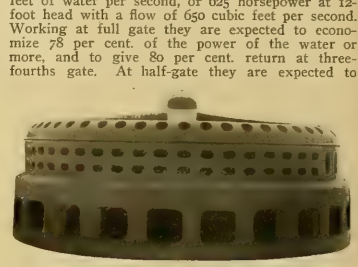


FIG. 2. BULLOCK VERTICAL GENERATOR FOR SEWALLS FALLS.

Standing directly over the turbines with their stator parts supported on the generator-room floor are the two generators, one for each turbine. The rotor shafts are direct-coupled to the shafts of the turbines and form the upper parts of the turbine shafts. The weight of the rotors is carried by the thrust bearings of the turbines; but they have a steady bearing above the coupling to keep them in line.

The generators, one of which is shown in Fig. 2, are of the Bullock vertical waterwheel type, with upper guide bearing supported in a housing bolted to the stator. The stator or armature rests on a substantial cast-iron ring supported by the foundation. The revolving field consists of a cast-steel spider securely keyed to the vertical shaft and provided with dovetail grooves in its rim for holding the laminated pole-pieces, which are secured in place by tapered steel keys. The field coils are wound with copper strip bent on edge.

Each generator can deliver 500 kilowatts at 2,600 volts, three-phase, 60 cycles, 111 amperes per line. The speed is 100 revolutions per minute, the revolving fields having 72 poles. The fields are wound for separate excitation at 120 volts and the generators have an efficiency of 94 per cent. at full load, 93 per cent. at three-quarters load and 91 per cent. at half-load, and will stand a 100 per cent. momentary overload without injury.

The armatures have a three-phase winding of heavily insulated coils capable of standing a 5,000-volt puncture test between coils and frame. The field insulation is tested with 1,500 volts applied between the coils and field cores or spider. The supporting yoke for the armature core is of open construction.

For exciting the alternators a motor-generator set consisting of a 75-horsepower induction motor coupled to a 45-kilowatt direct-current generator is provided. The induction motor is wound for 2,600 volts, three-phase, 60 cycles, and the generator for 120 volts; the full-load speed is approximately 680 revolutions per minute. Both machines are mounted on a common bedplate and the set has three bearings, two of which are carried in end housings bolted to the stator yoke of the induction motor.

The Allis-Chalmers Company of Milwaukee furnished the complete hydraulic and electric equipment.

Books Received.

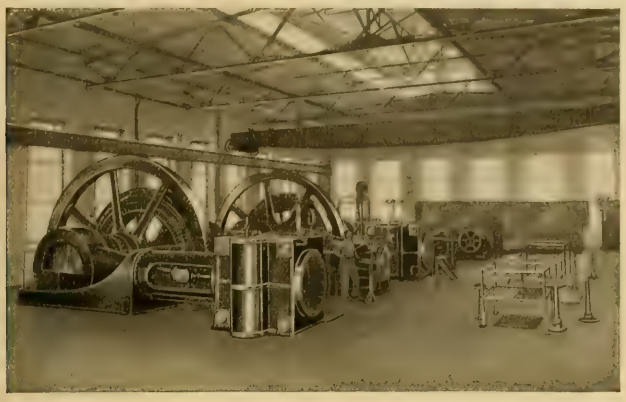
"Practical Pattern Making," by F. W. Barrows. Published by the Norman W. Henley Publishing Company, New York. Price, $2.

"Practical Talks on Electricity" (Parts I. and II.), by William Baxter, Jr. Published by the Engineer Publishing Company, Chicago. Price, $3.

Electricity in a Large Paper Mill.

By F. M. Feiker.

Of all the varied industries in which electricity has been so widely applied as a motive power there is none to which it is better adapted than the manufacture of paper. In modern paper mills the flexibility and general efficiency of this system are causing it to supplant rapidly the older methods of mechanical drive. Not only does the flexibility of electric motor drive for paper making machinery render it particularly applicable, but there are also



POWER PLANT OF LARGE ELECTRICALLY OPERATED PAPER MILL.

many subsidiary reasons which have helped to bring about the change.

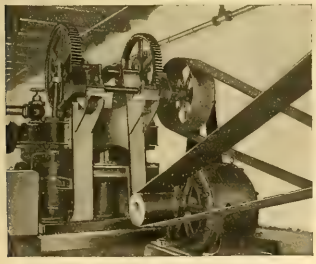
One of the most prominent of these causes is the general simplicity of the electric system. There are no idle-running shafts or belts; indeed little shafting and belting is required. From the starting point at the generating apparatus up to the moment when the electrical energy is converted into useful work there is a minimum of transmission loss.

At the generating end we may have a water-wheel-driven electric generator deriving its power from the same river which floats the raw material to the mill in the form of logs; or, the location, for commercial reasons, may of necessity demand steam-power generation of electricity.

Another reason which makes the use of electric power advantageous is the ease with which it can be measured. At the main switchboard in the power house are located the measuring instruments, through which all current passes and is accurately metered. With the mechanical, steam or hydraulic distribution of energy the accurate measurement of the energy used is practically impossible. Using the electric system, the power consumed in various mills or departments of the same mill is known to the fraction of a horsepower and may therefore be properly charged.

In the third place, in the distribution of power, electricity again has the advantage. Leaving the main switchboards the current is led by overhead or underground transmission lines to the various buildings or mills. This transfer of energy takes place with a small loss in comparison with the cumbersome methods of mechanical or hydraulic-power transmission.

At the receiving end of the line there are many marked advantages for the electric drive. The



PUMPS OPERATED ELECTRICALLY IN LARGE PAPER MILL.

motors may be of either the direct or alternating-current type, although the latter design, the induction motor, is better suited to most paper-mill work.

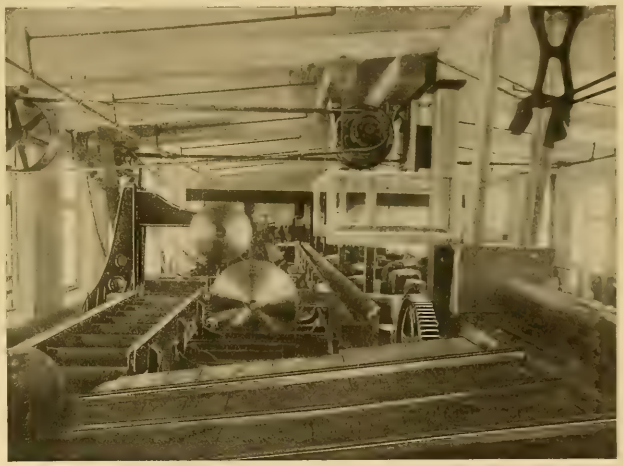
In order to bring out more clearly special adaptations of the electric system an interesting example of an electrically driven paper mill is briefly described. This plant, located at Munising, Mich., consists of three groups of buildings—the power house, the sulphite fiber mill and the paper mill. The power house is centrally located so as to supply steam for the various processes of paper manufacturing, such as heating driers, drying the paper, etc.

In this generating station is located the complete electrical equipment. The boiler house contains 10 500-horsepower boilers, with an aggregate capacity of 12 units. These boilers supply steam at 150 pounds pressure, and about one-half the steam so generated is required for direct use in various parts of the paper manufacture. For [illegible] steam is used to operate the various [illegible] paper machines, as the exhaust from the

[illegible] The entire electrical equipment [illegible] the General Electric Company, [illegible] N. Y.

engines is the most ready means of drying the paper. The furnaces are designed to burn either wood or coal, being equipped with interchangeable grates. An electric railway is being constructed to bring the refuse from a number of shingle mills in the vicinity of the plant. This refuse will first pass through an electrically driven hogging machine and then be fed to the boilers. At present coal is used for firing.

The electrical equipment consists of two 500 kilowatt 600-volt alternating-current generators,



MOTOR-DRIVEN SAW IN LARGE ELECTRICALLY OPERATED PAPER MILL.

each direct connected to compound condensing engines rated at 850 indicated horsepower. There is also a 600-volt alternating-current generator having a capacity of 50 kilowatts, direct connected to an engine with the field exciter mounted on the same shaft. The other generators are supplied with current for field excitation from a 30-kilowatt direct-connected engine exciter set and a duplicate motor-driven set. For operating the railway the necessary direct current is furnished by a 35-kilowatt 550-volt motor-generator set. Because of an increasing need for power it is proposed to add to this equipment soon a 1,500-kilowatt Curtis turbo-generator set which will take care of the increasing load and also provide a reserve capacity.

The remaining illustrations show some examples of induction-motor drive operating in the mill. The method of adapting the motors is self explanatory. All of the machinery is so arranged that one-half of the plant can be shut down without interfering with the operation of the other half. From the time the logs are run out of the canal on electrically driven conveyors until the

Chicago Street-railway Situation.

The Chicago City Council [illegible] at [illegible] with the [illegible] traction ordinances [illegible] The franchise extension ordinances for the Chicago City Railway Company and the Chicago Union Company, and its underlying [illegible] by the local transportation committee, [illegible] been presented and considered. Along with these the mayor's $75,000,000 Mueller certificate ordinance was also to have been taken up, the object being to arrive at something definite for presentation to the voters at the spring election. As soon as the council was called to order, and before it got as far as committee of the whole, a resolution was presented and passed sending the franchise-extension ordinances back to the local transportation committee, with instructions to consider all suggested amendments and such other matters germane to the question as might be presented.

The resolution was presented by those friendly with the majority of the transportation committee. It recited that the ordinances represented the best efforts of the majority of the committee in the way of a solution of the traction problem, and that they embodied the limit of concession on the part of the companies. It stated that the majority of the committee believed that the settlement proposed by the ordinances, if submitted to a referendum, would be accepted by the people and would bring about traction conditions of a high degree of efficiency and amply safeguard the present and the future interests of the city. Whereas amendments had been suggested to the ordinances, and, whereas the amendments, like the ordinances, would have to be accepted by the companies before becoming effective, and, whereas the companies had already said that they would not accept the ordinances if essentially changed, therefore, the object of the resolution was, to have the amendments taken up by the local transportation committee, which would listen to all suggestions and negotiate at once with the companies concerning the proposed amendments.

Meetings have already been held by the local transportation committee, which has been listening to suggestions from various speakers. There were many minor objections offered to the ordinances,

some of them being covered by the amendments submitted to Judge Grosscup by his special traction adviser, John M. Harlan. On the four points covered by Mr. Harlan, and which are here given, all the objectors agreed. They are, in brief:

That all bonds of the Union Traction Company in excess of $20,000,000 be either paid or provided for inside of three years. That the Consolidated Traction Company be made a party to the ordinances, giving up its present franchises and accepting new ones. That unless all the ordinances are accepted by the grantee companies none of them become operative. That a fund be set aside by the companies for renewals and maintenance.

At the time of going to press the committee is in adjournment, awaiting a reply from the traction companies as to the amendments mentioned. The committee was instructed to report to the council next Monday night.

Col. James Hamilton Lewis and G. W. Browning, representing the city of Chicago, and John P. Wilson, representing the traction companies, were scheduled to appear in the Supreme Court in Washington this week to argue the tunnel question. This question comes from the Supreme Court of Illinois, which decided the city had legal authority to enact an ordinance requiring the street railways to lower the tunnels under the river. The 99-year cases were also expected to be argued this week.

Westinghouse Electrostatic Voltmeter.

In electrical testing and experimental work high pressures are frequently used, and the measurement of these potentials is often a perplexing problem. A number of different methods of high-pressure measurement have been used, with varying degrees of success as to their accuracy, but all involve some uncertainty as to results. Where it is required that such apparatus as dynamos, transformers, cables, insulators, etc., be subjected to a specified pressure test as a condition of their acceptance, controversy often arises as to whether the required voltage has been applied.

Theoretically correct, at least, is that method of high-potential measurement employing an electrostatic voltmeter, but certain obstacles, the principal one of which was the lack of an insulating

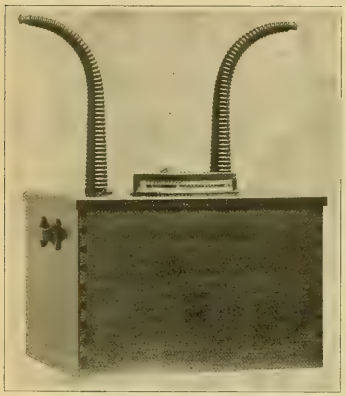


FIG. 1. ELECTOSTATIC VOLTMETER COMPLETE.

medium of sufficient dielectric strength, have heretofore prevented the development and application of this type of instrument. The Westinghouse Electric and Manufacturing Company believes that it has succeeded in overcoming these difficulties and in producing a meter that requires for its operation a negligible amount of energy, that is free from the effects of variation of wave form and is direct reading. It is said that the faults inherent in all other methods of high-potential measurement are entirely absent from this meter. Fig. 1 is a view of the voltmeter complete.

The operating elements of this instrument are immersed in a special grade of oil contained in a metal-lined wooden case, with an insulated cover. The metal lining acts as a screen to prevent outside fields or influences from affecting the meter. As the insulation is one of the most important parts of an instrument of this type, a few of the advantages derived from the use of oil may be summarized as follows:

(1) The distance between the operating elements may be greatly lessened, thereby reducing the size of the instrument.

(2) The actuating forces are greatly increased, due to the smaller distances between active parts and the high specific inductive capacity of the oil.

(3) The reduction in distance between working parts of the meter makes possible a better form of scale.

(4) The oil acts as a damper and makes the instrument nearly dead beat and easy to read.

(5) The oil buoys up the moving element, thus removing practically all weight from the bearings.

The arrangement and relative position of the parts of the meter are shown in the diagrammatic sketch, Fig. 2. The curved plates (B_1) and (B_2) are of such a shape and so arranged with respect to the moving element that a deflection in a positive direction shortens the gap between the element and the plates. The charges induced on the two extremities of the moving element (Fig. 3) are of such a nature that they exert forces of attraction on the charges on the plates, which bring about such a movement. The turning of the moving element is restricted by a spring, and the deflection of the pointer is read on the scale. The condensers (C_1) and (C_2) are in series with other parts of the instrument, one plate of each being metallically connected to a curved plate and the other to a terminal. The instrument may be operated with either or both condensers short-circuited, thus giving a wide range to the meter.

Curved plates, with the condenser plates attached, as shown in Fig. 4, are supported from the insulated cover by means of grooved posts of suitable insulating material. The separate con-

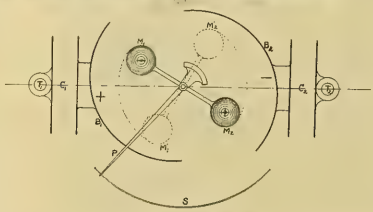


Fig. 2. Diagramatic Sketch.

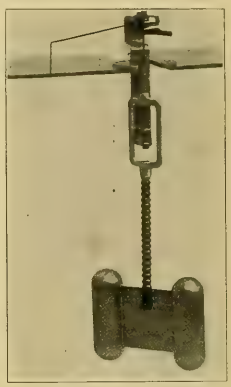


Fig. 3. Moving Element.

ELECTROSTATIC VOLTMETER.

denser plates are supported in a similar manner. As all parts are firmly fastened to the same base, they are held in constant relation to each other, and no error can result due to disarrangement of parts. The height of the oil in the case, together with the long paths over the suspension posts, prevent leakage between the plates. The horn-shaped terminals (Fig. 4) extend to the same distance below the oil as the suspension posts and are also grooved so as to prevent leakage over their surface.

Bearing springs and adjustments are similar to corresponding parts of Westinghouse standard indicating instruments. The cylindrical parts of the moving elements are hollow, and so proportioned that the buoyant effect of the oil removes almost all weight from the bearings, thereby eliminating friction and wear. The scale over which the pointer passes is placed on an edgewise cylindrical form similar to the scale of an edgewise switchboard instrument, and the reading may be taken from a safe distance. With the exception of the glass window through which the scale is read, the cover over the pointer is all metal, and acts as a screen to prevent external static fields from affecting the pointer. Instruments of this type may be obtained for potentials as high as 200,000 volts. The one shown in the illustrations may be used for voltages up to 100,000 volts with the condensers in circuit, or for approximately 50,000 or 25,000 volts, with one or both condensers short-

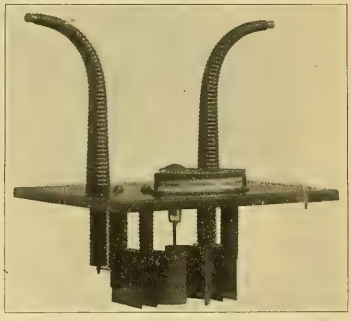


FIG. 4. CONDENSER PLATES AND HORN-SHAPED TERMINALS OF ELECTROSTATIC VOLTMETER.

circuited. The case is 22 inches long, 18 inches wide, and 15¼ inches high, with terminals projecting 18 inches above the case.

The membership list of the National Electric Light Association, which has just been brought up to date by Secretary Eglin, shows that the association has grown considerably during the last year. The membership companies, Class A, number over 500, and there are long lists under classes B, C, D and E.

The "Hold-fast" Lamp Guard.

Users of incandescent electric lamps will be interested in the Hold-fast lamp guard, illustrated herewith, patented by Charles P. Anderson, on August 15, 1905. The design of the collar makes it impossible to pull or jerk the guard from the socket. The center spreading ring is corrugated, and is said to be superior to a plain ring so far as strength and rigidness are concerned. The corrugations are deep, allowing the rib wires to lie inward from the extreme outward circumferential point of the ring. In that position the connections are protected from any injury by impact upon the guard. This center ring is in the greater diameter of the guard and must meet practically all of the impact, thus protecting the ribs from becoming bent or dislocated. Its rigid construction makes it capable of withstanding a heavy blow without collapsing, and for this reason the Hold-fast guard is said to be the only one made that is self-protecting.

The spiral cushion is a guarantee against injury to the lamp under all conditions of usage. This cushion can be raised or lowered to fit any length or shape of lamp by bending the three terminals up or down.

Through the bottom ring the lamps are removed or replaced. By its construction are eliminated all

THE "HOLD-FAST" LAMP GUARD.

adjustable parts for that purpose. This is a marked improvement.

The Hold-fast guard can be set down like an ordinary oil lamp when long cords are used around work benches or tables. When hanging, there is no obstruction to the downward rays of light. It is impossible for grounds to occur on this guard, as no part of it can get in contact with the terminals of the lamp socket.

The maker of this guard, the Hold Fast Lamp Company of St. Louis, recently turned over the manufacture of these guards to W. N. Matthews & Bro. of that city. It is stated by the maker that, conservatively, 90 per cent. of the lamps on suspended sockets never burn their entire rated life before they are carelessly or accidentally broken. Taking the average life of a lamp at about four months at 26 days each, counting 10 hours per day, and at a cost of 20 per cent., if broken the first month, it means a loss of 75 per cent. on the investment. The second month 50 per cent. and the third month 25 per cent. Any lamp broken carries with it a proportional per cent. of loss.

Municipal ownership and operation of an electric-light plant at Thorntown, Ind., have proved a failure. The plant is depreciating and losing money every day, while the taxpayers are bringing suits to prevent the trustees from paying interest and principal on the bonded debt on the ground that the contract entered into for the construction of the plant was illegal.

Inter-pole Variable-speed Motor for Machine-tool Work.

There has been for a number of years an imperative demand for variable-speed motors for the direct driving of machinery. It is the general opinion that the great bulk of machinery in the future is to be direct driven by electric motors rather than belt driven, especially in view of the fact that a substantial reduction in cost of manufacture in several different industries has been demonstrated, when saving in space, labor, cost of installation and all other items are taken into account. There are a number of important conditions which are essential and which must be met in order that variable-speed motors shall come into general use. Among these may be mentioned non-sparking under excessive overloads, a large range of speed of motor, speeds to be kept constant at all loads when adjusted to any desired speed, compactness, simple wiring, reversibility, simple control and simple accessories, the lightest possible weight and high efficiency under average loads.

The Electro-Dynamic Company of Bayonne, N. J., believes that in its inter-pole motor there has been developed a machine which will fill the exacting requirements of machine-tool drive. Several important claims are made by the company for this motor. The speed variation is given from 2 to 1 up to 6 to 1. Almost any variation of speed control can be obtained. Changes can be made instantly and the controlling apparatus can be placed anywhere on the tool or machinery for convenience of operation. The speed can be set at almost any point between the limits with a certainty that practically constant speed will be maintained under varying loads. The torque is increased as the speed is decreased, and this is an important factor both in maintaining constant speed and in having the tool work uniformly and with proper cutting capacity.

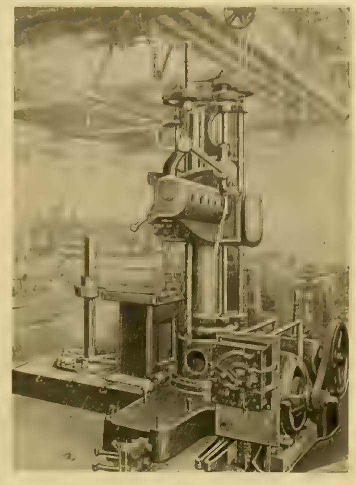
In the past considerable trouble has been experienced by sparking, at the commutator, when varying speed of motors, and especially when overloading. This difficulty is said to have been overcome entirely in the inter-pole motor, and it is asserted that it will not spark, even when overloaded 100 per cent. and reversed. The control of this motor is effected by turning the handle of a controller placed within the reach of the operator. The motor operates on a single voltage. The inter-pole feature provides a separate field which makes excellent commutation, thus increasing the life and efficiency of the motor and making greater the saving in operating expenses.

Among the recent applications of the inter-pole motor stand forth prominently its employment for driving elevators, machine tools, blowers, pumps, fans and similar classes of machinery. The advantage of the scientific method of treating machine-tool work calls for such apparatus as shall produce the desired speed and keep the tool up to its proper cutting capacity. The wide steps in cone pulleys frequently render proper cutting speeds impossible, owing to the fact that the correct speed cannot be obtained, and consequently a workman is obliged to push through work at a slower cutting speed than that called for.

The facility with which the speed can be edged up to the proper point by the inter-pole motor and the certainty with which its speed will be held (independent of load) make it a valuable accessory to a machine tool, and this facility imparts a distinct tone to the product of the shop.

Ability of the inter-pole motor to stand heavy overloads without deterioration of commutator, due to absence of sparking, its excellent reversing qualities, compactness and durability in general, make it well adapted for machine work. The motor, being equipped with ball bearings, is enabled to be set much closer to the machine it drives and the reduction in bearing friction and the simplicity of maintenance [illegible] afforded [illegible] recommendation for the adoption of [illegible].

In particular it should be noted that the inter-pole motor is a variable speed motor [illegible] wide variation [illegible] and it is [illegible] that a motor [illegible] constant speed when the particular speed is determined upon. It is [illegible] that [illegible] speed at any point between [illegible] and irrespective of load, [illegible]



INTER-POLE MOTOR DRIVING RADIAL DRILL.

if the voltage is maintained constant. This gives a sense of security to the machinist or mechanic who operates it.

For printing-press work, where the motor has to stand very heavy overloads at certain times and run below its full-rated capacity at others, the construction of this motor is well adapted, and the company reports increased sales in this particular branch of its business. The ordinary variation given for printing-press work is 2 to 1 or 3 to 1, and in many cases a compound winding is used to give greater torque at the moment of excessive overload.

[illegible]

Michigan Traction Consolidation.

The [illegible] Lansing and St. Johns [illegible] president of the Lansing [illegible] and Battle Creek [illegible] Lansing and Jackson [illegible] which is under [illegible] of the Michigan Traction Company, [illegible] the Kalamazoo and Battle Creek [illegible] electric railway between the two cities [illegible] make possible the consolidation [illegible] having nearly 150 miles of track [illegible] the important [illegible] Southern Michigan. A consolidation [illegible] name of the Michigan United Railways [illegible] effected. The bond by which the project will be financed aggregate $9,000,000. Lansing will be the center of the system, and the local management of each line will remain [illegible] at present. The syndicate is composed of [illegible] W. Mills and George [illegible] of Port Huron and James R. Elliott of Lansing.

The construction of the Lansing and Jackson railway will first be completed. It is also intended to build a line between Jackson and Adrian and to extend the line now operating between Lansing and Pine Lake to Owosso, and from Owosso to Flint. The consolidation will give the company control of 141 miles of road, as follows: Kalamazoo, city, 14 miles; Battle Creek, city, 15 miles; Kalamazoo and Battle Creek, interurban, 30 miles; Jackson and Battle Creek, interurban, 37 miles; Lansing, city, 15 miles; Lansing and St. Johns, interurban, 22 miles; Pine Lake extension, eight miles. The completion of the Jackson-Lansing line will add 37 miles, and the Pine Lake extension to Owosso 18 miles, giving in all 196 miles.

Dinner to Indiana Traction Men.

After a pleasant trip over the Indianapolis and Cincinnati Traction Company's line the stockholders and prominent traction men were given a dinner at the Columbia Club on New Year's night, the guests of President Charles L Henry. Hugh J. McGowan had been invited to respond to a toast, his subject being "Indianapolis as an Interurban Center." Mr. McGowan was unable to be present, but sent a letter addressed to Mr. Henry, who acted as toastmaster.

Mr. McGowan's letter was listened to with interest, since he predicted that in a short time every Indiana hamlet will be on an interurban line. Referring to the Rushville single-phase line he said:

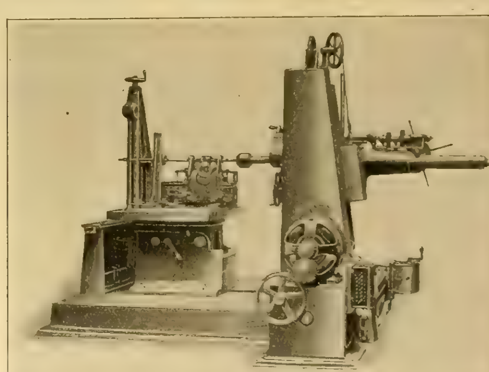
"I cannot let this opportunity pass without complimenting the president of the Indianapolis and Cincinnati Traction Company upon the splendid result of his single-phase system on the Rushville

Yerkes' Successors Named.

Sir George S. Gibb, L.L.B., general manager of the Northeastern Railroad, has been elected managing director and deputy chairman of the Underground Electric Railways Company of London and also managing director and chairman of the Metropolitan District Railway Company. At the same meeting of the board Mr. Edgar Speyer of Speyer & Co., American bankers of the Underground company, was elected chairman of the Underground company. These positions were made vacant by the recent death of Charles T. Yerkes.

Mr. Gibb, a British railroad man of long experience, is 55 years old and an Aberdeen Scotchman. He is accounted one of the most successful and up-to-date railroad officials in England. His railroad experience began in the legal department of the Great Western Railway Company in 1877. He was later solicitor and then general manager of the Northeastern Railway Company, which office he now leaves to enter the service of the London Underground. Mr. Speyer will have charge of the general financial interests of the company, and Mr. Gibb will have the executive direction of its technical operation, succeeding more directly to Mr. Yerkes' labors.

Main Bay of Electro-Dynamic Company's Works, Bayonne N J



Inter-pole Motor Driving Drilling, Boring and Milling Machine.

INTER-POLE VARIABLE-SPEED MOTOR FOR MACHINE-TOOL WORK.

Efficiencies.[1]

By James Swinburne.

Heat includes what is called sensible heat, or heat that makes things latent heat, such as heat that disappears when ice is melted or water vaporized and chemical energy. I must tell you that it is not orthodox to call chemical energy heat; and you will not find any such treatment of the subject in books on thermodynamics. At present I believe that I am alone in classing chemical energy or defining heat so as to include chemical energy. But the treatment of chemical energy in chemcial thermodynamics is quite consistent with my definition, so I may use it provided I give you due warning of any heterodoxy.

I think that it is not realized that chemical energy is necessarily low-grade energy, only partially convertible into work. This involves the idea of chemical temperature which may be important in chemistry in discussing the way any given possible reaction will go; but we are not concerned with that here. It will be said that the coal is cold when it is put into the furnace, as cold as the air, in fact, so that if this idea is right, none of the chemical energy is available.

But I must give some idea of what I mean by chemical temperature. If carbon and oxygen are heated to a high enough temperature you get a state in which on the least fall of temperature the carbon and oxygen combine and give out sensible heat at that temperature under the other circumstances that obtain. The least increase of temperature, however, causes the carbon and oxygen to separate again, absorbing sensible heat. At this temperature, therefore, under the pressure and quantitative relations of the carbon, oxygen and carbon monoxide, sensible heat and chemical energy are interchangeable. This temperature may be called the chemical temperature of the energy of carbon and oxygen. I need not trouble you with discussions as to whether the energy is really in the carbon or the oxygen or the ether, or as to the effect of pressure and proportions of carbon, oxygen and monoxide on the reaction. I merely want to give you a broad idea of carbon as having or controlling chemical energy, or heat with a corresponding "chemical temperature" of the order of 3,000° C. or more. If the burning coal, containing of course other constituents, such as hydrocarbons with other chemical temperatures could hand over its heat at 3,000° C., nearly all of it would be available. As the heat is finally rejected at condenser temperature of 100° or so, 3,000 — 100 ÷ 3,000, or about 97 per cent. of it would be available. But the boiler takes it up at under 500° C. absolute, so that five-sixths is degraded or rendered unavailable right off.

It might be supposed that there is enormous room for improvement in the steam engine. An efficiency diagram looks as if all the loss is due to the engine which gets 68 per cent. and only gives out seven per cent., but we must not be hard upon the engine. It is turning out work, or high-grade energy, and it is receiving heat, or low-grade energy. This engine is probably taking in steam at about 450° C. absolute and rejecting it at about 375° C. absolute, so it could if perfect only turn out 68 × 75 ÷ 450 = 11.3; so it is not really doing so badly. The real loss is between the fuel and the boiler, and it is not loss of energy but loss of availability. Though the chemical is low-grade energy, it has such a high chemical temperature that 97 per cent. is theoretically available; but we cannot run a boiler and engine between 3,000° C. and 4,000° C. Engineers are always trying to improve the results by using higher and higher temperatures; but as you cannot use the pressure that would then correspond with saturated steam you can only superheat. This does not mean that most of the heat is taken in at the high temperature, and the resulting gain is chiefly due to such things as reduction of cylinder condensation. There are great practical difficulties in reducing the lower temperature. The condenser reduces it to about 100° C. or 373° C. absolute; but even then the steam is not completely expanded, and blows into the condenser under pressure. The efficiency has been raised more recently by reducing the lower temperature limit by means of sulphur dioxide. I do not know who was the first to propose this. Rayleigh suggested it as early as 1876. It is being put in practice now in Germany.

The right-hand part of the accompanying diagram illustrates the yearly losses in the Metropolitan system, supplying several London areas from Willesden. I am indebted to Mr. Highfield for the figures. It will be seen that the transformers are very efficient, and when they can be cut out at light loads so that the transformers in use are always well loaded, the efficiency can be made very high. The diagram is also a little deceptive because it takes no notice of the time at which the energy is wasted. Energy wasted at the time of station full load is serious, because if it were not wasted it might be sold, or else the station might be a little smaller in proportion. But most of the waste in transformers is at light loads, and it costs very little extra to generate extra power at times of light load, for it costs nothing extra in capital, superintendence or labor, and it does not cost much in coal, for the boilers have to be kept hot, and some engines have to be kept running in any case. These points have to be borne in mind in considering the meaning of such diagrams. It will be seen that there is a loss of six per cent. in "station losses," only two per cent. feeder losses to sub-stations and 13 per cent. conversion losses and lighting of the sub-stations.

These are for the year. They alter from time to time, so the wastes are shown black to the left for three representative times. Thus the station losses are seven per cent. at noon, four per cent. at top load and 20 per cent. at three in the morning, and so on. This is because the losses do not vary in proportion to the loads. Through the various sources of waste energy the final result is that there is 21 per cent. loss at noon, or 79 per cent. efficiency, and 74 per cent. efficiency at six p. m., and up to 65 per cent. at three a. m., which is astonishingly good when the system is considered.

If a station is run by a town the accounts must be kept by an absurd system. Towns are generally concerned with such things as sewerage systems, in which there is no profit and loss account. The town may not treat its sewerage system as a permanent asset at all. It has to borrow money to put down its sewerage system, say £100,000 at three per cent. Then it has to pay £3,000 a year interest. But that is not all—it has to pay back the whole of the £100,000 in a certain number of years. To do this it has to provide out of the rates a sinking fund, such that in the prescribed term of years the whole of the debt is paid off. The town then has a sewerage system to the good, which has been paid for over many years out of the rates. The town therefore does not save money like the private individual and then buy what it can afford. I do not think it would be allowed to do such a rational thing; it has to borrow money for everything and pay it back over a term of years. The length of the term has no reference whatever to the nature of the work done, as the work is not in any way security for the loan; the local rates are the security. There is an epidemic of outcry just now about municipal indebtedness, but it is apt to give a totally wrong impression to the average reader, as he does not realize that municipalities must be in debt owing to the way these things are arranged. For a private individual always to be in debt would be bad; for a town it is another matter; the only question is how much the town ought to be in debt. The nation itself does business in the same sort of way; it has no ready money, and when anything has to be done it borrows. But local authorities are now taking up such businesses as electric supply and tramways, which have profit and loss sides; they are obliged to work the businesses on the same lines as town improvements, which is absurd.

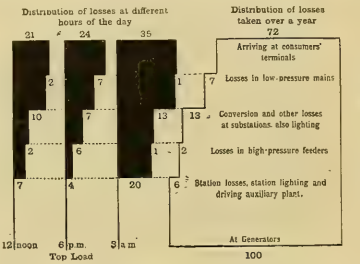


DIAGRAM SHOWING LOSSES IN METROPOLITAN ELECTRIC SUPPLY SYSTEM.

A municipal electric-light scheme is thus worked under absurd difficulties. It is like a public company that has a negative capital—that is to say, all its money is borrowed. The shareholders are the ratepayers. They hold shares depending on the rate assessments. The dividends are generally negative. All the shareholders are so by compulsion if they live in the place. The only thing they can do if they do not want to be shareholders in such undertakings is to move off to another town; but then they become shareholders in another set of ventures. I believe the only way to avoid being shareholders in these compulsory undertakings is to live in a barge on a canal. Be this as it may, the undertaking, though a profit and loss concern, must keep its accounts on the same principle as if it were a sewerage system. To begin with, the town may only borrow enough money to put down the plant. This has to be paid off, as already explained, by the sinking fund, which returns all the borrowed money in say 20 years. The plant may last 10 years, or it may last 50; that has nothing to do with the case. If the plant lasted 20 and then went into powder, like Holmes' "one-hoss shay," the sinking fund would correspond with correct depreciation. If it lasts less something more should be allowed, and less should be written off for the parts that will last longer. This right depreciation to be allowed in municipal works is a burning question between the advocates of municipal trading and its opponents. Again, a private concern would start business with enough capital to put down the station and to run it at a loss for a year or two until it turned the corner. The municipality may not do anything as sensible as that; it may only borrow money enough to put down the station, and the first few years' losses must be paid for out of the rates for these years. This sometimes excites the ratepayers.

Almost any business has to be run at a loss at first, and enough capital is provided to meet the deficit, and when the business pays it ought to pay on the whole capital. No one would think of starting, say a works, with no working capital at all, and distributing a negative dividend during the next few years to pay the losses. This is one of the many absurd conditions under which municipal work has to suffer. In one case a lovingly solicitous gas company felt that it was hard that a municipality should lose during the first years, so it got a clause inserted to the effect that if there were a loss the price should be raised and raised until there was either no loss or no customers; it did not matter which, though in its heart of hearts the gas company preferred the latter. This clause was solemnly inserted in one or two acts by the collective wisdom of the country. It may interest you to realize that the large commercial interests of this country are controlled by a set of people who think that if a manufacture does not pay, the simple expedient of raising the price will put things right.

Referring to the comparative costs of different artificial illuminants, if electrical energy costs 4d. a Board of Trade unit, an ordinary glow lamp will give nearly 800 candlepower for 1s. A flame arc with energy at 3d. gives you 14,000 candle-hours. It must be remembered that the 1s. is all spent on energy, nothing is allowed for renewal of lamps, interest on fittings, meter rents, interest on arc lamp, cost of carbons or labor. For 1s., with energy at 5d., you get about the same light as with a flat-flame gas burner and gas at 4s. The ordinary oil lamp, with paraffin at 8d. a gallon, beats them both hollow, and it is out of the running with acetylene. The great fight between electricity and gas has been fought with the flat-flame burners and carbon lamps, and there has been much discussion. I have been accused of a strong partiality for electric light. But I feel impartial. I really do not know which is the worst. The gas mantle makes an enormous difference and brings gas, say at 3s., ahead of everything but the mercury and flame arcs at, say 4½d. a unit. The flame arc is essentially for large lights, while the mantle lights can be made quite small. The comparison is, I repeat, only for the same money paid for gas or energy. To make a real comparison many other factors are to be taken into account. There is the interest on the mercury lamp for one thing; then its color is not good; and if you add carbon lamps the efficiency goes down. On the other side, however, you have to estimate the cost of mantles, the trouble and worry of breakages, and of the jets getting stopped up, and so on. Even then it must be clear that the mantle has a large margin of economy for the house lamps, such as the Nernst, the metal and the carbon incandescents. For outdoor use and for large buildings the flame arc seems to have plenty of margin over the mantle, though large mantle lamps are even better than some of the smaller ones.

In addition to the cost of lamps, mantles, etc., we must remember that if an illuminant spoils the decorations the extra cost of redecorating should be charged against it. Gas blackens the ceilings and destroys paint, and so on; and the extra cost of decoration may be as heavy as the whole cost of electric light, in which case it does not pay to employ gas at any price. This argument annoys the gas industry, so it is sound and good.

1 Abstract of an address given to the Manchester local section of the British Institution of Electrical Engineers.

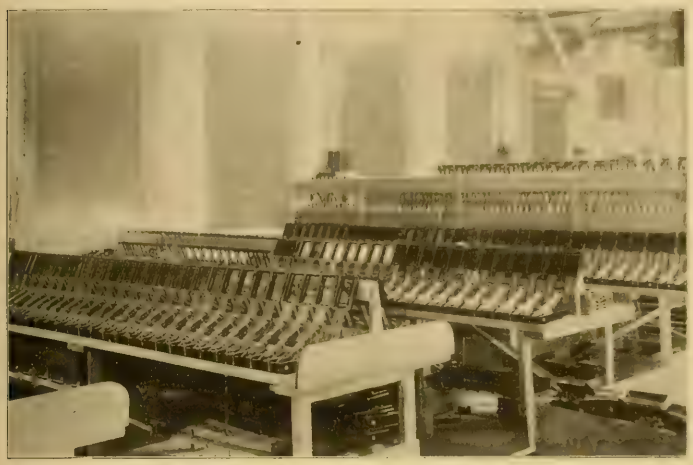
California Electric Power Consolidation Completed.

The final consolidation of the principal electric power interests of California, under the name of the Pacific Gas and Electric Company, was brought about last week. The promoters of the new company early in the week turned over to the Union Trust Company, trustee for the San Francisco Gas and Electric Company, $3,150,000 in cash and $10,101,460 in five-per cent. gold bonds to be distributed among the stockholders of the San Francisco Gas and Electric Company in the proportions of $25 in cash and $65 in bonds for each share of stock in the San Francisco Gas and Electric Company. The taking over of the California Gas and Electric Corporation by the Pacific Gas and Electric Company had already been accomplished. The owners of the new company are N. W. Halsey & Co. of New York, and the leading stockholders of the California Gas and Electric Corporation. John A. Britton has been elected president of the new company. The new company has secured extensive quarters on the eighth and ninth floors of the Shreve Building, San Francisco, in which executive offices will be established. It is still unknown whether or not the company will be able to secure control of the Mutual Electric Light Company of San Francisco. It is known that a large number of stockholders of the Mutual company are in favor of selling, but there is a strong minority which is opposed to the deal.

Growth of the Wright Demand Indicator Business in the United States.

The Wright demand indicator was invented by Arthur Wright of Brighton, England, for use with the Wright demand system of electrical charging. This system was introduced in Brighton in 1893 and was promptly followed by increased sales and income, by greatly improved load factor and by a large increase in the number of long hour customers.

R. S. Hale brought over from England in 1897 the first Wright indicator in the United States. In 1897 Mr. Wright himself read before the National Electric Light Association at Niagara Falls a paper entitled, "Profitable Extensions of Electricity Supply Stations," in which he outlined his system in detail. This served to focus the attention of central station managers on the rate question and the principles enunciated by Mr. Wright rapidly gaining recognition. At the present time a demand system of some form based on these principles is in use in the more prominent cities of the United States such as New York, Chicago, Boston, Detroit, Cleveland, Cincinnati, St. Louis, Topeka, Denver, St. Paul, Minneapolis, Seattle, Rochester, N. Y., and Springfield, Mass., as well as in a large number of the smaller cities.



WRIGHT DEMAND INDICATORS IN FACTORY READY FOR INSPECTION.

The manufacture of Wright demand indicators in this country was begun in 1898 by the General Incandescent Arc Light Company of New York, which purchased the right from the English company. The business grew rapidly and was transferred to Pittsfield in 1903, where improved facilities were obtained and the present capacity of the works of the Stanley-G. I. Electric Manufacturing Company is 1,000 indicators per week. The business continues to grow, and for the first 10 months of the present fiscal year, which dates from February 1st, is already 34 per cent. ahead of last year's total.

The accompanying illustration shows some of the assembly benches in the factory at Pittsfield, Mass., with indicators awaiting inspection.

The New Philadelphia Subway.

On December 18th the first section of the new Philadelphia subway, previously allude to in the Western Electrician, was opened for traffic. This section runs from Fifteen Street to the Schuylkill River under Market Street. Two inside tracks will be used for express trains and two outside tracks for locals when the subway is completed. The completed section is 48 feet six inches wide inside and 14 feet six inches above the rails. The walls are of reinforced concrete and the floor of plain concrete.

An interesting type of track construction is used, having no ballast, for the purpose of providing a perfectly sanitary condition. The entire roadbed can be washed down with a hose and drained through sumps placed at frequent intervals. The rails for the local tracks are mounted on cast-iron chairs, which, with the rails, are embedded in concrete. The rails are secured to the chairs by adjusting screws, making it possible to set the rails to exact gauge. Except at crossovers, the express tracks are mounted on yellow-pine blocks, to which they are attached by clips and screw spikes. One rail for each express track has been reserved for block signaling; the other rail is bonded with a protected bond, and the two return rails are cross-bonded.

As surface trolley cars will be operated over the local tracks, an overhead wire is provided, supported in a special flexible suspension. The

Engineering Features of the Jhelum Power Installation in India.

About 20000 [illegible] the Jhelum River [illegible] meet the city of Baramula [illegible] ments having been completed [illegible] sports. The contract for the [illegible] of the plant has been let to the [illegible] Company of San Francisco.

The [illegible] conduit [illegible] be approximately 11,000 feet [illegible] the upper 8,500 feet will [illegible] ditch lined with masonry. [illegible] of the water channel [illegible] flume, as a wooden flume [illegible] in talled [illegible] of the character [illegible]

will have a capacity of over 500 cubic feet per second.

The forebay at the end of the gravity line and at the head of the pressure pipes will be constructed of masonry and will be provided with special headgates.

The pressure lines will consist of riveted steel pipes designed with a factor of safety of five, each supplying one of the hydro-electric units. For each pipe line a standpipe and two special vacuum valves will be provided, in order to protect the pipe against injury in case the water should be drawn out suddenly. The pipes of each pressure line will vary in diameter from 30 to 36 inches, with a 54 to 36-inch taper pipe, 10 feet long, at the upper end. The pipes will be 790 feet in length and will deliver the water under an effective head of 400 feet. The interior piping of the power house will consist of welded pipe with welded flanges.

Twelve main units and three exciter units have been planned for the equipment of the power house. Each main unit will consist of a Doble tangential waterwheel with automatic oil-pressure governor, delivering 1,765 brake horsepower to the shaft, under an effective head of 400 feet. Each wheel will be direct connected to a 1,000-kilowatt alternator, the speed of the unit being 500 revolutions per minute. The exciter units will each consist of a tangential waterwheel, delivering 285 brake horsepower to the shaft under an effective head of 400 feet. The speed of the exciters will also be 500 revolutions per minute.

The power house will be of solid masonry construction and will have a wide veranda as a protection from the tropical sun. A double steel roof will be provided, and two traveling cranes will be installed for handling the machinery. The transformers will be installed in a bay of the main building or in a separate structure.

The conditions under which the plant will be installed are decidedly out of the ordinary as compared with similar work in this country. The specifications for the electrical and hydraulic equipment stipulated that no single piece of machinery should weigh more than four tons when packed, for the reason that there is 200 miles of road transportation, including a lift over a range of mountains 8,000 feet high. Transportation in that section of the country is limited to bullock carts and no single piece of machinery heavier than four tons can be transported, a total of five tons an

Oscillographic Researches on Surging in High-tension Lines.

[illegible]

[illegible] continually diminishing amplitude. The amplitude [illegible] the oscillations set up depends on the [illegible] the impressed electromotive force [illegible] when the circuit switch is closed. [illegible] the frequency of the oscillations set up is independent of the impressed frequency, but depends [illegible]

The instantaneous values of [illegible] and currents were obtained by means of a Blondel-Carpentier oscillograph. In the ordinary form of oscillographs the images are obtained on a photographic plate 3.5 inches by 4.5 inches. It was [illegible] visable to arrange some means by which the records would be taken for a time sufficient to include conditions not only during the period of surging but for the time before and after.

Instead of the ordinary plate a film 3.5 inches wide by 4.5 feet long was wound on a wooden cylinder placed in a closed box with a shutter and arranged so that the images on the galvanometer mirrors could be thrown on the film. This drum was rotated by a small motor, so that the width of a period length as shown on the film could be altered by speeding or slowing the motor. It was thus possible to obtain a large number of periods on one film.

The transmission lines experimented upon are shown in Fig. 1 on the next page.

The two stations of Plan du Var and La Mecla operate in parallel. These stations are 4½ miles distant. The line joining them is overhead, three-phase, three conductors, 24 inches apart, No. 1, B. & S. copper wires. From station of Plan du Var two overhead transmission lines, 17 and 15 miles long, go respectively to sub-stations at La Begude and Ste. Agathe. The line to La Begude is made up of three conductors, No. 2, B. & S., 24 inches apart, and that to Ste. Agathe of No. 1, B. & S.; conductors same distance apart.

The sub-stations at La Begude and Ste. Agathe are connected by an underground three-conductor lead-covered cable eight miles long, No. 00, B. & S. conductors.

Capacity in microfarads between one conductor and the other two connected to the lead covering, 0.825 per 1,000 feet. Capacity in microfarads between the three conductors joined together and the lead covering, 0.825 per 1,000 feet.

It was thus possible to experiment with a circuit forming a loop of a total perimeter of 40 miles—32 miles of which was overhead, the remaining eight miles undereround, the underground part about midway along the loop.

A three-phase 600-kilowatt-ampere 25-cycle 11,000 volt alternator, driven by a 900-horsepower horizontal turbine, provided the electric power. The switchboard in the station was equipped with high-tension oil switches and three-pole air knife switches were also provided.

The electromotive force wave of the generator showed the effect of the fifth and seventh harmonics, which were the only ones noticed, and they were quite small, the fifth being less than two per cent. of the value of the fundamental one.

The first experiments consisted in making and

[illegible] Paper in abstract of Mr. David's paper given, with introduction [illegible] before the Electrical Section of the Canadian Society of Civil Engineers November 2 [illegible]

breaking with an air switch the charging current at the sending end of the line, the charging current being approximately five amperes at 8,000 volts. The 40-mile circuit was unloaded but for a few transformers with open circuit secondaries which were left accidently on the line.

In Fig. 2, (U_1) is the electromotive-force wave across one phase at the generator, (U_2) the voltage at the end of the line. Waves (U_1) and (U_2) have been shown in opposition of phase, that is (U_2) is displaced by 180° to show the two curves more distinctly.

The line is shown to have been switched on the bus-bars when the impressed electromotive force is changing sign, and, as would be expected,

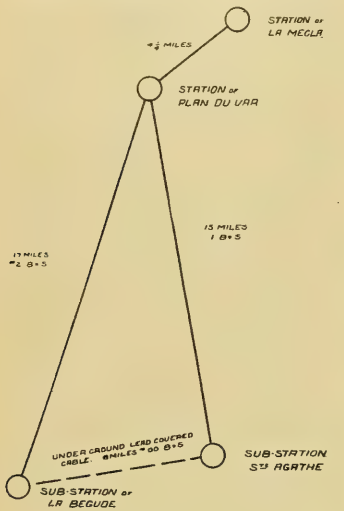


FIG. 1. TRANSMISSION LINES, WIRES 24 INCHES APART.

the oscillations produced are very small. The oscillations cease in the first half period after the make. When the line is opened there are no oscillations on (U_1), but the wave (U_2) shows at the rupture a damped oscillation of large period.

Fig. 3 shows the line switched on at the moment when the impressed electromotive force is near one-fourth period.

At first the impressed electromotive force is suddenly reduced, but further a rise of potential takes place, giving a 50 per cent. increase of impressed pressure. A rise is also shown on wave (U_2). The oscillations cease in the first period after the make. Here again there are no oscillations in the impressed electromotive-force waves when the circuit is opened, but (U_2) shows a momentary surge.

When the line was switched on at a moment when the impressed electromotive force was at or near one-third, one-half or two-thirds period, the surges on both ends of the line were well shown and quite large. The rise of potential, however, did not in any one of a large number of experiments exceed 55 per cent. The oscillations took place in one period after the make of the switch. When the switch was opened the voltage never rose, but in all cases the wave (U_2) showed a much longer period and is damped out in a single oscillation.

Records taken on the unloaded line, when operated with an oil switch in place of the air switch, do not differ very much from those just shown.

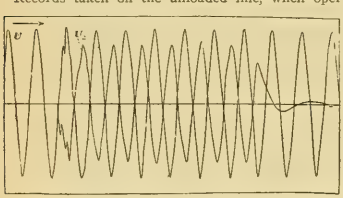


FIG. 2. OSCILLOGRAPH CURVES WHEN IMPRESSED PRESSURE WAS CHANGING SIGN.

In 12 different experiments the rise of voltage for (U_1) and (U_2) is as follows (line switched in):

		Per Cent.
U_1 (E. M. F. at bus-bars)	one rise of potential	.64
	two " "	.60
	one " "	.50
	three " "	.25
	one " "	.18
	two " "	.10
For U_2 difference of potential end of line:	one rise of potential	.67
	two " "	.64
	one " "	.58
	two " "	.30
	one " "	.25
	two " "	.17
	one " "	.8

Oscillographic records were taken on non-inductive load with oil switch and were given for the switch placed between the generator bus-bars and the line and the switch placed between the line and th load. A three-phase water rheostat was placed at the end of the lint as a load.

The experiments under load were carried out in

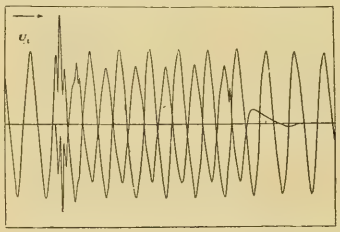


FIG. 3. OSCILLOGRAPH CURVES WITH IMPRESSED PRESSURE NEAR ONE-FOURTH PERIOD.

the following manner: The alternator was loaded through the 40-mile line on the water rheostat. The switch was then opened for one-half second and then closed. The load was adjusted to 22 amperes, a voltmeter on the line side of the switch reading (U_1) (7,200 volts on one phase) and a voltmeter placed on the rheostat reading (U_2) (6,200 volts).

The opening of the switch took place when (U_1) was zero. No rise of potential occurred. Other records showed similar results. The break was always shown to take place at zero value of impressed electromotive force. Mr. David is uncertain as to whether this was due to the oil switch or pure hazard.

In other diagrams, waves (U_1) and (U_2) are shown when the switch is closed. There is no surging or rise of potential. The regime is steady after the first period following the close of the circuit.

With a high-tension oil switch placed at the end of line, the oil switch was placed between the receiving end of the line and the rheostat, so that the alternator was kept on the line when the load was switched off. Oscillations were shown on (U_1) and (U_2), but without rise of potential.

Experiments were carried on with an air switch, this switch being of special make, allowing the arc made at the break to rise between copper horns, increasing the length of the arc until it broke. The records showed that the rise of potential with this switch is considerably greater than with the oil

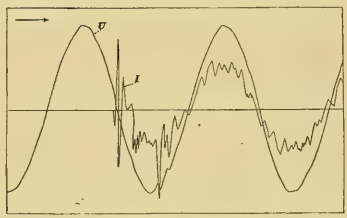


FIG. 4. OSCILLOGRAPH CURVES ON UNLOADED CABLE.

switch under similar conditions of load and that the oscillations are kept up for at least two periods after the opening of the circuit.

An underground cable was experimented with also, being a three-conductor lead-covered cable, four miles long. The cable unloaded was switched on the bus-bars through an oil switch, and records of electromotive force and current are shown in Fig. 4. The bus-bar voltage was 9,700. The current value is not given but could not be more than a few amperes.

In Fig. 4 (U) the electromotive-force wave shows little oscillations, not so with the current wave (I). Rapid oscillations take place during the first half period corresponding to the closing of the switch.

A cable was switched on when the impressed electromotive force was about changing sign. The electromotive-force wave showed no oscillations. The current wave showed violent ones. The maximum values of the current exceeded the width of the film and were not recorded on the plate. The negative and positive waves were dissimilar and the distances between the zero values were unequal. The switch was opened after an interval of four periods and the current had not then taken its normal value.

The North St. Louis Power Company has been incorporated with $10,000 capital stock by S. T. G. Smith, John G. Keyser and M. C. Keyser of St. Louis and Robert Gaylord, H. P. Young, W. T. Alden and C. R. Latham of Chicago, to develop waterpower.

Central Illinois Independent Telephone Meeting.

The Fifth District of the Illinois Independent Telephone Association, comprising the managers and owners of Independent telephone exchanges in Peoria, Marshall, Tazewell, Mason and Logan counties, held a meeting in Peoria on January 5th and 6th. The Fifth District is composed of progressive men, who are giving the toll-rate committee of the association all the assistance that lies in their power. To promote the best for the business in which they are interested they are organized, besides their affiliation with the state association into the Central Illinois Independent Telephone Association, which is connected with the Inter-state Telephone and Telegraph Company. This company has upward of 3,000 telephones in Peoria, with lines extending almost to Chicago. It has made Peoria the hub of the Independent business in Central Illinois.

The meeting in Peoria was to consider the question of the adjustment of toll rates throughout the district and, incidentally, throughout the entire state. The plan as advanced by the toll-rate committee, composed of J. S. Dailey of Chillicothe, James Barrett of Pekin and C. A. Camp of Sparland, is that the Independent companies throughout the Fifth District unite on a uniform toll rate that shall obtain in all parts of the territory, and establish a clearing house, to be opened possibly in Peoria, from which the earnings will be distributed equitably among the lines participating in the carriage of a message.

Some 50 of the owners and managers of the systems radiating from Peoria attended the meeting and took part in the discussion of the question of merging their interests to bring about the best results. The toll-rate committee was continued in service until the April meeting, with enlarged powers, the most important of which are the solicitation of toll connections in all parts of the state and in other and adjoining districts to join in the agreement and accept the articles which will be drawn up by the committee, the reception of whose report will be made the order of business at the next meeting of the association.

For a number of months the Independents have had a working agreement among themselves and have handled the business of the public more from the standpoint of accommodation than for the actual monetary consideration to be derived therefrom. The need of this adjustment of the toll rates led to the appointment of the toll-rate committee at the meeting of the Central Illinois Independent Telephone Association held several months ago. The work of reaching an agreement is a difficult one. In the district within the bounds of the five counties are 65 different concerns operating 108 exchanges, with 30,000 telephones and 6,000 miles of toll wire. An extension of the toll lines in Central Illinois is planned. A new line will be strung between Peoria and Washington, a distance of 12 miles, at which place connection is to be had through El Paso with the Independent toll lines north and south, from the outskirts of Chicago to Springfield. From the present indications the year 1906, it is believed, will be the most prosperous one in Central Illinois in the building of toll lines.

TELEPHONE MEN.

F. P. Fish, president of the American Telephone and Telegraph Company, reached San Francisco from Boston a few days ago.

Leigh W. Prentice, formerly manager of the telephone exchange in New Richmond, Wis., and afterward at St. Cloud, Minn., died a few days ago of consumption at his home in Clinton, Iowa. He had been manager of the Tri-city Telephone Company in Clinton for several years.

As a memorial to his father, Alexander Graham Bell has presented to the Association for Diffusion of Knowledge to the Deaf, for the benefit of the Volta Bureau, real estate, bonds and gifts valued at $75,000. The bureau was established by Dr. Alexander Melville Bell. Three generations of the family have been interested in problems relating to its work.

E. B. Danielson of Chicago died a few days ago at the age of 35 years. He had been in the employment of the Chicago Telephone Company for many years and had charge of its supply department when this department was made a part of the supply department of the Western Electric Company several years ago. Since that time he has had charge of that part of the supply business of the Western Electric Company relating to the business of the Chicago Telephone Company. Mr. Danielson had many friends throughout the country who will be grieved to learn of his death.

The monthly instrument statement of the Chicago Telephone Company shows for December a gain of 2,104 subscribers in the city and 816 in the country. Total gains for the year 1905 were 17,644 telephones in the city and 7,686 in the country, a total of 25,330. A call has been issued for the annual meeting of stockholders, to be held in the offices of the company on January 17th.

Indiana Telephone Items.

The Mutual Telephone Company of Shelbyville will soon begin the construction of a new plant. A building will be erected for exchange purposes, and all the wires in the business portion of the city will be laid underground. David B. Wilson is president of the company. It is expected that the new plant will be in operation by the first of May.

The Central Union Telephone Company and the Hope Independent Telephone Company at Hope, Bartholomew County, have combined exchanges. Some time ago the Citizens' Independent Telephone Company of Columbus made an effort to buy the Hope company's property, but the price demanded was too high.

The Indiana Independent Telephone Association has issued the first number of The Bulletin, a monthly publication devoted exclusively to the Independent telephone industry in Indiana. The Bulletin is under the direction of C. S. Norton, secretary of the association. The first issue is creditable in appearance and character. The chief aim of the first issue seems to be to convince the people that the greater number of telephone connections possible the more valuable the service, and that, unlike many other industries, the larger the plant the greater the cost, proportionately, to operate it.

The Salem Ridge Mutual Telephone Company of Rising Sun has been incorporated. William A. Rockafellow, Charles Rice, G. A. Woods and Clay Miller are the directors.

The Indiana branch of the Illinois Central railroad is being thoroughly equipped with Independent telephone service. Copper wire weighing 166 pounds to the mile is being used for the long-distance circuit.

The Central Union Telephone Company is nearing the completion of new lines surrounding the city of Crawfordsville. During the last two months this company has set 90 miles of poles and is now running 600 miles of wire to complete the necessary connections.

It is expected that the final struggle between the New Long-distance Telephone Company and the Bell telephone company for the long-distance business arising from the exchange of the Citizens' Telephone Company in Kokomo will take place at the next meeting of the City Council of Kokomo.

The Central Union Telephone Company has finished placing its wires underground in the city of Lafayette. The improvement in the appearance of the streets by the removal of the poles and wires is marked.

A petition will be filed with the new Board of Public Works in Indianapolis next week from the Indianapolis Telephone Company requesting several changes in the contract between the city and the Home Telephone Company to the end that the company may increase its rates in Indianapolis and also for an extension of its 25-year franchise. The Indianapolis Telephone Company—a holding and operating and interest-guaranteeing concern—operates in Indianapolis under the contract made by the city in May, 1898, with the Home Telephone Company. The Indianapolis Telephone Company recently passed from the hands of local holders into a syndicate that is dominated by St. Louis and Toledo financial interests. The opposition to a modification and an extension seems to be melting away, and it is generally believed if the new holders make it plain to the Board of Public Works and the City Council that the improvements named in their petition will be made there will be no great opposition to granting the request for an increase of rates and an extension of the franchise.

The United States Circuit Court of Appeals has affirmed the decision of the District Court and holds that the Cumberland Telephone Company is on the streets of Evansville, with no rights under the law. The injunction to prevent the city from disturbing the company's property has been dissolved. While the decision means that the Cumberland Telephone Company is without a franchise and the city has a right to remove its poles and wires, the feeling of the people has undergone a change. The Cumberland system covers the territory of Evansville as no other does, and it is claimed that the people of Evansville prefer this system to any other. The Pocket Telephone (Independent) is asking for a franchise and claims to have a good system in the territory. However, it is conceded that the Cumberland company has the advantage by reason of its established plant and can afford to bid higher than a new company for a franchise. S.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has installed a local exchange for Isanti, Minn. The company is improving its toll lines around Lake Minnetonka, from Excelsior, Minn., and has just completed connection with St. Bonifacius.

J. J. Maloney, manager of the Northwestern Telephone Exchange Company at St. Cloud, Minn., has been transferred to Albert Lea, Minn., for the same company. He is succeeded at St. Cloud by James P. Howatt, who has been wire chief.

During the next two years the Twin City Telephone Company proposes to construct about 21,000 feet of underground conduit in Minneapolis, which will cost about $22,000. This, together with the [illegible] of cable [illegible] [illegible] total [illegible].

The [illegible] River [illegible] Telephone Company [illegible] and [illegible] Telephone Company [illegible] Wis.

The [illegible] Telephone Company has reported [illegible] earnings [illegible] for the [illegible] ber 30th. The gross earnings of [illegible] preceding year were [illegible].

The Northwestern Telephone Exchange Company will remove all old telephones [illegible], Minn., and install the Bell [illegible]. The improvement will cost [illegible].

The Star Telephone Company of [illegible], Minn., is installing a local exchange at Rosemount, Minn.

Charles Sundberg of Madelia, Minn., has bought a controlling interest in the new telephone [illegible] of St. James, Minn., and has [illegible] charge.

The city of Minneapolis in 1899 fixed January 1, 1906, as the date when overhead wires in a certain rather extended area should be done away with. The date find very little progress made in getting the total area cleared of wires. The companies interested say that the space covered was too extended and was unreasonable. The council may reduce the underground territory materially and require the wires to be put underground within two years. The companies say that seven to 10 years should be allowed.

A new telephone exchange has been installed in the North Dakota Agricultural College at Fargo.

The Northwestern Telephone Exchange Company has established a new division to include most of the business section of Minneapolis, the Main exchange having become filled. A new north division will also be established shortly. R.

Ohio Telephone Notes.

The statement has been made that a new company will be formed to take over the property of the Federal Telephone Company and that collateral bonds will be issued to take care of the debt against the company and to provide money for improvements and extensions. The Everett-Moore syndicate, to which the large part of the debt is due, will take stock in the new company in payment and the other stockholders will be asked to participate in the same way. The St. Louis syndicate that has been spoken of so many times in connection with the company is expected to take the bonds with a 40-per cent. stock bonus besides considerable of the stock issue.

Thee Cleveland Telephone Company, according to General Manager Yensen's recent statement, has secured 5,000 new subscribers during the last year. Besides building a new exchange, as already mentioned in the Western Electrician, the company will probably expend something like $1,000,000 in improvements and extensions in and about Cleveland the coming year. The number of subscribers' stations is now 25,000, Mr. Yensen said.

The Columbus Citizens' Telephone Company is engaged in installing new telephones, orders for which have been waiting for many months, some of them two years. It is reported that the company has announced an advance in the price of the service and that some dissatisfaction has been caused thereby.

The Cumberland Telephone Company will build four direct wires from Louisville to New Orleans. This will give the company better service with the South.

The Van Wert Home Telephone Company of Van Wert has notified the secretary of state of an increase of capital stock from $50,000 to $100,000.

The girl operators in the Bell exchange at Delaware struck last week because the manager forbade them talking to each other while on duty, and closed the window blinds so they could not see out on the street.

The Bell exchange at Elyria was badly damaged by the fire that destroyed the Hotel Adwur on January 6th. Men were put to work at once repairing and installing a new exchange across the street from the hotel where the old one was located.

Fred Lubbe and others have organized the Dillsboro Telephone Company at Dillsboro with a capital stock of $1,000.

It is reported that the Bell people have reduced their rates at Toledo in competition with the Independent company. Two-party residence telephones have been reduced from $24 to $18; two-party business telephones have been placed at $36; independent or single-wire residence telephones from $36 to $27; independent business telephones from $60 to $54, with $12 additional for extensions. The four-party lines have been abolished and two-party lines will be furnished at the same rate. All existing contracts will be continued at the new rates.

The Union County Telephone Company of Marysville has been incorporated with a capital stock of $200,000 to take over all the Independent interests of the county. Newton E. Liggett, W. C. Fullington, W. C. Shearer, G. E. Whitney and H. E. Conkright are the incorporators.

The Central Union Telephone Company has arranged to establish a branch exchange in Columbus on the North Side at the corner of High Street and Fifth Avenue, where the entire floor of a [illegible]

Indiana District Telephone Meeting.

A [illegible] meeting of the [illegible] of the Indiana Independent Telephone Association was held at [illegible] on January [illegible] Independent companies operating in [illegible] [illegible] [illegible] [illegible] were represented at the meeting. O. B. [illegible] was chosen president and Frank [illegible] of [illegible] secretary. The principal matter discussed was the advisability of making [illegible] contract with the Central Union Telephone Company at Danville, Ill. [illegible] the appointment of a committee to take up the matter with the Commercial Club of Danville and seek to have the long-distance business at Danville distributed among all the long-distance companies. The matter of independent companies becoming sub-licensees of the Bell company was [illegible]. Local operating methods were also discussed, after which William [illegible] of the New Long-distance Telephone Company of Indianapolis talked of the latest phases of the Independent telephone situation in the state. Mr. [illegible] said that within a short time Independent long-distance facilities would be brought to every Independent company in the state.

Modern Telephone Exchange for Manila.

The Philippine Island Telephone and Telegraph Company, which was organized in San Francisco some time ago for the purpose of constructing telephone and telegraph lines in the Philippine Islands, is now installing a modern telephone plant at Manila. A switchboard is now en route to Manila, accompanied by a force of electricians. An underground-conduit system is now being put in. The company has a 50-year concession from the Philippine Commission, and has purchased the property of the Manila Telephone Company, a Spanish corporation, which put in a plant about 20 years ago. It is said by San Francisco representatives of the company that as soon as the city system is completed a number of long-distance lines will be extended into various provinces.

GENERAL TELEPHONE NEWS.

The Kinloch Telephone Company will erect a new building in Granite City, Ill., to cost $10,000.

The Attica Telephone Company has received a franchise to operate a telephone system in Attica, N. Y.

The Lamoure County Telephone Company of Marion, N. D., has been granted a franchise to operate a telephone system in Marion.

The Kansas City Home Telephone Company has secured a permit for another branch exchange building in Wabash avenue, Kansas City, Mo.

The city of Shawnee, Texas, has granted a 21-year franchise to the Pioneer Telephone Company for the installation of a telephone system. It is proposed to invest $100,000.

T. J. Smith and J. B. Rhodes have received a telephone franchise from the City Council of New Lexington, Ohio, and will at once commence to build throughout the entire county of Perry in conjunction with the Independent toll service.

A good programme and entertainment have been provided for the annual meeting of the Nebraska Independent Telephone Association to be held at the Lindell Hotel, Lincoln, on January 23d and 24th. Important matters are to be discussed and decided, among them a plan to harmonize the Independent telephone interests of the state. A large attendance from Nebraska and adjoining states is expected. R. E. Mattison of Lincoln is acting secretary.

Albert Haynes and associates of Royal Oak and Birmingham, Mich., have entered into a sub-license contract with the Michigan State Telephone Company and will operate telephone exchanges at Birmingham and Royal Oak under the name of the Detroit Suburban Telephone Company. This company will take over all Michigan State property in both towns and will connect with the long-distance system. About 80 subscribers are already in the service in Birmingham and about 75 contracts have been secured in Royal Oak and vicinity.

CORRESPONDENCE.

Great Britain.

London, December 27.—After the usual uncertainties which are yearly created by the notices of intention to deposit bills in Parliament during the forthcoming session, it is now possible to give a correct estimate of what is likely to take place, the statutory period for depositing bills having expired. Of course, chief attention will again be attracted to the electric power bills for London, there being no less than 10 such measures. Only three, however, schedule an area of supply and deal with the matter in a comprehensive manner, viz., the revised Administrative County of London and District Electric Power Company, a new company ostensibly formed to supply London railway companies, but whose bill will, no doubt, be regarded with suspicion by competitors, owing to a somewhat ambiguous drafting, and the London County Council's electric power bill. The capital involved in these three measures amounts to something like $48,000,000, but, from the nature of the proposals, only one can be sanctioned. The majority of the remaining electric power bills are combinations of existing electric-supply authorities for powers to give mutual supply in each other's areas, by agreement, a thing at present rendered impossible by a clause in the electric-lighting acts. A welcome sign in connection with these latter bills is that local authorities and companies are combining with the object above stated. One bill schedules the larger part of the County of London north of the River Thames, but there is a rumor that it is intended to appoint a royal commission to inquire into the whole matter, a proceeding which would be fatal to the passing of any of the measures.

Appertaining to the question of electric power supply, is the recent attitude of the London County Council to those borough councils owning electricity undertakings. The County Council is the authority in London for granting electric-lighting loans, and there now seems to be a tendency to discourage any further extensive loans, pending the result of the power-bill controversy. This is not done in an impartial spirit, however, for it is evident that the object is to secure business for the council's own project, should it pass into law. It may be taken for granted that were a power company to succeed, the granting of loans would go on as merrily as before.

The National Telephone Company's head exchange in Glasgow was burnt out at the end of last week. Fortunately none of the operators were in peril of their lives, but the inconvenience to many thousands of subscribers is considerable.

There is a very rapidly growing tendency in Great Britain, especially in busy towns, toward the adoption of covers to the roofs of double-deck tram cars. In Sheffield, Glasgow, London and many other places quite an extensive use is made of this form of vehicle, and, quite naturally, a town of the size of Birmingham would wish also to adopt them. The Board of Trade's consent, however, has to be obtained in every case, and in regard to Birmingham it has been withheld on account of the narrowness of the tracks and the danger of capsizing, due to wind pressure. The corporation has a very good reply, however, in that the cars of the company, which has running powers over the municipal lines, have been fitted with roof decks for 18 months. An answer to this is now being awaited.

From the very inception of the National Physical Laboratory, the complaint has been heard that the funds granted by the government are insufficient to carry the institution on. Frequent representations have resulted in some slight but always insufficient increase. Consequently it is not surprising that an application has been made to the new government with the same end in view, and in this instance a great deal of detail has been gone into in making comparisons between what is done in the United States and other countries. The sum of $120,000 has been granted for buildings in connection with the National Physical Laboratories, together with a grant of $27,000 (not permanent) per annum. Against this it is pointed out that the United States has provided $350,000 for buildings, $225,000 for equipment and an annual grant of $95,000 in connection with the National Bureau of Standards. The memorial embodying these arguments has been presented to the new chancellor of the exchequer, in the hope that he may make further provision for the laboratory in the forthcoming education estimates.

Mr. Fell, the chief officer of the London County Council, has presented a lengthy report in which he comments on and compares, in a very candid manner, the various systems of tramways and street railways in the United States. The report is the outcome of a recent visit to the United States. The comparisons in many details are not favorable to British methods.

The giving of the contract for the electrical equipment of a portion of the London, Brighton and South Coast railway, with the single-phase system, to Germany, appears to have engendered considerable feeling in certain quarters here. It is clear, however, that most of this is at the hands of unsuccessful bidders, and, after all, from official information, there is not much in it. The patents are held in England, and with the exception of the first few motors, etc., the majority of the work will be carried out by the British Thomson-Houston company. In fact, it is announced that the latter concern was associated with the Allgemeine Elektricitäts Gesellschaft in its very favorable tender for the work. G.

Dominion of Canada.

Winnipeg, Man., January 6.—The Winnipeg Electric Street Railway Company has applied for permission from the City Council to place additional side tracks in order to give better service on William and Sherbrook streets. The company has just opened a new line to Headingly, about 11 miles from Winnipeg, which will make a good route for the transportation of produce and garden truck from the farmers along the route. Plans have been prepared for a belt line with Elmswood and St. Boniface. A new bridge will be built by the company across the Seine River, St. Boniface paying half the cost.

The British Columbia Electric Railway Company is installing additional machinery to the value of about $35,000 in its Vancouver sub-station. The chief improvement is a new rotary converter with transformers and equipment This will be used in connection with the street-railway circuit and leave the machinery at present used for this purpose available for other uses. It will be employed in providing a separate system for all motors supplied with power by the company which are now operated on the trolley circuits. In connection with the public-lighting service new transformers will be put in at an expense of $8,000 and a new two-phase switchboard which will cost approximately $2,000.

W. M. Douall, president of the West Kootenay Power and Light Company, states that the cost of the new machinery at Bonnington on Kootenay River, B. C., together with the pole lines, will be about $1,000,000. The company will have 28,000 horsepower for railway and industrial purposes and expects the lines into the boundary will be ready for transmission purposes by March or April.

Robert P. Inglis of Montreal has a charter for the construction of a street railway in Edmonton. He has gone to Europe to secure capital for his enterprise. The principal part of the business will be between Edmonton and Strathcona. The equipment will at first consist of 10 cars. Mr. Inglis is interested in the Montreal, the Toronto and the Winnipeg street railways.

An electric railway connecting Windsor with Buffalo will be the outgrowth of the Windsor, Essex and Lake Shore Electric railway. The grading of the roadbed is finished between Kingsville and Windsor, and the tracks are now being laid. The waterpower of Niagara Falls will be used when Buffalo and Detroit are connected. The distance is 220 miles. The route will be from Windsor to Essex, Kingsville, Leamington, Wheatly, Tilbury, Chatham, London and thence to Buffalo and Detroit.

James Milne of Toronto has accepted the position of general superintendent of the British Columbia electric railway. H.

New York.

New York city, January 6.—The appellate judges have denied the application of two taxpayers, acting in the interests of the Board of Aldermen, to restrain the Board of Estimate and Apportionment from acting in the matter of new subway applications. This decision, unless reversed by the Supreme Court, confirms the constitutionality of the new law which took away from the Board of Aldermen the power to grant traction and telephone franchises. Following this decision, the Rapid Transit Commission has announced that it will advertise for bids for new subways on May 1st, as relating to proposed new subways on Third, Lexington, Seventh and Eighth avenues.

August Belmont, in a letter to the Brooklyn Transit Reform League, says that the merger of the Interborough and Metropolitan does not alter the situation as far as the completion of the Flatbush extension is concerned. The merger will not change the policy of the Interborough with regard to extensions. If there is any change, it would be forced, he says, by those who have assumed that the companies are incapable of conducting transportation properly. The combined companies seek to promote the efficiency of their service on sound and stable lines of operation, to the end that the public may be better served and that rapid-transit facilities may be more speedily extended between the several boroughs. These statements give satisfaction in Brooklyn.

There are prospects that, as far as Brooklyn is concerned, there will be rival bids for subways from the Interborough company, the Brooklyn Rapid Transit Company and from the syndicate identified with J. Edward Swanstrom, president of the Brooklyn Transit Reform League.

The Supreme Court has refused to restrain the Pennsylvania Railroad from closing Thirty-third Street, between Ninth and Tenth avenues, for the purpose of tunnel building in connection with the Pennsylvania-Long Island line across Manhattan.

A collision on Wednesday on the Long Island Railroad near Jamaica between an electric passenger train and some freight cars showed conclusively that the steel passenger cars are capable of withstanding an impact at the rate of 50 miles an hour.

The State Lighting Commission is still hearing evidence as to the cost of gas in this city. Prof. E. W. Bemis, a gas expert, has stated that he has calculated that the profit made by the Consolidated Gas Company is 45.65 cents for every thousand cubic feet of gas it sells in New York. It appears that the Consolidated reserves 10 cents per thousand feet for depreciation of plant, or five times more than Professor Bemis thinks needful.

During the year just ended there has been a net gain of 35,000 telephone instruments operated by the New York Telephone Company in Manhattan and the Bronx.

In an appellate decision the New York Telephone Company has been ordered to pay a householder $200 for the use of his roof for affixing telephone wires.

One of the last acts of the retiring fire commissioner, N. J. Hayes, was to recommend the speedy installation of a new fire-alarm system. The first act of the new commissioner is to order Bell telephones to be placed in every fire station, as supplementary to the present departmental service, which is so deficient that it frequently breaks down.

The New York Tribune reports that a Brooklyn boy, named Austin Curtis, has invented a space-telegraph apparatus by which he has been enabled to pick up messages from the Brooklyn navy yard.

The De Forest Wireless Telegraph Company announces that 22 steamships sailing from New York port are equipped with its system, and that the equipment of 20 more vessels has been ordered.

The New York and Westchester Auxiliary Fire Alarm Company has been incorporated with a capital of $50,000, and offices at Yonkers, N. Y.

An examination for an electrical engineer for the Federal service will be held at the Brooklyn Postoffice Building on January 24th. Details are obtainable at the Civil Service Bureau, Custom House, New York city.

Bids are returnable on January 15th for installing electric elevators in the Manual Training High School, Brooklyn. The value of the work is approximately $10,000.

The General Electric Company has installed at the Brooklyn navy yard a searchlight of 20,000 candlepower, similar to a twin light at Sandy Hook. The carbon is 2½ inches in diameter, used with 200 amperes current, at 50 volts. The lens is 60 inches in diameter and there is a powerful parabolic reflector. D. W. W.

Ohio.

Cleveland, January 6.—The trouble between the Schoepf interests at Lima and the Western Ohio Railway Company threatens to break into the courts. The trouble is over the joint use of certain tracks in Lima.

Mayor Tom L. Johnson of Cleveland appeared before the special committee of the Chamber of Commerce a few days ago and gave his version of what should be done regarding franchises. He does not believe in renewing franchises which, he says, will give the company rights that are worth from $20,000,000 to $40,000,000 without some compensation in return. The mayor holds pretty closely to his old idea of three-cent fare or some form of municipal ownership.

It is said that the larger electric railways out of Cleveland are making plans for the development of business the coming year and that some of them at least will have traveling passenger agents to work along their lines. In the past the roads have taken largely only the business that has come to them. Now they propose to make business. The excursion business will be given attention and all other matters will receive more care than usual. In addition more publicity will be given the roads and their manner of conducting business.

George F. Wilson of Delphos and Engineer Huntoon of the Fort Wayne, Van Wert and Lima road are laying off a line between St. Marys and Defiance, and it is said that Delphos and Fort Wayne men are interested in it.

The Dayton Citizens' Electric Company of Dayton, with a capital stock of $100,000, has been incorporated by Cyrus E. Mead, F. T. Griest, H. B. Arnold and others.

Purchasers of the Springfield, South Charleston, Washington C. H. and Chillicothe road have incorporated the Washington Traction Company to take over the property. The nominal capital stock is $30,000, and J. S. Hrashman, F. J. Southard, A. M. Irwin, H. J. Andrews and E. M. Buel are the incorporators. The intention of the new company is to complete the line to Washington C. H. and eventually to Chillicothe. It has been in the hands of a receiver for some time and the new owners have arranged for financing the debt.

The directors of the Columbus Public Service Company have declared a three per cent. dividend on the $250,000 preferred cumulative stock.

The Cleveland City Council has appropriated $56,000 for improving a municipal light plant recently acquired by the annexation of territory.

It is said that traction officials in this state are considering the advisability of reducing the number

of free passes issued. They feel that too many people have been receiving them.

Interurban railway men will probably have a bill introduced in the Legislature this winter making a $2 bill the maximum amount that may be tendered to a conductor for a cash fare. At present there is no limit and conductors are not always in a position to make change for a $10 or $20 bill.

All the substations of the Columbus, Delaware and Marion line were put in operation at the first of the year. O. M. C.

Indiana.

Indianapolis, January 6.—As a result of the acquisition of the Indiana Northern Traction Company by the Indiana Union Traction Company, through cars are now running between Anderson and Wabash, with close connection for Indianapolis. All of the employes of the Indiana Northern have been dismissed and the repair shops of the company have been closed.

Joseph A. McGowan, secretary to Hugh J. McGowan, president of the Indianapolis Traction and Terminal Company, has been promoted to the office of auditor of the company. Leroy E. Snyder has been made assistant secretary to President McGowan with the duties of secretary.

Franchise ordinances were presented to the Seymour City Council on January 2d for the entrance of the Indianapolis, Columbus and Southern Traction Company and the Louisville and Indianapolis Traction Company to that city.

Robert I. Todd, recently appointed general manager of the Indianapolis Traction and Terminal Company, has arrived in Indianapolis and taken up the active duties of that office. Mr. Todd has a reputation among traction men as one of the ablest executive and operating men in the business.

C. C. Reynolds, who was recently made general superintendent of the syndicate controlling most of the Indiana trolley lines, has moved his headquarters from Lebanon to the Traction Building, Indianapolis, where D. G. Edwards, president of the merger company, will likewise make his official headquarters.

Edgar Elliott and Harry B. Gates have purchased a controlling interest in the Louisville and Eastern Electric railway extending from Louisville to Beard Station. The sale of the road involves more than $2,000,000. There is considerable speculation about this deal, and it is currently believed that the merger traction syndicate of Ohio and Indiana is back of the deal, notwithstanding Mr. McGowan says he knows nothing about it.

The city electric-light plant at Cannelton was destroyed by fire on January 1st. The plant was purchased by the city two years ago and several thousand dollars have been expended on improvements. The two private plants are insufficient to supply the light and power needed and the city plant will be rebuilt and installed with new appliances at once.

Mayor McCormack of Columbus has recommended that the council take immediate steps toward the securing of an incandescent commercial lighting service to be conducted by the city. The plan is to erect and install a municipal-lighting plant.

A 25-year franchise has been granted by the City Council of Andrews to the Andrews Light and Water Company for the construction and operation of an electric railway from the middle of the city to the station on the Fort Wayne and Wabash Valley traction line, a half mile north of the town. It is understood that the Andrews company will receive assistance from the Wabash Valley company, as it will prove a good feeder.

The Capital Circuit Traction Company, recently incorporated to construct an electric railway around Indianapolis, about 25 miles out, and connecting a number of good towns and cities, has elected the following-named officers, with headquarters in Indianapolis: President, J. N. Crabb; vice-president, J. W. Trotter; secretary-treasurer, C. E. Northchief; engineer, J. A. Shafer.

The interurban express and freight business during Christmas on the Indianapolis and Northwestern required four express cars, each averaging $200 a day. It is said the other interurban lines did equally as well.

The Northern Indiana and the Winona Electric Railway Companies have jointly ordered plans for the construction of a joint terminal station for all lines entering Goshen. A four-story building with offices above and station below is the plan to be followed.

Land values in Indiana lying near interurban lines are increasing at an unprecedented rate. In traction localities the farmers have raised the prices of their holdings until good farms cannot be bought for less than $100 to $500 per acre.

The largest concrete arch on any interurban line of the state has just been completed over Williams Creek on the Indianapolis and Cincinnati traction line, near Connersville. The arch is 200 feet long, contains 5,000 cubic feet of concrete and cost $45,000.

The Indiana Public Service Company of Aurora, Ind., has been incorporated with the purpose of constructing an electric-light and waterworks plant in Aurora. David J. Hauss is chairman of the board of directors.

The citizens of Walkerton, Ind., [illegible] contracted an electric light [illegible] per year for [illegible] city.

Southeastern States.

Charlotte, N. C., January 6. [illegible] Atlanta, Ga., has approved the [illegible] to the Southern Light and Power [illegible] year franchise. The ordinance [illegible] collection of a gross receipts [illegible] 20 years and three per cent for the remaining 10 years. It provides that the company may charge more than $65 for arc light per month or $28 for incandescent light.

The town of Edgewood, Ga., near Atlanta, is considering the feasibility of floating $15,000 worth of bonds for municipal lighting purposes. It is the intention of the town to build an independent lighting plant.

The Southern Power Company, which has been for several years buying in waterpowers in the Carolinas, now holds title to eight waterpowers which are estimated to be capable of producing 200,000 horsepower. All are on the Catawba River except one, which is located on Broad River in South Carolina. The company is now master of the Catawba River and may soon turn its attention to other rivers in the South. The company has just bought $250,000 worth of electrical machinery from the Westinghouse company for its new plant at Great Falls, near Fort Lawn, S. C. Several important cotton-mill plants in the section where the Southern Power Company operates have recently become subscribers to the electric power and its use in the mills is daily becoming more and more popular with the mills. L.

Northwestern States.

Minneapolis, January 6.—The Minneapolis General Electric Company has notified the City Council of its plans for placing its wires underground.

The Grand Forks (N. D.) Gas and Electric Company has prepared plans for a two-story brick building in that city for a storehouse and office. Next season it will also construct a large powerhouse adjoining its present buildings.

The survey for the proposed trolley line from Milwaukee, Wis., to Sheboygan, with a branch line to Fond du Lac, which will be built by the Milwaukee and Northern, is progressing rapidly.

H. L. Wherland has resigned his position as superintendent of the water and light plant at Waseca, Minn.

The Tripoli (Iowa) Canning Company is planning to install an electric light plant in the spring.

Electric power will be furnished the two pumping stations at De Pere, Wis., by the Electric Light and Power Company. A contract has been entered into for that purpose.

The Penn Iron Mining Company has contracted for a complete hydro-electric plant to be installed at Sturgeon Falls, Mich. The first contract is for apparatus that will furnish 2,000 horsepower, which will be doubled later.

There is talk of putting in a new electric-lighting system at Paynesville, Minn.

A. M. Worthington has resigned as superintendent of the electric-light system at Ortonville, Minn.

It is announced that work will be started at once on a trolley line on the Iron Range, connecting all towns between Biwabik, Minn., and Hibbing. A right-of-way has been granted to the Missabe Range Traction Company, and it is estimated that the road will cost about $700,000. The road will be approximately 40 miles long. F. B. Myers of Biwabik is president of the company.

C. W. Hurd has been appointed city electrician at Stillwater, Minn.

The Sioux Falls (S. D.) Interurban Railway Company has been incorporated and will build a trolley line from Sioux Falls to Parker and Marion Junction. R. F. Brown is president and G. A. Pettigrew, secretary.

The City Council of Pipestone, Minn., is investigating the advisability of installing an electric-light plant.

The courthouse and city-hall commissioners of Minneapolis and Hennepin County have awarded the contract to the Electrical Machinery Company for a generator and engine to cost $4,800. They have also let the contract for a new $9,000 switchboard.

The electric light plant at Ladysmith, Wis., has been sold to G. E. Newman. R.

Pacific Slope.

San Francisco, Cal., January 5.—The municipal authorities of San Francisco are meeting with determined opposition to the reconstruction of the Geary Street cable road, as a municipal electric line, from the bondholders of the Geary Street Railroad Company. Isaac Strassburger, one of these bondholders, attempted to secure an injunction restraining the city from proceeding with its plans. He failed to get the injunction, but secured an order to show cause why an injunction should not issue. Notwithstanding this suit the supervisors have passed a motion urging the mayor to proceed as expeditiously as possible with the purchase of property for use as a site for a municipal power house.

[illegible]

PERSONAL.

R. W. Harris of Kalamazoo, Mich., [illegible] out of the Michigan Traction Company, has tendered his resignation and will leave [illegible]

C. A. Coffin, president of the General Electric Company, with Mrs. Coffin and daughter, left New York on January 6th on board the White Star liner Celtic, for a Mediterranean trip.

Alexander E. Orr, president of the Rapid Transit Commission of New York city, has been elected president of the New York Life Insurance Company. Mr. Orr will not resign from the Rapid Transit Commission, it is said.

George P. Zwerner of Marysville, Ohio, has resigned his position with the Marysville Telephone Company to become superintendent of the Marysville Light and Water Company. Mr. Zwerner succeeds Howard M. Jones, who has gone to the Standard Stamping Company.

Marcus Smith of Wilkesbarre, Pa., died suddenly at his home on Christmas evening from a stroke of apoplexy. Mr. Smith was the founder of the Wilkesbarre Gas and Electric Company and was a leading citizen of Wilkesbarre. He was 68 years of age and is survived by five sons.

C. E. Mitchell has resigned his position as assistant manager of the Western Electric Company of Chicago to engage in a financial enterprise in New York city. Mr. Mitchell has many friends in Chicago who learn of his departure with regret. It is understood that his new work will practically take him out of the electrical field.

R. S. Mitten, who has been general sales manager for the Eureka Electric Company of Genoa, Ill., for the last three years, has severed his connections with that company and has taken a position with the Electric Appliance Company as assistant to Mr. S. A. Dinsmore in the telephone department. He will have charge of the correspondence of this department.

George H. Thayer, for 30 years superintendent of the Chicago and Northwestern railway division of the Western Union Telegraph Company, died on January 8th at his residence in Norwood Park, Chicago. Mr. Thayer was born at Weathersfield, Vt., on January 8, 1843, and had lived in Chicago 53 years. He was connected with the Western Union company 45 years. His widow, a daughter and three sons survive him.

Dr. Otto A. Moses died at his home in New York city on January 3d. He had a world-wide reputation as a chemist and geologist. Dr. Moses was born in Charleston, S. C., in 1846. He was a graduate of the University of Leipsic, and introduced most of the Edison inventions in Europe. For some time he was state geologist of South Carolina and general supervisor of the phosphate works. Dr. Moses was the founder of the Hebrew Technical Institute, in Stuyvesant Street, an institution for the free education of poor boys.

Mr. Radiguet, a scientist of Paris, has died after a lingering illness caused, it is said, by his experiment with radiography. He was a maker of instruments, but on the discovery of the rays by Dr. Röntgen applied himself immediately to the study of the new force. About two years ago his right arm was attacked, and partial mortification set in, owing to his having subjected it to the rays to observe experimentally the effects of the latter, which were not then known. The progress of the affection was slow, but eventually ulcerous wounds were produced, which every remedy failed to heal.

H. W. Goode, president of the Portland General Electric Company of Portland, Ore., returned recently from a six-weeks' trip through the East.

where he went to arrange for considerable improvements to the company's plant in Portland. He stated that work will be commenced at once on the company's new $200,000 office building. The reconstruction of the electric-lighting system of the city, which will cost nearly $1,000,000, will be undertaken early in the year. The improvements and extensions include a pole line to Salem, Ore. A contract has been made to supply the local lighting company at Salem through this line.

H. I. Wellman, in the employment of the Western Electric Company in Chicago, was instantly killed by a train on January 3d. He resided at Riverside, Ill., and was hurrying across the tracks of the Chicago, Burlington and Quincy Railroad to catch a train to work when he was struck by an approaching fast train. Mr. Wellman was one of the designing engineers of the Western Electric Company. He was a skillful engineer and was highly esteemed by his employers, who anticipated an exceptionally successful career for him in electrical engineering. Mr. Wellman came to the Western Electric about a year ago. He had been with the General Incandescent Arc Light Company previous to its consolidation with the Stanley company. He was 32 years old and leaves a wife and one child.

ELECTRIC LIGHTING.

Fire in Beresford, S. D., recently destroyed the electric-light plant in that city. The loss is said to have been $25,000.

The Humbird Lumber Company and the Panhandle Smelting Company are both applicants for an electric-light franchise in Sand Point, Idaho.

The Kirksville (Mo.) Gas, Heat and Electric Company has been incorporated with $30,000 capital stock by B. F. Henry, Fred Grassle, Charles Sands, F. J. Storm, W. P. Foster and P. C. Miles.

The stockholders of the Utah County Light and Power Company of American Fork, Utah, have voted to increase the capital stock from $50,000 to $200,000 and will at once proceed to install a second plant of much larger capacity directly above its present plant and thus be enabled to furnish all the power needed by the fast-growing community.

ELECTRIC RAILWAYS.

P. S. Briggs and John L. Davis are seeking a franchise for a street-railway system in Beloit, Wis.

The Central Pennsylvania Traction Company has commenced the construction of its new power plant in South Cameron Street, Harrisburg, Pa.

The Central Railway Company contemplates building an electric railway through Prairie Home and Booneville to Marshall, Mo., from California, Mo.

Robert K. Cochrane, a councilman of Pittsburg, Pa., is threatened with blindness from blood poisoning, which he believes he got from a street-car strap. While holding a strap in a crowded car Mr. Cochrane rubbed one of his eyes frequently to relieve it from itching, and he thinks he conveyed poison germs from the strap.

The Lansing (Mich.) and Suburban Traction Company is planning to install a comprehensive block signal and dispatching system, practically the same as that used on the steam roads. When the new offices are in shape a telephone line will be installed, covering both the city and interurban systems, to be used by the dispatcher.

The four elevated railways of Chicago carried 123,654,432 passengers in 1905, compared with 113,050,400 in 1904. Of the total for 1905 the Metropolitan carried 45,358,843, the South Side 32,959,752, the Northwestern 28,238,621, and the Oak Park 17,097,216. All the roads show a good increase over 1904, the percentage of gain being 8.69 per cent. During the month of December traffic on the Oak Park line averaged 52,044 passengers daily. This was the largest in the history of the road and a gain over December, 1904, of 9.89 per cent. The average increase for the year over 1904 was 7.09 per cent.

At a meeting held in South Bend, Ind., the directors of the Kalamazoo, Elkhart and South Bend railway elected officers for the ensuing year and made public the fact that the organization had been incorporated in both Michigan and Indiana. The line contemplated by the company will run from Kalamazoo to Vicksburg, thence to Parkville and Three Rivers, Constantine, Mottville, Union, Elkhart and South Bend. The road is intended to be a connecting link between lines diverting to points in Michigan from Kalamazoo and from South Bend to points in Indiana. A private right-of-way will be used.

PUBLICATIONS.

The Chandler & Taylor Company of Indianapolis, Ind., has published two new bulletins, E-104, covering stationary tubular boilers, breechings, fronts, etc., and E-105, showing plain slide-valve engines with detailed description of parts. These bulletins are high-grade both in printing and in the character of the half-tone illustrations. These bulletins the company will be pleased to mail upon request.

Two important mining machines—the Jeffrey electric drill for cutting coal, and the Jeffrey electric locomotive for hauling it—are illustrated on the 1906 calendar of the Jeffrey Manufacturing Company of Columbus, Ohio. The calendar is well designed.

A circular that is attracting attention, and favorable comment is being distributed by the Consolidated Engine-stop Company of 100 Broadway, New York. It concerns the Monarch engine-stop and speed-limit system, which is a safeguard to life and property against accidents due to the running away of engines or to persons becoming caught in machinery, and requiring the machine to be stopped instantly to save their lives.

A concise pocket telegraph code for use in the electrical profession and trade in general has been published by F. B. Badt & Co., 1504 Monadnock Block, Chicago, and is being sent out by them. Different from most codes now in existence, the Badt electrical trades telegraph code is not bulky and can be easily carried in the pocket. The selection of code words has been given special attention by the author, Mr. Badt, and they meet the exacting conditions of accuracy and dispatch.

Allis-Chalmers belted-type Reliance Corliss engines are described in bulletin No. 1501, sent out by that company. The line of engines described embody the latest design in Corliss construction, but in detail are somewhat different from other types manufactured by the company The bulletin describes the important parts of the engine in detail, giving numerous illustrations. A bulletin from the electrical department of the company describes Bullock alternating-current generators of the engine and flywheel types.

Open belt-type motors and generators and various types of electric hoisting machinery are described in two recent bulletins from the Crocker-Wheeler Company of Ampere, N. J., numbered, respectively, 61 and 62. The line of belted machines described includes a large number of sizes and ratings from 10 horsepower to 275 horsepower, and from nine to 225 kilowatts. A general description of these machines is contained in Bulletin No. 61. Electric hoists and winches of various types are shown in Bulletin No. 62, for different purposes, such as contracting work, prospecting, dock work, for traveling cranes, etc.

The Peru Electric Manufacturing Company of Peru, Ind., is distributing a circular calling attention to the special features of safety in its National Electrical Code standard cartridge fuse blocks, which it asserts are found in no other line. Under the heading of "Greater Protection" it emphasizes the advantages of Peru blocks. Another circular describes the exhibit of the Peru company at the electrical show, Chicago, January 15th to 27th, which will not only display Peru products to the best advantage, but will also have a number of unique features, making its booth very attractive. All are cordially invited to visit its exhibit.

"If a man can write a better book, preach a better sermon, or make a better mouse trap than his neighbor, though he build his house in the woods, the world will make a beaten path to his door." There is a good deal of truth in this saying, and one of the firm believers in its efficacy is the Bull Dog Specialty Company of South Bend, Ind. This company has just issued a new descriptive price-list upon Bull Dog soldering fluxes, which come in various forms, and are especially useful in electrical work. One of the products described in the pamphlet in which the company takes special pride is the new six-inch slim soldering stick, manufactured for both the domestic and export trade.

Proceedings of the thirty-third annual convention of the International Association of Fire Engineers have been compiled in book form by A. A. Farrington, official reporter, Duluth, Minn. One of the papers, by Frank C. Stover of Chicago, was on "Advantages of Fire-alarm Equipment in Fire Departments." Mr. Stover advocates the addition of an auxiliary fire-alarm service to the regular city system, extending that system to any desired point in the interior of buildings, thus saving the time that would otherwise be lost in running from the point of discovery of the fire to the nearest street box. The auxiliary service, he said, should be operated on entirely independent circuits, having no electrical connection with the fire-department circuits, thereby preventing the possibility of trouble on the city circuits from causes originating in the auxiliary plants.

The Illinois Telephone Construction Company has issued a handsome brochure which gives the present status of the great underground tunnel system in Chicago. The book contains about 35 half-tone illustrations and many drawings illustrating various parts of the work. All the different sections of the tunnel constructed up to December 1st are enumerated, with the number of lineal feet in each section. The total number of feet on that date was 208,212. The title of the booklet is "Chicago Subway." At the end George W. Jackson, general manager and chief engineer of the company, says:

"So many misleading, malicious and vicious reports have been circulated about damages being done by this company's work, that I feel it my duty to state emphatically that in the construction of the entire system it has been accomplished without the company being called upon to defend or pay any claim for damages of any kind. No deaths have occurred that can be attributed to tunnel construction, and not one employe has been disabled to such an extent as to prevent him from following his usual vocation."

SOCIETIES AND SCHOOLS.

The Massachusetts Institute of Technology, Boston, has issued its catalogue for December, 1905, being Vol. 41, No. 1 of the Bulletin. It is a book of 408 pages giving detailed information about the Institute. General information, officers, courses of instruction, requirements for admission, subjects and methods of instruction, laboratories and equipment, libraries, regulations, summer courses, etc., are the subjects treated.

The tenth annual meeting of the National Fire Protection Association will be held in Chicago on May 22d, 23d and 24th. A committee of the association on "uniformity of requirements" is prepared to compile a glossary of words, terms and phrases used in connection with the insurance business or the various trades, arts and sciences with which that business has to deal, and which are more or less commonly used or referred to in the reports and standards of the association. To that end the committee will undertake to list and define any words, terms or phrases that may be sent for that purpose to its chairman. The committee will also be glad to receive suggestions of definitions along with the words in cases where members have already made research and determined the same. H. E. Hess, 32 Nassau Street, New York, is chairman of the committee.

MISCELLANEOUS.

Sir Edwin Cornwall, chairman of the London County Council, has issued to the press a proposal for an international congress of representatives of cities having over 500,000 population, to meet annually for the discussion of municipal methods. In conjunction with this congress Sir Edwin proposes an exchange of pupils between the schools controlled by the municipalities holding membership in the congress.

Governor Higgins of New York, in his message to the Legislature, said that the preservation of Niagara Falls could not be accomplished without an international agreement to protect the cataract and river from spoliation. The state of New York, however, could limit the amount of water taken by American companies, repeal all undeveloped charters, and institute legal proceedings to result in forfeiture in the case of abuse of franchise powers by corporations.

Vice-consul Kaiser of Mazatlan, Mexico, reports that the Standard Oil Company will establish a large factory in Torreon, Mexico, in which the guayule plant will be utilized in the production of rubber. The company is known as the Continental Mexican Rubber Company. The price paid for the plant is $35 per ton Mexican, and there is a large demand at that price. The rumor is current, says Mr. Kaiser, that the same company will establish a number of smaller plants, which would greatly increase the rubber output of the country and place it in the lead of other Mexican materials on the market.

Electrification of the railway in the Simplon tunnel has been entrusted by the Swiss government to the Swiss firm of Brown, Boveri & Co. Inasmuch as the Simplon line reaches into Italy, and will eventually be operated jointly by the Swiss State Railways and by the Italian government, the latter has arranged with Ganz & Co. for the use of some of the three-phase locomotives now employed on the well-known Valtellina line for the Simplon tunnel, and has placed these locomotives at the disposal of the Swiss government, so that the tunnel may be opened for public traffic in June, 1906. Brown, Boveri & Co. are now building two other three-phase 1,000-horsepower electric locomotives, which will also be used to handle the traffic through the tunnel.

F. S. Richardson at a recent meeting of the American Gas Light Association in Milwaukee gave some interesting experiences in connection with electrolysis in a six-mile pipe line paralleling a street railroad and connected with the trolley rail at five places near the center of the line in proximity to the power station. On account of damage done to the pipe before it was connected to the rail it was necessary a short time ago to remove about 600 feet. One length of pipe had 27 pits in it, and three other lengths were so badly pitted that they leaked. Originally the pipe line had insulated joints every 500 feet, but it has since been bonded, making it a continuous conductor. Insulated joints will not keep the pipe from being damaged, and in fact have quite the opposite effect, as tests have shown that a difference of potential exists between the ends of

each insulated joint, which causes current to pass from one length of pipe to the next by way of the soil.

The Swiss Oerlikon Company has just completed its experimental single-phase locomotive which will be tried on its line close to Zurich. The voltage on the line will be 15,000 at 25 cycles. The locomotive is mounted on two swivel trucks, and geared motors are used. The axle of the motors is perpendicular to the wheel axle. The motor are of 200 horsepower output, of the series compensated type. There are eight principal poles and eight commutating poles. The speed is 650 revolutions per minute and the working voltage is 350. Speed variations are obtained by varying the voltage, and for this purpose the transformer on the locomotive is provided with 12 taps. The motors can, it is stated, safely sustain an overload of 100 per cent. The trolley collector is of the inverted bow type of the Oerlikon company.

The Pittsburg Reduction Company has made a contract with the Niagara Falls Hydraulic Power and Manufacturing Company for 27,000 horsepower, to be delivered in 1907. To use this power the Pittsburg Reduction Company plans to erect a very large new aluminum works on a four-acre site which it has leased form the power company. It is understood that contracts for the electrical equipment of the proposed new plant are about to be made. Power for the new works will be supplied from a new power house to be erected at the water's edge in the gorge, the site for which has been excavated in the debris slope. On top of the high bank the canal basin has been extended several hundred feet to the north of the flouring mills, and a large new forebay is being built at the edge of the bank. Next spring the work of building the new power house will be commenced and prosecuted with great vigor. The output capacity of the station will be 110,000 horsepower.

Dr. Jacques Loeb believes that he has discovered the reason of the electrical effects of galvanic current upon nerve and muscle tissue. In previous investigations Dr. Loeb had discovered that sodium and potassium in solution stimulated nerve and muscle fibers, and that the subsequent administration of solutions of calcium and magnesium neutralized the stimulating action of the other two substances. Dr. Loeb now says that his last set of experiments has demonstrated that this phenomenon is due to the fact that when the galvanic current is applied these chemical substances migrate and concentrate in the region of application of the electrodes, or poles of the battery. The oleates and stearates, which are normally in the nerve and muscle tissue, precipitate the calcium from the solution under the action of electricity, and in this way the calcium, or lime, is prevented from interfering with the stimulant action of the sodium and potassium.

Electric tramways are "all the go" in New Zealand. In addition to the well-established and successful lines in Auckland, Wellington, Christchurch and Dunedin, the local authorities at Hutt and Petone are considering the question of introducing electric tramways. There are also considerable extensions in contemplation to the existing system in the suburbs of Wellington. In regard to electric lighting, development [illegible] more [illegible]. Although there are a large number of [illegible] in the colony, most of the cities and towns [illegible] to gas. At Wellington the streets and [illegible] are, however, nearly all lighted electrically. [illegible] power is fast coming into general use in New Zealand, nearly all the larger [illegible] either employing electric driving or schemes for converting machinery to electric power are under consideration. Dunedin corporation has lately taken over the Waipari Falls Power Company, whose generating works are partly constructed, and there is a general disposition to develop the waterpower of the colony by the state, which has reserved all the water rights for this purpose.

TRADE NEWS.

J. Reed has purchased the electrical business of George P. Thompson at Santa Ana, Cal.

W. N. Matthews & Bro. of St. Louis call attention to the fact that their business in the East has grown so large that it has been necessary for them to open a New York office at 39 Cortlandt Street, to give it proper care; also that they have just bought the patents and have taken over the manufacture of the Hold-fast lamp guard.

The general purchasing agent of the Isthmian Canal Commission is inviting sealed proposals until January 23d, for furnishing a number of engines, dynamos and switchboards for delivery on the Isthmus. Proposal blanks and detailed information can be obtained from the above-mentioned officer, located at Washington, the assistant purchasing agent, 24 State Street, New York, or the chief quartermaster, Department of the Lakes, Chicago.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until January 23d for furnishing a quantity of weatherproof wire and electrical supplies, embraced in schedule 313, obtainable at the navy pay office in New York or upon application to the bureau. On February 6th the bureau will open bids for furnishing the Norfolk navy yard with a portable electric jib crane, embraced in schedule 317, obtainable from the same sources. The bureau is also inviting sealed bids, until January 30th, for furnishing and installing in the United States naval hospital at Washington a quantity of electrical apparatus. The schedule number is 321, which can be obtained from the bureau.

BUSINESS.

Electrical dealers desiring to add to their line two specialties of proven merit, are invited by E. R. Crolius & Son of 6419 Peoria Street, Chicago, to correspond with them. They are the man[illegible] not already handling them [illegible]

[illegible] working [illegible]

The Weber Gas and Gasoline Engine Company of Kansas City, Mo., [illegible] has been one of the [illegible] business in the [illegible] portable engines, pumping [illegible] has been [illegible] The buying of gas and gasoline [illegible] ing machinery [illegible] a great many new [illegible] our part of the country [illegible] been excellent, as the company manufactures special [illegible] mule-back when [illegible] to the [illegible] country. The large-engine business has exceeded expectations, the Weber company [illegible] a great many plants for various uses, including a number of complete electric-light installations for private use and for municipal purposes. The outlook for 1906 is good in all departments, many orders being on the books for future delivery.

The electric-light and power equipment in the Majestic Theater Building in Chicago is one of the best and most modern private plants of its kind in the city. It was built and installed by the Allis-Chalmers Company of Milwaukee and consists of three generating units, composed of Reynolds-Corliss engines, of the Reliance type, direct-connected to Bullock direct-current generators. Two of the engines are 20 inches by 26 inches, producing 300 horsepower each; the third is 16 inches by 30 inches and of 150 horsepower. The two larger engines are each connected to a Bullock direct-current generator of 200 kilowatts capacity, while the smaller is coupled with a 100-kilowatt generator of the same make. There are two compensating sets, each consisting of a Bullock 45-kilowatt generator and a 15-kilowatt machine. This plant produces a 220-volt power current and a 110-volt lighting current, distributed by the three-wire system through a seven-panel switchboard. The power is used for running the elevators, scene-shifting machinery, compressed-air plant, ventilating plant, etc., and furnishes the lighting current for all the building and the theater illumination.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 2, 1906.

808,620. Tube-drawing Apparatus. George Baehr, McKeesport, Pa., assignor to the National Tube Company, Pittsburg, Pa. Application filed September 17, 1904.

An electric motor is used to drive the apparatus.

808,635. Apparatus for Treating Diseased Tissues. Antonino Ciolfi and Rolland A. Case, Cleveland, Ohio, assignors to the American Specialty Company, Cleveland, Ohio. Application filed September 21, 1904.

Two electrodes are used, each in a compartment by itself, an electrolyte being introduced into the compartments. The device is used for electrotherapeutical purposes.

808,641. Wireless Telegraphy. Patrick B. Delany, South Orange, N. J. Application filed May 14, 1903.

A microphonic contact is placed in the path of the received waves or impulses. Electromagnetic means variably maintaining the microphonic contact at a high periodicity comprise a local circuit controlled at the contact and a receiver whose circuit is controlled at the contact, modification of the contact by the received waves or impulses effects manifestation of the signals by the receiver.

808,669. Tablet Board. Charles B. Macfarlane, Waltham, Mass. Application filed February 28, 1905.

Three terminals are fixed to the tablet, a pair of bus-bars being fixed to the top face of the tablet and connected with two of the terminals, the bar is branched and each branch adapted to be connected with a fuse. A bus-bar on the opposite side of the tablet and connected with the other terminal, is branched and each branch is adapted to be connected with a fuse.

808,717. Electric Locomotive. Asa F. Batchelder, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 12, 1903. Renewed June 14, 1905.

The locomotive truck comprises an inclosing frame constituting the field-magnet structure for a number of armatures, transverse members joining opposite sides of the frame. The pole pieces are secured to the transverse members and the motor-armatures operatively located with reference to the pole pieces.

808,718. Regulating Transformer. Henry J. Blakeslee, Hartford, Conn. Application filed April 8, 1905.

A regulating transformer having a magnetic frame is provided with a stationary primary coil, a stationary secondary coil and a core always having the same magnetic relation to the primary coil but adapted to be moved to vary its magnetic relation with the secondary coil.

808,723. Annunciator. Albert Carliss, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed May 25, 1901.

Combined with a drop or shutter are a pintle or pivot-pin having a central upward bend and a lever to actuate the drop or shutter and extending beneath the upward bend.

808,729. System of Control for Electric Motors. Maxwell W. Day, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 15, 1905.

A motor having a shunt field winding and series field windings has also means for connecting the motor to a source of current supply in such a manner that the effective excitation of the series windings assists that of the shunt winding both when the motor is propelling a load and when it is overhauled by the load and acting as a generator.

808,740. Transformer. John J. Frank, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 27, 1905.

A magnetic core formed of three laminated units has the planes of lamination intersecting each other at 120 degrees, each unit being formed of a number of bundles, some of the bundles overlapping the others to form tenons which interlock with the other bundles.

808,755. Electrical Battery. Carl Jäger, Rock Island, Ill., assignor to the Rock Island Battery Company. Application filed February 27, 1904.

A battery cell having a zinc cup is supplied with a carbon pencil within the cup, a compound of dioxide of manganese, iron filings and powdered graphite surrounding the carbon pencil and a filling of flour and plaster-of-paris between the cup and the inclosed body.

808,763. Automatic Holdfast for Electro-hoister Drums. Asher Lambert, Newark, N. J. Application filed April 13, 1905.

Mechanical features of a clutch on the gearing of an electrically operated hoist are set forth.

808,773. Surface-contact Electric Railway. George H. McFeaters, Johnstown, Pa., assignor to the Lorain Steel Company. Application filed August 15, 1904.

Combined with an upper fixed electrode are a lower movable electrode and a flexible conductor connecting the movable electrode with the supply side of the system. An arc guard or shield in the form of a thin plate or disk of insulating material is situated below the movable contact and covers the flexible conductor.

808,777. Telegraph Key. Addison E. Peterman, Repton, Ala. Application filed October 13, 1905.

A base to the key having a number of contacts representing different lines is associated with a turntable mounted on the base and carrying a key lever to operate any one of the lines and means carried by the turntable to hold the other lines closed.

808,778. Motor-control System. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 10, 1904.

Several groups of motors, each group comprising motors permanently connected in series, the motors being adapted for operation on either direct or alternating current, are provided with means for supplying alternating or direct current to the motors. A switch is adapted to connect the groups in series and in parallel and to vary the amount of resistance in the motor circuit and a switch is adapted to vary the field strength of the motors. (See cut on next page.)

808,779. Electric Generator. Benjamin P. Remy and Frank I. Remy, Anderson, Ind., assignors to the Remy Electric Company, Anderson, Ind. Application filed May 27, 1905.

Annular segmental poles are journaled within the stationary poles of the machine.

808,832. Receiver and Recorder for Wireless and Other Transmissions. Fred E. Gallagher, San Francisco, Cal., assignor of one-third to Simeon L. Phillips and one-third to Walter D. Valentine, San Francisco, Cal. Application filed June 15, 1905.

A type wheel having constantly-operative impelling means is associated with a pivoted armature carrying means for locking the type wheel, another pivoted armature carrying a striking hammer, a pair of magnets for each armature arranged respectively at opposite sides of its pivot, a controller circuit which includes one magnet of each armature and a striker circuit which includes the other magnet of each armature. (See cut.)

808,834. Relay. Charles L. Goodrum, Rochester, N. Y. Application filed November 11, 1905.

An armature, front and rear pole pieces, one of which forms a support for the relay, the other forming a support for the armature, contact springs mounted on the supporting pole pieces and means removably securing the core to the supporting pole piece are the essential features.

808,852. Trolley Device. Frank J. Ludolph, Rochester, N. Y. Application filed July 18, 1905.

A trolley device comprises the pole and a harp in two separable sections for holding the wheel, the two parts of the harp having mutually interlocking elements between the wheel-bearing and the outer end of the harp for preventing their separation.

808,868. Telephone Signaling Apparatus. Karl H. Poyas, Los Angeles, Cal. Application filed July 24, 1905.

In a telephone receiving instrument are a base of insulating material in the instrument, two normally closed manually operated make-and-break switches mounted on the base and forming a part of the instrument circuit, one switch in each branch, a ground plate secured to the base at a point to be engaged by the switches when they are moved to open the circuit and a connection from the plate to the ground.

808,894. Adjustable Suspender for Electrical Devices. Austin Berry, Ottawa, Canada. Application filed July 11, 1905.

Mechanical features are described.

808,944. Alternating-current Motor Reverser. Edwin H. Porter and Burleigh Currier, Philadelphia, Pa. Application filed March 29, 1905.

Combined with a source of alternating-current energy is a motor connected with and adapted to operate from the source of energy having a number of energizing circuits, part of which is supplied with two opposing alternating electromotives forces in series. Means are supplied for automatically varying one or both the opposing electromotive forces so that their sum is greater or less than zero. (See cut.)

808,957. Circuit Controller. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed October 31, 1904.

A permanent magnet, a rotary shaft carrying a block of iron tending to close the magnetic circuit of the magnet and a circuit-controlling lever interposed between a pole of the magnet and the block of iron are the patentable features.

808,958. Spark-ignition System for Explosive Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed March 28, 1905.

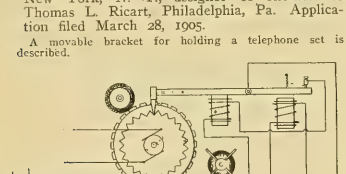
An ignition system for explosion engines comprises an induction coil, an igniting device and means whereby, according to the speed of the engine, a single spark or a series of sparks will be created at the igniting device.

808,966. Weft-replenishing Loom. Horace W. Wyman, Worcester, Mass.; Mary H. Wyman, administratrix of said Horace W. Wyman, deceased. Application filed May 11, 1905.

The filling-detector feelers of the loom are electromagnetically operated.

808,983. Telephone Holder. Louis S. Hallowell, New York, N. Y., assignor of one-half to Thomas L. Ricart, Philadelphia, Pa. Application filed March 28, 1905.

A movable bracket for holding a telephone set is described.



NO. 808,832.—SPACE-TELEGRAPH RECEIVER.

809,026. Electric Scale for Accurate Lard Weighing. Charles E. Snypp, Gretna, La., assignor to the Southern Cotton Oil Company, Jersey City, N. J. Application filed June 25, 1903.

An electromagnet arranged in connection with a lever of the weighing mechanism operates to close the valve which controls the flow of the melted lard.

809,060. Ringer for Telephones and the Like. Elbert R. Hobbs, Lamar, Colo. Application filed November 10, 1904.

Combined with a magnet are a supporting plate, mechanism connected with the plate and adjusted relatively thereto, the mechanism being provided with brackets, springs connected with the brackets and depending therefrom and an armature mounted upon the springs and free to rock.

809,083. Automatic Electrical Controller for Air Compressors. Fred D. Ackerman, Kendallville, Ind. Application filed May 17, 1905.

The improved automatic controller comprises a valve chest and valve, an air cylinder and a slidable piston contained therein and connected with the valve. A spring opposes the movement of the piston in one direction, a second air cylinder having a spring-pressed piston. An air conductor connects the second cylinder with the valve chest, a slidable bar being connected with the last-named piston. A casing applied to and slidable on the bar contains a spring which applies pressure between it and the bar. An electrical switch has one member connected with the casing, spring locking and release mechanism is connected with the casing and holds it normally inoperable and the switch normally closed until a certain predetermined air pressure is accumulated.

809,085. Electrolytic Apparatus. Henry S. Blackmore, Mount Vernon, N. Y. Application filed filed July 22, 1903.

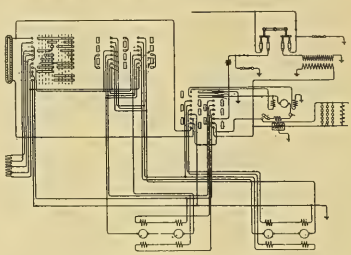
Apparatus for electrolyzing light metal compounds comprises an electrolytic vessel having a means for producing a heavy and light metal alloy by the electrolysis of the light-metal compounds, in combination with means for displacing the heavy and light metal alloy by gravity, means for associating the heavy and light metal alloy with a metal hydroxide, means for removing the light metal oxid thus produced, means for converting the light metal oxid into light metal hydroxid, and means for returning a portion of the light metal hydroxid to the chamber containing the heavy and light metal alloy.

809,088. Process of Producing Caustic Alkali. Henry S. Blackmore, Mount Vernon, N. Y. Application filed May 10, 1905.

The process of producing caustic alkali consists in providing a liquid metal cathode having in communication therewith a liquefied alkali-metal compound of a weight sufficient to digress the surface thereof below its normal level and electrolyzing the alkali metal compound.

809,116. Method of Producing Circulation in Electrolytic Processes. Hugo Koller, Vienna, Austria-Hungary, and Paul Askenasy, Nuremberg, Germany. Application filed October 29, 1903.

A mechanical process for causing the circulation of the electrolyte is described.



NO. 808,778.—MOTOR-CONTROL SYSTEM.

809,120. Electric Railway. Charles Levinson, New York, N. Y. Application filed July 18, 1905.

A safety device for preventing the starting of a car comprises a contact or switch located in the driving-motor circuit independent of the motorman's controller and associated with a gate of the car, the contact or switch is so arranged as to be opened and to cut off the current from the driving motor independent of the motorman's controller when the gate is open.

809,126. Electric-light-fixture Insulator. Louis McCarthy, Boston, Mass. Application filed February 2, 1905.

Two ribs are provided on the insulator separated by an intervening depression, the outer edge of one rib being adapted to engage the inside edge of a canopy of one size, and the inner edge of the other rib being adapted to engage the outside edge of a canopy of another size, whereby the insulator may be used with more than one size of canopy.

809,127. Station Meter Index. Donald McDonald and Lynn M. Scofield, Albany, N. Y., assignors to the American Meter Company, New York, N. Y. Application filed April 29, 1904. Renewed December 8, 1905.

A revolving cylinder is adapted to carry the chart. This and other mechanical features form the basis of the patent.

809,183. Current Tap. William D. Harris, Philadelphia, Pa. Application filed March 24, 1905.

Combined with a body of insulating material are a set of plug contacts and a second set of socket contacts and terminals for the attachment of conducting wires in electrical connection with certain of the contacts.

809,186. Telephone System. Henry A. Judge, Washington, D. C. Application filed September 9, 1905.

In a telephone system are a talking-circuit comprising a direct path of negligible resistance for continuous current, a magnetic discharge coil, a transmitter and a source of current therein and a shunt-path around the coil only. The shunt is opaque to continuous current but passes high-frequency currents directly.

809,211. Starting Means for Gas or Similar Engines. Francis L. Orr, Thurman, Iowa, assignor of one-half to Mark Morrow, Percival, Iowa. Application filed February 21, 1905.

Details are described.

809,220. Collector Ring. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 22, 1904.

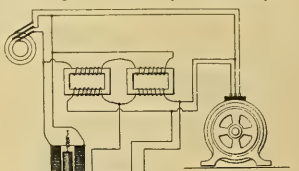
A collector ring is cut away to form a flexible part and a supporting stud is carried by the part.

809,232. Semi-automatic Telephone-exchange System. Arthur T. M. Thomson, London, England. Application filed October 6, 1905.

A telephone exchange comprises a subscriber's latent-signal set arranged to send its signals in separate groups, a calling-board with subscribers' jacks, a bench carrying calling plugs, a called board with subscribers' jacks, a bench carrying called plugs and an electromagnetic distributer. A numerical indicator comprises a set of indicators at the called board in the plug circuit, energized by the plugging of a calling plug into the calling subscriber's jack to simultaneously indicate to the called operator the several elements of the signal set on the subscribers' latent-signal transmitter.

809,237. Semaphore Mechanism. Bruno O. Wagner, Swissvale, Pa. Application filed March 9, 1905.

Electromagnetic mechanism operates the semaphore.



NO. 808,944.—ALTERNATING-CURRENT MOTOR REVERSER.

809,262. Contact Device for Induction Apparatus. Ralph O. Hood, Danvers, Mass., assignor of one-half to Warren D. King, Peabody, Mass. Application filed April 11, 1905.

In a contact device for sparking apparatus are a casing, a flexible closure therefor forming therewith a substantially air-tight chamber, a fixed contact point, a movable contact point passing through the flexible closure and adjusting means for the fixed contact point.

809,267. Station Indicator. Richard F. Le Broco, Etna, N. J., assignor of one-half to James P. Niemann, New York, N. Y. Application filed March 30, 1905.

One claim reads as follows: "In indicators, indicating means, a stop actuated in unison with the indicating means, a stop-lever carrying a detent co-operating with the stop, an electric switch actuated by the stop-lever, setting means to actuate the stop-lever, a setting-switch actuated by the setting means, a motor to operate the indicating means and electrical contacts in series and co-operating with the stop-switch and the setting-switch to control the motor."

REISSUE.

12,431. Induction Motor. Abe L. Cushman, Concord, N. H., assignor to the Cushman Electric Company, Concord, N. H. Application filed November 19, 1904. Original application dated April 14, 1903.

In an induction motor are a secondary member provided with a secondary winding having elements arranged in multiple arc, all adapted to carry currents in one direction only, any desired number of which may be used at the same time. Each when in use acts as an effective element of the winding contributing to the polarization of the secondary member. Means carried by the secondary member bring the elements one at a time into action and remove them from action, the means admitting the current fully to each element as such element is brought into action.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on January 8, 1906:

395,682. Electric Train-brake Apparatus. Augustin I. Ambler, Washington, D. C.

395,703. Trolley for Electric Railways. Wilton F. Jenkins, Richmond, Va.

395,706. Dry Voltaic Battery. Isidor Kitsee, Cincinnati, O.

395,755. Holder for Electric Arc Lamps. Jacob Pawlowski, Cincinnati, O.

395,761. Conduit for Electric Railways. Samuel Trott, Halifax, Nova Scotia, Canada.

395,769. Voltaic Battery. Theophilus Coad, Forest Gate, County of Essex, England.

395,773. Cathode for an Electric Depositing Apparatus. Elisha Emerson, Providence, R. I.

395,814. Support for Aerial Electric Conductors. Henry H. Cutler, Newton, Mass.

395,836. Apparatus for Charging and Discharging Secondary Batteries. William P. Kookogey, Brooklyn, N. Y.

395,878. Process of Electric Welding. Charles L. Coffin, Detroit, Mich.

395,932. Medical Battery. Henry E. Waite, New York, N. Y.

395,936. Regulator for Incandescent Electric-lighting Systems. Merle J. Wightman, Hartford, Conn.

395,950. Electrical Heating. John V. Capek, Brooklyn, N. Y.

395,958. Electric Signaling Apparatus. Mark W. Dewey, Syracuse, N. Y.

395,959. Electric Signaling Apparatus. Mark W. Dewey, Syracuse, N. Y.

395,961. Electrical Store-service Apparatus. Richard N. Dyer, East Orange, N. J.

395,962. Method of Manufacturing Electric Lamps. Thomas A. Edison, Menlo Park, N. J.

395,963. Incandescent-lamp Filament. Thomas A. Edison, Menlo Park, N. J.

395,974. Electrical Measuring Apparatus. Hammond V. Hayes, Cambridge, and Anthony C. White, Boston, Mass.

396,009. Forming, Brazing and Welding of Metals by Electricity. Elihu Thomson, Lynn, Mass.

396,010. Method of Electric Forging. E. Thomson, Lynn, Mass.

396,011. Method of Electric Welding. E. Thomson, Lynn, Mass.

396,012. Apparatus for Electric Welding and Working Metals. E. Thomson, Lynn, Mass.

396,013. Electric Pipe Joining and Pipe Work. E. Thomson, Lynn, Mass.

396,014. Electric Metal Working. E. Thomson, Lynn, Mass.

396,015. Method of Electric Riveting. E. Thomson, Lynn, Mass.

396,039. Coupling for Gas and Electric-light Fixtures. Reinhold Herman, Crafton, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVIII.

The Chicago Electrical Show.

Beautified with bright-colored decorations and thousands of electric lamps, and with admiring throngs of people filling the galleries and the aisles around the various booths, where electrical apparatus of almost every type was to be seen, the interior of the Coliseum in Chicago presented a brilliant and animated scene on the opening night of the Electrical Show. With only two days in which to prepare exhibits before the evening of the opening, which was January 15th, things were in a much more completed state than would be thought possible when it is considered that so many of the exhibits required quite complicated wiring and the installation of heavy machinery.

At the opening of the show on Monday evening there were several thousand people present, principally by invitations sent out by the Electrical Trades Exposition Company. They thronged the aisles and filled the galleries, and the general opinion expressed on all sides was that the show was going to be a great success.

One of the drawing cards at the opening was the reception of a telegram from President Roosevelt by "wireless" at the Coliseum station of the American De Forest Wireless Telegraph Company. The message was received at about 8 p. m., and said: "Congratulations and best wishes. Theodore Roosevelt." To the public at large the space telegraph is still a thing of mystery, and hundreds of people were packed around the De Forest booth at the time the message came in, waiting anxiously for some outward indication of the coming of the signal.

The accompanying illustration of the interior of the Coliseum gives a fair idea of its appearance on the opening night, though it hardly does justice to the blaze of light which greets the visitor upon entering the hall. Most of the space around the edges is occupied by booths, and in the center portion of the hall are displayed a large portion of the apparatus to be found in the exhibit of the Chicago Edison Company, the Commonwealth Electric and North Shore Electric Companies. Perhaps the greatest variety of interesting things to be seen, and the idea of the exhibit is to acquaint the people with the advantages of electricity in everyday life. To fulfill this object the exhibit was made very complete and well fitted. Many people, especially the ladies, were greatly interested in the electric kitchen, where actual cooking operations were in progress. Here were to be seen electrical cooking utensils of all description, also an electric ice [illegible]

GENERAL VIEW OF THE CHICAGO ELECTRICAL SHOW ON THE OPENING NIGHT.

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Across the aisle from the Edison exhibit the General Electric Company showed in one department a large amount of kindred apparatus such as electric flatirons, curling-iron heaters, cooking utensils, etc.

C. H. Thorardson made some experiments during the evening at his booth in the north end of the building. Here he showed apparatus for interesting the public and at the same time drew attention to his business. The feature of his demonstrations was a high tension spark discharge which could be seen and heard from all parts of the room.

On Tuesday evening Prof. Clarke began a series [illegible] dishwasher. Coffee, made on the spot, was served to visitors. This department of the exhibit received a great deal of attention, people standing in several ranks in order to get near enough to watch the operation of the novel apparatus. Just back of the kitchen was to be found an example of a cozy dining room with all the conveniences that could be wished, including a commendable scheme of dining-room lighting. Other things shown by these three companies in their exhibit space included all kinds of household electrical appliances and fixtures for decorative lighting.

[illegible] hall on [illegible] about [illegible]

back of the star, and as the latter revolves the lamps of different colors are alternately lighted and extinguished, giving a pleasing effect.

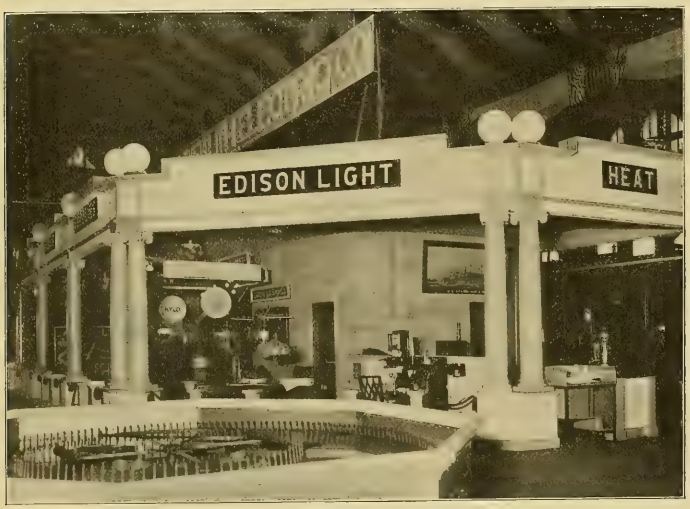
Another feature in the lighting which could not but attract attention was the row of Siemens flame arc lamps which formed part of the central illumination scheme. There were eight of these lamps in a row down the center of the hall and the soft but intense light which they emitted brought forth much favorable comment. Part of these lamps emitted a pinkish light, part a bluish light and the remainder a nearly white light. The mechanical construction of these lamps is somewhat simpler than that of the ordinary arc lamp, though the cost of maintenance is slightly more, owing to the cost of the carbons. The carbons are the distinguishing feature. They are made up with a special core which is a secret with the Siemens-Schuckert Company, the maker of the lamp. The efficiency of the lamp is very high, and the maker predicts for it a brilliant future. The lamp is now used to light the streets of Berlin.

Several of the leading universities and colleges in the Middle West are represented in what is known as "College Row." The institutions exhibit-

ing products of their laboratories and views of their buildings and grounds are the University of Illinois, University of Wisconsin, Armour Institute, University of Colorado and Purdue University. "College Row" is a popular meeting place for alumni of the various institutions represented.

Franklin Day was observed at the Electrical Show on Wednesday, January 17th, that being the bicentenary of Franklin's birth. On Franklin Day the Exposition Company distributed handsome medallions as souvenirs of the occasion. These medallions were of bronze nearly as large as a silver dollar, bearing upon one side the head of Benjamin Franklin with his name suitably inscribed. The reverse side bore the inscription, "Souvenir, Electrical Show, Coliseum. Chicago, January 15-27, 1906." The keepsakes were much admired and they were given to each ticket holder.

The music by Weil's Band of St. Louis is greatly enjoyed by all those in attendance. This band, it will be remembered, was the official band at the St. Louis Exposition. Afternoon and evening concerts are given daily and the music rendered is of a high order, the heavier pieces being interspersed with popular airs, making this feature of the show adaptable and pleasing to all tastes.



CHICAGO ELECTRICAL SHOW.—CENTRAL-STATION EXHIBIT NEAR CENTER OF HALL (FOUNTAIN IN FOREGROUND).

Considerable attention was attracted to the large motor-generator in the northeast corner of the hall, which was installed by the Chicago Edison Company to furnish current for the exhibits. This machine furnished 60-cycle three-phase current to the exhibits, principally for power purposes, though a portion of the current was used for exhibit lighting. On the opening night the peak load upon the alternating-current side of this machine was about 25 amperes.

Facilities for the comfort of visitors are provided on every hand. Unlike most of the previous shows held in the Coliseum, the galleries in this instance are left entirely free to visitors, all the exhibits being confined to the main floor. This leaves ample seating space for those who desire to rest and listen to the music. An up-to-date café is located in the annex, where excellent meals are served. Wardrobe checkrooms are conveniently located, where articles of clothing may be checked if desired.

The great electric searchlight which carried off the honors at the World's Fair at St. Louis has been installed on the roof of the Coliseum, and its rays were visible at night far up and down the shores of the lake. It is equipped to cover a radius of 12 miles, but because of the atmospheric conditions it has not yet reached that distance.

The Electrical Show as a whole is brilliant, and showed at the start that it will draw the public fully as well, if not better, than any of the "shows" in various lines of development which are held each year as the Coliseum. Next week the Western Electrician will undertake to describe more in detail the various exhibits.

Following is a list of additions and corrections to list of exhibitors as printed last week:

American Bank Protection Company, E 14.
American Electric Fuse Company, A 5.
American Electrical Novelty and Manufacturing Company, I 7.
American Electrical Supply Company, J 7.
Belden Manufacturing Company, I 3.
Bullock & Co., T. H., A 8.
Chicago Pneumatic Tool Company, F 12.
Chicago and Milwaukee Telephone Company, F 24.
Dossert & Co., E 21.
Electric Gaslighting Company, C 5.
Electrocraft Publishing Company, D 8.
Electrical World, D 8.
Engineer, The, B 10.
Federal Electric Company, F 4.
Krantz Manufacturing Company, F 13.
Newman Manufacturing Company, A 7.
Niagara Tachometer and Instrument Company, C 12.
Schott, W. H., I 11.
Standard Electrical Manufacturing Company, A 8.
Taylor, J. F., I 2.
Universal Electric Storage Battery Company, D 12.
Wagner Electric Manufacturing Company, D 10.
Western Electrician, E 22.

Modern Sub-station Practice.

At an interesting and well-attended meeting of the Chicago branch of the American Institute of Electrical Engineers held on Tuesday evening in the rooms of the Western Society of Engineers Louis A. Ferguson, one of the managers of the Institute, presided in the absence of K. B. Miller, the regular chairman. Prof. P. B. Woodworth gave abstracts of the recent Institute papers by Sydney W. Ashe and C. W. Ricker, the respective subjects being "The Relation of Railway Sub-station Design to Its Operation," and "Some Considerations Determining the Location of Electric Railway Sub-stations." The latter paper was given in full in the Western Electrician of December 23d, page 489. Mr. Ashe's paper is on the same general subject as the same author's article, entitled "The Practical Operation of a Modern Railway Sub-station," written for the Western Electrician, and published in the issues of September 30th and October 7th last.

George A. Damon opened the discussion. He gave some of the results of his experience, saving that he had not found a practicable application of Kelvin's law. Theoretical assumptions are of course profoundly affected by practical conditions.

P. Junkersfeld remarked that in starting rotaries in large systems the direct-current side is usually used. In interurban roads and in small systems the alternating-current side is usually used. Rotaries are employed in units as large as 2,000 kilowatts. In large cities the cost of real estate for sub-stations is a serious item. Often the buildings are designed so that they can be used for commercial purposes if it should later become advisable to take out the equipment. Cranes are sometices omitted, decreasing cost and making sub-station buildings more strictly available for commercial purposes. The storage battery has a very important place in the sub-station. As to Kelvin's law, it is perhaps sometimes used unconsciously by engineers. But it is always modified by the existing conditions.

J. M. S. Waring spoke more particularly of the storage-battery feature. In railway sub-stations there is not at present, so far as the speaker is aware, a battery operated without a booster. Therefore, there is no purely floating battery in this class of work. He made the statement in view of a possible misapprehension on this particular point that might follow a reading of Mr. Ashe's paper. Mr. Waring said that a battery is not a panacea for all ills, but he made reference to the saving in copper and transmission losses effected by the installation of line batteries on urban and interurban systems and to the possible elimination of a sub-station by the adoption of a battery of this description.

Ernest Lunn also spoke of the battery feature. Both he and Mr. Waring agreed that the resistance is the all-important feature of the battery in station regulation.

B. J. Arnold, past-president of the Institute, said that he believed in the use of sub-station batteries on variable loads for various reasons, the principal one being the reliability thereby secured. In the New York Central terminal work it was thought wise to spend the large amount of money called for by the batteries because the work is of such magnitude that reliability in train operation is of paramount importance. Here the battery takes the overload up to twice its one-hour discharge rate. Above that the overload is divided between battery and rotary. On interurban roads, where trains are few and far between, batteries are desirable. On direct-current Edison systems they have amply proved their usefulness. In alternating-current work "inverted rotaries" are employed. The weak feature of this device is the interposition of revolving machinery between battery and line.

Mr. Ferguson said that perhaps the most important question in sub-station work, is, How far is it advisable to go to protect apparatus and service? The subject of protective apparatus is very important both in lighting and railway stations. Reliability of service is essential. As to the storage battery, it is a most useful adjunct. In the Chicago central-station system some 12,000 or 13,000 kilowatts of battery is employed.

W. G. Carlton of New York, but formerly of Chicago and back on a visit, speaking of the reverse-current relay as one protective device, said that with high-potential alternating-current systems it was necessary to have a considerable number of protective devices, such as reverse-current relays, overload relays and speed-limit devices. It is hard to determine how far to go in installing these devices. More information is needed on these points.

W. M. Moran said that simplicity is the great essential needed in sub-station work. Referring to danger from lightning, he said that in this direction protection in alternating-current high-tension work is still very poor. Turning to the ordinary risks of service, he noted that the direct-current side of the rotary is the more vulnerable side. Reverse-current relays are all right, but they are very delicate. Nevertheless he would use them in a large installation. But more attention should be paid to the wiring and care of these appliances. Mr. Moran also made the point that it was possible to eliminate many reserve rotaries in a string of sub-stations by having one in reserve, suitably arranged on a flat-car or otherwise, to be transported where needed.

L. H. Zapp of Highwood, Ill., said in the interurban system centering in that place they used what they called double-pole relays, with two current transformers, for the operation of the protective devices. Thus if one should fail, the other would still stand up, undoubtedly, and furnish current for the protective apparatus. This was in answer to Professor Woodworth, who asked what would happen if the current transformers broke down.

Mr. Junkersfeld called attention to the personal equation in the sub-station operators. In a large system it may be necessary to train 100 or 150 men for this work. The percentage of efficiency is, of course, considerably below 100. "Much as we should strive for simplicity," said the speaker, "we can hardly do away with our protective devices."

Mr. Winslow said the reverse-current relays and other protective devices should be tested about once in every 10 days.

R. E. Hellmund, recently from Germany, briefly contrasted European and American practice. For one thing, in Germany, until very lately, motor-generators were used in sub-station work rather than rotaries. Mr. Lunn also gave some of the results of observations made by him on a recent European journey. He found that practice differed widely in different parts of Europe.

Others taking part in the discussion were Ernest Gonzenbach, Edward Schildhauer and D. W. Roper.

Municipal Light Plant Shut Down.

A dispatch in the Saginaw (Mich.) News bearing the date line of Monroe, Mich., January 5th, says: "Darkness prevailed in Monroe last night and the prespects are it will every night for some time to come. The municipal lighting plant, which the voters refused to improve or sell, has gone to the bad and the glimmer of a few commercial lights on the streets only intensifies the darkness. It is said that the Board of Works cannot secure any more coal, as the city owes $700 for what has been used. The situation is the sole topic today. The council is being criticised for appointing a superintendent of lighting at the fat salary of $1,800, nearly as much as is received by the superintendent of the Detroit lighting plant, which is $2,000."

The Automatic Control of Rotary Converters.

Rotary converters, to operate at their highest efficiency, should be provided with some means whereby the load upon the converter may be maintained approximately constant within a large working range regardless of the variations in the load upon the direct current system. It has been common practice heretofore to so construct the converters and combine them with auxiliary apparatus that the voltage impressed upon the direct current system may remain practically constant or may rise as the load upon the system increases. If, however, it is desired to employ storage batteries in connection with rotary converters, it is essential that the voltage impressed upon the direct current system by the rotary converters shall decrease as the load upon the system increases, since storage batteries deliver decreasing electromotive forces as the current demand increases.

In order to meet this condition in the operation of rotary converters a plan has been devised and patented by Benjamin G. Lamme, Charles F. Scott and Frank Conrad, all of Pittsburg, which embodies a system of one or more rotary converters and a storage-battery means for causing the direct-current electromotive force of the rotary converters to decrease as the load upon the system increases, this means comprising automatic voltage regulators located between the alternating-current supply system and the rotary converters. By their use the alternating-current electromotive force applied to the rotary converters is varied inversely as the load upon the direct-current system varies. The voltage regulators may be so adjusted as to secure the following results under the various stated conditions of operation:

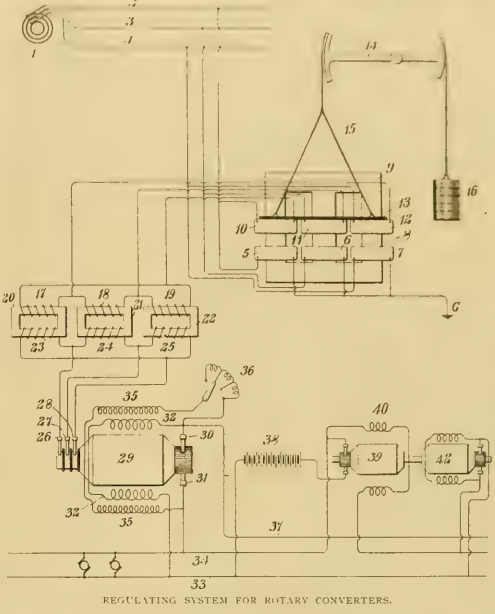
If the service requires less than a normal full-load current output of the rotary converters, the electromotive force of the rotary converters will rise slightly above that corresponding to full-load output and the open-circuit electromotive force of the storage battery, and the storage battery is then charged.

When the service requires the normal rotary-converter output, the current will be supplied to the direct-current system by the rotary converters alone at a voltage corresponding to that load, which is also equal to the open-circuit electromotive force of the storage battery.

When the demand for current upon the direct-current system exceeds the normal rotary-converter output, the regulators which are located between the alternating-current supply system and the rotary converters cause the alternating-current voltage supplied to the rotary converters to diminish, and consequently current is delivered to the direct-current system at a reduced voltage. The excess of current demanded by the direct-current system over the normal rotary-converter output is then supplied by the storage battery, since the voltage of the system is less than the open-circuit electromotive force of the battery, and the rotary converters continue to deliver approximately their normal rated output of current.

If the demand for current upon the direct-current system is greater than the normal rated full load output of the rotary converters plus the maximum allowable current output from the battery, the voltage regulators cease to operate, and a constant alternating-current electromotive force is delivered to the rotary converters. The additional load upon the direct-current system is then carried as an overload upon the rotary converters, the direct-current electromotive force remaining approximately constant. Under this condition the current which the rotary converters may safely deliver in addition to that delivered by the storage battery is determined by the capacity of the rotary converters. The accompanying diagram illustrates a system embodying the invention.

Alternating-current energy is supplied from any suitable source to distributing conductors (2), (3) and (4).



REGULATING SYSTEM FOR ROTARY CONVERTERS.

Corresponding terminals of the secondary windings of the voltage regulator, constituting one set, are connected, respectively, to the supply conductors, and the corresponding terminals, constituting the other set, are connected to delta-connected primary windings (17), (18) and (19) of three transformers. Secondary windings of the transformers are delta-connected and are also connected to brushes (26), (27) and (28) at the alternating-current end of a rotary converter (29).

Direct current is supplied from the commutator brushes (30) and (31) of the rotary converter through series field-magnet winding (32), to supply the conductors of the direct-current system. The rotary converter is also provided with a shunt field-magnet winding (35), and the amount of current supplied to it may be adjusted by means of a suitable rheostatic device, such as that shown at (36). If more than a single rotary converter is employed in the distributing system, an equalizing connection, such as that indicated at (37), should be made between the terminals of the armature windings, which are connected to terminals of the series field-magnet windings.

A storage battery (38) and a booster-generator (39) are connected in series between the supply conductors (33) and (34), booster (39) being provided with a field-magnet winding (40), that is connected in series with the conductor (34) in order that the charge and discharge of the battery may be dependent largely upon the current demand upon the system. The booster may be operated by any suitable means, such as a motor similar to the well-known devices employed for the purpose of regulating the current in arc-lighting circuits. When currents traverse the circuits of the primary and secondary coils of the regulator, these coils repel each other, the strength of the repulsive action being proportional to the amounts of the currents that traverse the windings. As the coils separate, the magnetic leakage between them increases, and consequently the voltage at the terminals of the secondary windings decreases.

Automobile Shows In New York.

club in [illegible]

[illegible] Louis Ruppelt and [illegible] novel pleasure vehicle, which they [illegible] trique. The [illegible] and exceeding 25 miles [illegible] The battery current [illegible] arranged in the front [illegible] accessible by lifting a [illegible] tors and controllers are [illegible] showed a two ton truck equipped with [illegible] E-27 cells, and traveling 25 [illegible]

The Dayton Electrical Manufacturing Company, represented by V. G. Apple, showed several novelties in the line of ignition devices. The company is also putting on the market a new portable battery charger, with which a current of constant speed [illegible] made up of units each weighing 7 pounds. The unit is a lead bottle with the vent at the [illegible] prevent the fumes eating the terminal [illegible] Other batteries were shown by the Edison Storage Battery Company, the National Carbon Company and the Eastern Carbon Works. The Waterbury Storage Battery Company was also represented.

Spark coils were shown by the Connecticut Telephone and Electric Company, which claimed that it has designed its products especially to meet the conditions required by gasoline engines.

The Byrne-Kingston Company of Kokomo, Ind., had a well-organized exhibit of commutators, coils and plugs. This company was represented at both of the New York shows by C. J. Byrne, George B. Kingston, J. P. Grace, J. W. Johnson, Marion Black and William H. Diehl. Other coils were shown by C. F. Splitdorf of New York.

In the large gymnasium was an interesting exhibit by William J. Hammer, represented by Edward Durant, who gave a demonstration of his method of signaling from balloons by means of incandescent lamps. In this system a ring is suspended from a small captive balloon, carrying eight incandescent lamps of different colors. The lamps are controlled from a keyboard, and a very high speed of communication can be maintained. On the same balloon the Eric Bruce signaling method was illustrated, in which an incandescent lamp is placed within the balloon itself. Around the walls of the gymnasium were several hundred photographs, loaned by Mr. Hammer, and illustrating the art of aerial navigation and its progress during recent years.

The lighting of the armory was in the hands of James Riley & Sons of New York, and comprised 64 arc lamps and many thousands of incandescent lamps, arranged in a definite decorative scheme.

The show in the Madison Square Garden was held under the auspices, for the first time this year, of the Association of Licensed Automobile Manufacturers. The makers of all the machines in the Garden recognize the rights of the Selden patent as governing the principles of the internal-combustion engine. The armory exhibitors, on the other hand, are known popularly as the independents, as they have thus far refused to recognize the basic rights of the patent. This sharp legal division is really the reason for the two shows.

Both shows contain about 425 exhibitors. There were 220 in the Garden and 205 in the Armory. The Armory, however, contains a larger number of makers of different machines. In the Armory there were 44 types of American pleasure cars, two electrics, two steam, seven commercial and 18 foreign makes of cars represented, a total of 73 varieties. The Garden had 50 different makes, being divided into 30 American cars, 11 foreign, eight electrics and seven commercial vehicles. Nearly 200 complete cars and chassis were shown in the Armory and about 190 in the Garden.

Ferranti-Hamilton Alternating-current Meter.

In electric wattmeters of the induction-motor type for use on alternating circuits it is necessary to produce a lag of 90 degrees in the magnetic field produced by the shunt-current, behind the impressed electromotive force.

The object of an invention by Sebastian Ziani De Ferranti and William Hamilton of Hollinwood, England, is to provide a simple form of meter in which the required phase displacement is obtained without the use of special arrangements, such as additional choking coils or secondary circuits.

The invention consists, broadly, in employing a shunt magnet having large magnetic leakage through non-hysteretic and non-conductive material, such as air, so as to obtain a lag of 90 degrees of the effective torque-producing flux behind the impressed electromotive force without the use of additional flux-retarding devices. Further, it consists in de-

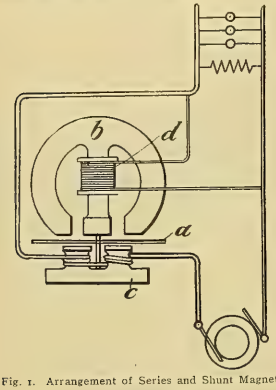


Fig. 1. Arrangement of Series and Shunt Magnets.

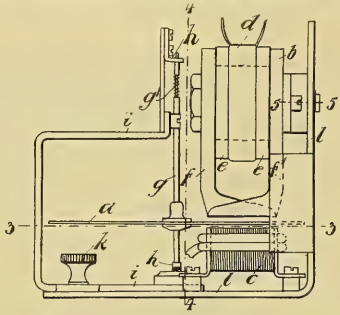


Fig. 2. Elevation.

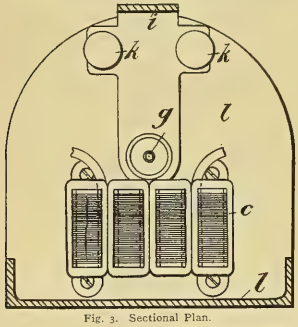


Fig. 3. Sectional Plan.

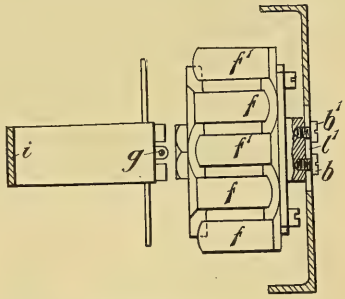


Fig. 4. Sectional Elevation.

FERRANTI-HAMILTON ALTERNATING-CURRENT METER.

vices for enabling sufficient speed to be obtained on inductive loads, thus rendering possible the construction of a meter practically equally accurate on both inductive and non-inductive loads and practically independent of frequency through wide variations.

Fig 1 is a diagram showing the arrangement of the series and shunt magnets in relation to the rotating disk. This figure also shows the connections to the supply circuit. Fig. 2 is an elevation of one form of the improved meter. Fig. 3 is a sectional plan on the line (3 3) of Fig. 2. Fig. 4 is a sectional elevation on the line (4 4) of Fig. 2.

Referring first to Fig. 1, a horizontal disk (a) is mounted on a vertical axis so as to be free to rotate between the poles of a shunt magnet (b) and those of a series magnet (c). The shunt magnet, which is disposed above the outer portion of the disk, has three limbs, forming poles. On the central limb is mounted a coil which is connected as a shunt across the source of supply. The series magnet, which is below the disk, has two poles on which are wound coils through which current passes to the working circuit. The poles of (c) are arranged practically opposite to the gaps between the poles of (b). In order to increase the lag of the effective field of (b) behind the applied electromotive force—i. e., the lag of the flux entering the disk (a) due to the magnet (b)—the core of the latter is made of such a form that there is a considerable leakage of magnetic lines from one limb of (b) to the others. The shunt coil (d) is placed high up on the central limb of (b), and the lower part of the limb is provided with an additional metallic cross-section, the effect of which is to produce a further lag in the magnetic flux which enters the disk. This additional metallic cross-section may be provided either by thickening up the lower part of the central limb of (b), as shown in Fig. 1, or by providing a non-insulated short-circuited winding (b') around the pole. By the above arrangement a lag of 90 degrees of the effective flux due to the magnet (b) behind the impressed electromotive force may be readily produced. Indeed, it is possible and convenient to produce an excessive lag and reduce this to exactly 90 degrees by means of a series non-inductive resistance. Careful experiments have shown that the lag of more than 90 degrees thus obtainable is due chiefly to the following causes: First, large leakage through non-hysteretic and non-conductive material, and, second, large iron losses.

In the form of meter shown in Figs. 2, 3 and 4 the upper or shunt electromagnetic (b) has five poles which are alternately north and south, and which project inward from the end pieces (f) and (f') of the core on which the coil (d) is wound. The coil (d) preferably does not occupy the whole of the space between the end pieces (f) and (f'); but a washer (e) is arranged on each side of it. This shunt magnet is arranged, as shown, above the horizontal disk (a), which is mounted on a vertical axis (g), free to rotate in bearings supported in a brass frame. This frame is clamped to the frame (l), which supports the magnets by means of a screw, so that when desired the frame (i), carrying with it the disk (a), may be removed without interfering with the other parts of the meter. The series electromagnet (c) has a core of laminated iron with four projecting poles, as shown in Fig. 2, on which are wound the coils through which the current passes to the working circuit. In order to obtain an adjustable starting torque when no current is flowing in the series coils the shunt magnet is mounted so that it can be displaced to the right or left, when the want of symmetry produces a starting torque.

The meter is also applicable to polyphase circuits. For example, a three-phase meter may be made of three meter elements, each element comprising a series and a shunt coil, as in one of the forms of a single-phase meter, so arranged that each of the elements acts on a disk common to all, tending to rotate it in the same direction.

The American Electrical Salesmen's Association will hold its first regular meeting in the Grand Pacific Hotel on January 20th. Any information regarding the meeting will be gladly given by Mr. George H. Erich of Room 52, 88 Washington Street, Chicago, who is secretary of the association, and has an office for the present at the above address.

Storage Batteries and Insulated Wir Discussed by Railway Signal Association.

The January meeting of the Railway Signal Association was held at New York city on January 9th, C. H. Morrison of the Erie Railroad Company presiding. The association has now 565 members, and among 36 new applicants elected at the meeting were Joseph Bijur, president of the General Storage Battery Company; Elmer F. Bliss of the General Electric Company, Schenectady; J. M. Walshe, General Railway Signal Company; F. C. Laverack, Federal Railway Signal Company, Chicago; Samuel B. Dusinberre, manager storage department, Westinghouse Machine Company; J. H. Dodd, Jamaica Government Railways, and John P. O'Donnell, London, England. G. M. Basford, the first president of the association, was made an honorary member. A. H. Rudd was elected eastern vice-president.

I. S. Raymer, chairman of the committee on storage batteries, in a preliminary report said there was a general tendency to use storage batteries for signal work. Such batteries were charged (1) by transmission wire, (2) by taking portable batteries to the central station, and (3) by the "primary-storage" method. The last method is used on the Pittsburg, Cincinnati and St Louis division of the Pennsylvania lines. Six storage cells are used at a signal location. Eighteen gravity cells are then put in series and similar terminals of each set are connected. The result is that the gravity voltage overcomes the counter electromotive force of the storage cells. The signal motors receive current from the storage cells, but when the signals are standing, current is supplied from gravity to storage. Three years' operation shows this method to be practical and economical.

C. C. Anthony, signal supervisor of the Pennsylvania Railroad, said that when storage cells were charged at a low rate it is desirable to have a periodic overcharge. He doubted the ultimate success of the primary storage method. D. C. Arlington of the Westinghouse Machine Company also approved a periodical overcharge which removes sulphate in cells used spasmodically.

E. B. Leslie of the Electric Storage Battery Company, Philadelphia, suggested combining a slow charge with an overcharge at the normal rate. The half-rate reduces the sulphate, and there was no sediment at low rates because it remained on the plates.

D. M. Case of the Queen and Crescent Railroad spoke on portable batteries. He cited an example in which each maintainer kept two extra sets and used them as substitutes while the regular cells were recharged. The extra set lasted six weeks. Recharging portables gave no trouble.

Edward L. Reynolds, sales agent of the Electric Storage Battery Company, said eastern engineers were much against portables. In the West they were used advantageously. As to charging portables, Mr. Bezar of Newark, N. J., said this is easier on account of the automatic cut-outs at the central stations. A. H. Rudd, assistant signal engineer of the Pennsylvania Railroad, estimated that portable batteries would stand 200 discharges, or say 20 years of life.

H. W. Lewis, supervisor of signals of the Lehigh Valley Railroad, read a paper on the care of storage batteries. He recommended a full initial charge, followed by a half discharge and a regular recharge. He asked for information as to the use of sodium sulphate to prevent sulphating.

I. M. Waldron of the Interborough Rapid Transit Company said that for 10 years they had given new batteries 100 per cent. overcharge and then set them to work. This method had never failed. Storage batteries are not delicate things if decently treated. They kept the plates covered, but did not test every day.

Information being asked as to charging with mercury arc rectifiers, F. B. Corey of the General Electric Company, explained the process, which, he asserted, is cheaper and more efficient than using motor-generators.

Instances of 500-per cent. overcharge, lasting from 40 to 60 hours, were related by Mr. Leslie. The positive plates got into good condition before the negative.

Azel Ames, Jr., chairman of the committee on wire inspection, reported briefly. He suggested the formation of a permanent inspection bureau for the use of all the roads. The committee was seeking to co-operate with the fire insurance inspectors as to methods of inspecting insulated wires.

F. F. Fowle of the American Telephone and Telegraph Company read a long paper on "Specifications for Line Wire." He laid down general principles for efficiency and economy under varying conditions, pleaded for standardization and suggested a number of problems for future investigation. He asked members to collect statistics as to the number of breaks per mile per annum. Answering a question by Mr. Ames, he said that no allowance was made for the extra weight of weatherproof wire because their wires were always strung with a very large factor of safety on account of sleet. Mr. Rudd said insulated wires carried more sleet, and mentioned a case of sleeting two inches thick. Mr. Fowle remarked that sleet caused wires to slack and so decreased then tension.

Double-braided No. 10 wire for storms, or No.

12 with 60 poles to the mile, were recommended by Mr. Ames.

No. 9 wire for signal circuits and No. 6 for charging lines were favored by Mr. Dudd. Weather-proof wire soon deteriorates, and he suggested using a cheaper copper to last only as long as the insulation. Present day braided wires are inferior to Mr. Balliet, are not so good as those of years ago. He mentioned insulated wire of 1891 which lasted 11 years. The old sort could be obtained if specified. Mr. Fowle said rubber insulation lasted for 80 per cent. of the life of the wire. Mr. Hamm said the old wire was bought by the mile and the new by the pound. Purchasing agents can get good wire if they will pay for it.

Mr. Anthony dwelt upon the defects of the old wires. Some manufacturers joined with single loops and put them through the insulating machine.

Dr. Clayton H. Sharp, introduced as a visitor, described satisfactory and economical methods of testing insulation. He is devising a method of aging wire prematurely. Mr. Smith reported five breaks per annum on 142 miles of wire. Mr. Anthony said the trouble is due to railroads buying wire in small quantities. The association should draw up a standard specification and make some arrangement for testing.

A preliminary report by G. K. Rogers of Calcutta on signaling on the East Bengal government railways was received, but member, expressed the view that they had nothing to learn from Indian methods.

President Morrison entertained the members of the association at dinner in the evening. The next meeting of the association will be held at Washington, D. C., on October 9th. D. W. W.

Central Light and Power Station in Hanover, Germany.

By C. Smith.

To meet the new conditions and greater demand for electrical power, the city of Hanover, Germany, has recently constructed a new central station to take the place of the old direct-current installation, which has been in continuous service for the last 13 years. But two of the three units have been installed, these two being sufficient at the present time to supply the current required. Space has been reserved throughout for the third unit, however, which will be put into operation as soon as required.

Coal is brought to the station by rail and stored in a shed separated from the boiler room by a fireproof wall. When brought to the boilers it passes over small scales, so that an accurate record of the coal consumption can be kept. Four Steinmuller boilers are in use at present, space being reserved for a battery of two more. They are of the water-tube type, with a heating surface of 4,000 square feet each, and a grate surface of 82 square feet. They generate steam at a pressure of 175 pounds per square inch. Steinmuller superheaters of 840 square feet surface are also used.

Furnace gases from each boiler are led through short flues to a main flue connecting with the stack, economizers not having been installed at present, although it is the intention to make use of them later.

A spring situated a few hundred feet from the building supplies the feed water for the boilers. Two pumps lift the water to two water purifiers, from which it passes overhead to the front of the boilers, being forced into them by two feed pumps, one being placed before each battery.

The steam from the boilers to the engines passes from the superheaters through a double conduit. The flanges are packed with asbestos, reinforced by inserted metal, a packing which does not blow out under the high pressure, so that the flanges could be made smooth and yet afford as much safety as the grooved ones usually used.

Two large separators are used to take out any water which may condense. This precaution was taken in view of the fact that the superheaters might be temporarily out of service and saturated steam would have to be supplied to the engine. These separators are each 79 inches high by 39 inches in diameter.

Steam leaving the boiler has a temperature of 509° F., but on reaching the high-pressure cylinder of the engine the temperature has fallen to 428 degrees, showing a loss of 81 degrees between boiler and engine, the steam pipe having a length of 164 feet.

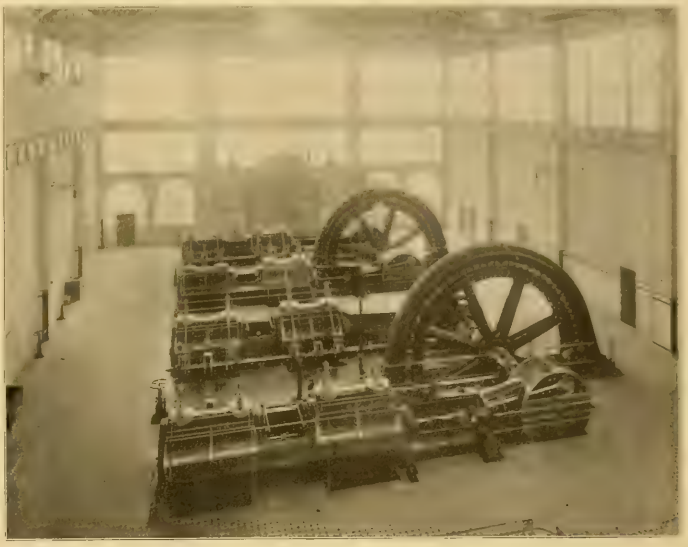
Fig. 1 gives an excellent idea of the interior of the engine room and the two units already installed. They are three-cylinder triple-expansion engines built by the Maschinenbau Actien Gesellschaft. They develop from 1,350 to 2,040 horsepower each. The alternators are placed between the pair of cylinders. The high-pressure cylinder has a diameter [illegible]

The common [illegible] speed 83.5 revolutions per [illegible] in the high-pressure cylinder [illegible] corresponding to the cut-off [illegible] cylinder, the maximum capacity [illegible] power is developed.

The rotor of the alternator [illegible] pounds and is situated at the middle [illegible] The governor is of the inertia type, and [illegible] satisfactory. In a trial, one engine [illegible] no load and the other under load [illegible] run at the same speed when coupled [illegible] and maintain synchronism in [illegible] minutes.

The engines are supplied with oil from a reservoir by gravity. After being used [illegible] tanks in the cellar and is pumped from [illegible] time, being raised to the elevated [illegible]

These two units were subjected to thorough tests before being accepted by the city. In the test with dry saturated steam at a pressure of 170 pounds per square inch 11.52 pounds of steam were consumed per horsepower-hour. With steam at 77 degrees superheat, the steam consumption was 10.56 pounds per indicated horsepower-hour.



CENTRAL LIGHT AND POWER STATION IN HANOVER, GERMANY.

The condensers are of the jet type and are located beside the low-pressure cylinders. They are each of sufficient size to be able to handle the entire exhaust from a single engine, but can maintain a better vacuum by working together. The water is led from each condenser through individual pipes to one large discharge main, which conveys it to a suction pit, located outside the small pump house. From there two centrifugal pumps, driven by induction motors, raise it to a cooling tower, from which it flows through piping 230 feet in length, to another pit, into which the suction pipes from the condensers dip.

The alternators used are of the Schuckert type and generate a three-phase current at 5,000 volts pressure, the frequency being 100 cycles per second. They have each a capacity of 1,000 kilowatts. Two vertical steam engines, developing from 400 to 500 horsepower each, and a horizontal engine of 200-horsepower capacity are also situated in the engine room. They drive electrical generators at a speed of 150 revolutions per minute, supplying current for excitation and also for driving small motors and other electrically operated machinery about the station.

The switchboard is located at the rear of the engine room. It is constructed entirely of iron and marble, and a glass cover entirely protects it from the injurious effects of moisture. The room in the rear is shut off from the engine room by iron gates, preventing unnecessary intrusion.

Five main cables conduct the current to substations, where transformers and rotary-converter

General Electric Salesmen's Meeting.

[illegible] Company in [illegible] January 15th, [illegible] commercial nature and are intended to increase the knowledge of the men by an interchange of ideas. Men especially versed in the different branches of the company's business address the salesmen and bring to their attention the particular points of merit in the various machines or appliances produced by the company. For instance, P. D. Wagoner of Schenectady spoke on transformers, F. G. Vaughen of Schenectady talked about meters, and F. G. Kimball of Boston gave a talk on small motors. Other speakers and subjects were as follows: "Induction Motors," J. T. Stockdale of Schenectady; "Railway Controllers," H. M. Ransom of Schenectady; "Incandescent Lamps," A. D. Page and F. W. Willcox of Harrison, N. J.; "Heating and Cooking Devices," N. R. Birge and W. J. Newcomb of Schenectady; "Specialties," H. C. Wirt of Schenectady; "Circuit Breakers," E. P. Edwards of Schenectady; "Railway Overhead Appliances," W. G. Carey of Schenectady.

Those present at the meeting from out of Chicago were the following-named: J. E. Lewis of Dallas, Texas, A. N. Feineman of Oklahoma City, Okla., C. W. Hough and J. F. Schaefer of Kansas City, George D. Rosenthal, F. C. Pullen, William Hand and C. R. Croninger of St. Louis, George A. Seabury and G. W. Munro of Omaha, C. H. Alexander of Helena, Mont., A. B. Cross and W. F. Smith of Minneapolis, R. A. Swain of Duluth, Minn., J. B. Tingley of Oshkosh, Wis., J. H. Livsey and W. W. Kittleman of Detroit, L. M. Paige of Grand Haven, Mich., A. L. Haralson of Cleveland, T. L. Rainey and A. H. Meyrose of Cincinnati, F. G. Kimball of Boston, A. D. Page and F. W. Willcox of Harrison, N. J., P. D. Wagoner, F. G. Vaughen, J. T. Stockdale, H. M. Ransom, N. R. Birge, W. J. Newcomb, H. C. Wirt, E. P. Edwards and W. G. Carey of Schenectady.

The usual banquet was not held this year. Instead the salesmen made frequent visits to the electrical show at the Coliseum, where the General Electric Company has a large and attractive exhibit.

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CONTENTS OF THIS NUMBER.

The Chicago Electrical Show. Illustrated....51, 52
Modern Substation Practice. (Institute discussion in Chicago.) 52
Municipal Lighting Plant Shut Down....52
The Automatic Control of Rotary Converters. Illustrated....53
Automobile Shows in New York....53
Ferranti-Hamilton Alternating-current Meter. Illustrated....54
Storage Batteries and Insulated Wire Discussed by Railway Signal Association....54, 55
Central Light and Power Station in Hanover, Germany. By C. Smith. Illustrated....55
General Electric Salesmen's Meeting....55
Editorial....56
Ohio and Indiana Electric Railway Associations to be Merged. 57
Northwestern Electrical Association. (Annual convention in Chicago.)....57
Magnetic Wells....57
Year's Earnings of Chicago Freight Tunnels....57
Electrical Trades Association of Chicago....57
Northwestern Cedarmen's Association. (Annual meeting in Minneapolis.)....58
Marshall H. Coolidge. Portrait....58
Electric Power for Large Iron Mine....58
Further Details of Sarnia Tunnel Equipment. Illustrated....59
The Dynelectron. Illustrated....59, 60
5,000 Kilowatts in Steam Turbines Ready for Shipment. Illustrated....60
The New "Poke Bonnet" Reflector. Illustrated....60
The Connectome. Illustrated....60
High-voltage Electrically Operated Oil Circuit-breaker. Illustrated....60, 61
Something about Hard-drawn Copper Wire....61
Finest Ever Printed in the United States....61
Long-distance Wireless. (Communication.)....61
American Energy Triumphing over Misfortune. (Communication.)....61
Co-operative Insurance for Railway and Lighting Properties.. 61
Opening of the Simplon Tunnel....61
Electrically Operated Irrigating System on Large Sugar Plantation....62
Auxiliary Telephone Circuits. By Charles H. Coar. Illustrated....62, 63
Telephone Men....63
Telephone News from the Northwest....64
Indiana Telephone Items....64
Ohio Telephone Notes....64
Southeastern Telephone Developments....64
Oregon Independent Telephone Association....64
General Telephone News....64

DEPARTMENTS.

Correspondence....64, 65, 66
Great Britain....64, 65
New York....65
Dominion of Canada....65
Ohio....65
Michigan....65
Indiana....65, 66
Southeastern States....66
Texas....66
Mexico....66
Northwestern States....66
Pacific Slope....66
Personal....66, 67
Electric Lighting....67
Electric Railways....67
Power Transmission....67
Publications....68
Societies and Schools....68
Miscellaneous....68
Trade News....68
Business....68, 69
Illustrated Electrical Patent Record....69, 70

DATES AHEAD.

Chicago Electrical Show (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

American Electrical Salesmen's Association (first annual meeting), Grand Pacific Hotel, Chicago, January 20th, 9 a. m.

Nebraska Independent Telephone Association (annual convention), Lindell Hotel, Lincoln, Neb., January 23d and 24th.

Ohio Interurban Railway Association (annual meeting), Algonquin Hotel, Dayton, Ohio, January 25th

American Institute of Electrical Engineers (two-hundred-and-third meeting), 44 West Twenty-seventh Street, New York city, January 26th, 8:15 p. m.

MARSHALL FIELD was not an electrical man, and yet we suppose there is not an electrical man of prominence in Chicago who does not feel a sense of personal loss at his death. He was a strong, reserved man, who kept his own counsel, but he was nevertheless a friend of progress and a commanding figure in the influences that made for the prestige and betterment of the city. He early recognized the advantages of electric light and power, and later became financially interested in the central-station and traction interests of Chicago. He was unquestionably the foremost citizen of the western metropolis, and was held in universal respect and honor. The death of such a man should be and is keenly regretted.

MUCH interest is naturally manifested in the contemplated attempt to reach the North Pole to be made by Walter Wellman, who has been commissioned by a Chicago daily newspaper to build an airship and undertake to proceed to the Pole in that manner from Spitzbergen. The celebrated aeronaut, Alberto Santos-Dumont of Paris, will act as Mr. Wellman's aeronautic engineer in the construction and equipment of the airship, which is to be of the dirigible variety. Mr. Santos-Dumont may also accompany the expedition to pilot the ship. Communication with the outside world is to be maintained, it is hoped, by the aid of space telegraphy and the submarine cable. For this purpose a wireless station is to be established at Spitzbergen, 550 miles from the Pole. This station will transmit the messages which Mr. Wellman may send to Hammerfest, Norway, 600 miles from the first station. From Hammerfest communication will be carried on with this country by means of the Atlantic cable. After what is declared to have been careful investigation, it has been decided that a sending apparatus to be carried on the airship can be made of necessary power to enable messages to be sent over the 550 miles between Spitzbergen and the Pole, granted, of course, that the Pole can be reached—and Mr. Wellman believes the chances of success are greater than the chances of failure. The effort is to be made next July or August or else in March or April of 1907, these two periods of the year being deemed the most auspicious.

There seems to be no question that the airship attempt, with wireless accompaniment, is to be made in good faith. Mr. Wellman has had previous Arctic experience and is a man of ability and resolution. The project seems to be a very daring one, especially in view of the unfortunate history of the Andre expedition. An airship such as is proposed has never been built, while it is difficult to believe that apparatus capable of sending 550 miles by wireless can be carried in addition to the passengers and the other machinery, instruments and stores. But the plan is boldly conceived at any rate; the latest applications of science are relied upon to bring success in the fascinating search for the Pole. We must be doubtful of the success of this most interesting plan, but nevertheless one cannot refrain from a certain admiration for it. A gallant fight against the Terra Incognita is promised, and for our part we wish the airship voyagers a successful journey and a safe return.

TELEPHONE conditions in London are such as to cause the judicious to grieve. And the august Times of that city, which, if not judicious—and we do not say that it does not possess that admirable characteristic—is at least judicial, or at any rate ponderous (we shall carefully eschew the word pompous)—the revered London Times, we repeat, devotes one of its column-long editorials in a recent issue to saying so. Our venerated contemporary, in its stately phrase, declares that the vexations of the telephone service in London are "very real and oftentimes very trying indeed." But, it pointedly asks, "Are they, after all, inherent in the use of the telephone and inseparable from it, or are they merely accidental and in large measure remediable concomitants of it?" Skipping now to the end of the column for the answer (our American brevity will be excused, we trust), we find that there is an answer, and it is in these momentous words:

"On the whole, then, it would seem that the evils which our correspondent associates with the use of the telephone may be largely mitigated, if not entirely overcome, by a combination of efficiency with good sense and good manners. If this is the true lesson of the telephone, it is one which we shall none of us be the worse for learning."

Nobody can gainsay the Times' conclusion. Indeed, it may be that nobody attempts to controvert the Great Mogul of journalism in anything. But, be that as it may, the defects of the telephone service in the British metropolis are not to be disposed of by mere banter; even the Times did not attempt that. The faults seem to be such as could be partly obviated by the proper training and supervision of operators—that is an important point; perhaps London needs a school for telephone operators such as that of the Chicago Telephone Company, recently described in the Western Electrician—and by the use of improved apparatus. But no doubt the telephone users need some training, too. For instance, there seems to be little system in handling the incoming calls in large establishments. We take it that private branch exchanges and extension service are not very common in London. The Times could no doubt do a real service to its readers by publishing a series of articles showing what a modern telephone service should be and how the public should take advantage of it. There is a telephone engineer in London, an Englishman, but well versed in American practice, who could write well on such a topic if prevailed upon to do so.

ELECTRIC FANS, by a little thought, may be made to do service in winter as well as in summer. As a valued correspondent points out, any machine which is allowed to stand still from half to two-thirds of every year is on principle a luxury, for the fixed charges upon it tend to assume too large a proportion of the total cost of possession and operation. While luxuries have their place, it is nevertheless a fact that if the owners of fan motors more generally realized their value in the cold season, the result would be mutually gratifying to both the central-station manager and the consumer.

In the winter the ventilation of dwellings and mercantile houses is a far more difficult problem than in the summer. The fan motor can be used to great advantage in such cases, for the circulation of air in closed rooms is difficult to maintain by natural means. The installation of a fan near a radiator in a room which is not easily heated often distributes the warmth most satisfactorily, and a little experimenting with a slightly opened window in one part of a room and an electric fan in another enables one to adjust the ventilation to a nicety. In some of the newer hotels fan motors are used with great success in maintaining an even draft at open fireplaces and in preventing the flow of smoke into apartments in case the direction of the wind is unfavorable. Everyone knows the convenience of the fan motor in evaporating frost as it gathers upon window panes, and in many confectionery stores the electric fan is employed to keep a constant circulation of air over trays and counters, so that the various candies may be kept cool and fresh in confined quarters.

The ventilation of photographic dark rooms, the drying of plates, and the supply of fresh air to and the removal of odors from lecture tables, laboratories and kitchens, are as important in winter as in summer. In the domestic laundry the drying of the family washing on stormy days may be greatly hastened by the use of a fan motor. The ventilation of steam-railroad cars in the winter is seldom satisfactory, and it would seem as though some improvement might be possible through the use of fan motors, at least on trains equipped with them for summer operation. Very satisfactory results have been attained by using a fan motor to expedite the drying of cement-lined vaults in new buildings. In such cases the natural circulation of air is usually very poor, and by placing the fan on a box near the top or bottom of the vault door, leaving the alternate bottom or top space open for suction or exhaust, the vault can be dried out in a much shorter time than by the old plan of letting things alone. In the hospital and the sick-room the fan motor, if of a noiseless design, can be employed advantageously in the winter season. The whole subject is certainly worth consideration by enterprising central stations.

Ohio and Indiana Electric Railway Associations to be Merged.

The annual meeting of the Indiana Electric Railway Association was held in the Claypool Hotel Indianapolis, on January 11th, President C. L. Henry presiding. The association voted in favor of consolidating with the Ohio association under the name of the Central Interurban Railway Association. A. W. Brady, president of the Indiana Union Traction Company, and chairman of the committee appointed to confer with a similar committee of the Ohio Electric Railway Association, reported that the two committees held a joint conference and after canvassing the situation with as much care as possible decided in favor of the plan of consolidation.

Mr. Brady explained the purposes of the consolidation and the advantages expected to be derived from the employment of a permanent secretary to compile and diffuse information concerning the various interurban companies, their facilities for transportation, knowledge and use of the interchangeable mileage tickets, connecting lines, etc. He said the most serious objection was that the jurisdiction was made coextensive and that the distance was a matter of concern to the members of Southern Indiana, but he thought these did not counterbalance the many advantages promised by the amalgamation. He said meetings should be held alternately in Ohio and Indiana and less frequent than heretofore. There was some discussion of the report, but generally favorable to the recommendation, and the report was then concurred in by the members.

A committee consisting of C. L. Henry, C. C. Reynolds, E. C. Emmons, W. G. Irwin and A. W. Brady was appointed with power to act in the completion of the consolidation of the Indiana and Ohio associations. The two state committees held a joint conference at once and formulated a plan of consolidation, drafted a constitution and by-laws, and arranged all matters necessary for the amalgamation, to be completed at the annual meeting of the Ohio association in Dayton on January 25th.

Charles C. Murdock of the Terre Haute Traction and Light Company presented a comprehensive and interesting paper on the subject of "Turbines." Mr. Murdock said the turbine engine as against the reciprocating engine was more simple in operation, required less floor space and was promising in the matter of a low-expense account. In comparing the American and the French turbines, he was of the opinion that the French turbine was not keeping up with the American machine in results. He said the efficiency of the turbine engine depends upon superficial heat and vacuum, causing as little friction as possible. Mr. Murdock took up the question of possible results from certain degrees of superficial heat and the effect in the matter of economy, and quoted some interesting figures derived from tests made by the turbine. The turbine installed in the Terre Haute plant, and with which they had obtained excellent results, cost $18,000.

Mr. Murdock's paper was discussed by George H. Kelsay of the Indiana Union Traction Company and C. L. Henry of the Indianapolis and Cincinnati Traction Company. Mr. Henry thought the adoption of the turbine was simply going back to original principles. Mr. Henry said he was favorably impressed with the simplicity of operation and results obtained from the turbines, and was getting ready to install them in the Rushville power station. After visiting a Chicago plant, where four large turbines were installed and in operation, he was convinced the turbine had come to stay. The low rate at which electricity is now being generated is surprising, he said, and he was delighted over the promise turbines have in store.

Questions taken from the question box at a previous meetings and submitted to A. W. Brady and J. A. Van Osdol of the Indiana Union Traction Company were answered by Mr. Brady, Mr. Van Osdol not being present. The first question related to the interpretation of the Indiana state law as to whether a conductor could be prosecuted for embezzlement in case he found a ticket of his company upon the street or in his car and appropriated it to his own use, or sold or gave it away to another. Mr. Brady said a conductor who comes into possession of a ticket by reason of his connection with the operation of the line is in duty bound to return the ticket to the company with a view of returning it to the rightful owner, otherwise he is liable for embezzlement.

The other question was, "What constitutes a legal tender in the payment of fare on an electric railroad?" Mr. Brady said there was no law on the subject in Indiana, and whether the amount tendered is reasonable is governed by circumstances. He cited a case in California where the court held that the tender of a $5 gold piece was a reasonable tender for a five-cent fare. In New York the court held that a $5 bill was not a reasonable tender for such fare, and that the Pennsylvania court had decided likewise, insisting that $2 in change was as much as ought to be required of a conductor. Mr. Brady thought street and interurban conductors should be supplied with a reasonable amount of change and said the amount of fare usually paid by passengers would determine the amount in a measure. He spoke of the practice of [illegible] passenger [illegible] change due.

[illegible] elected C. L. Henry [illegible] vice-president [illegible] C. H. Mich[illegible] [illegible] carried in and the [illegible] consolidation is completed.

The meeting adjourned [illegible] the members [illegible] around the banquet table [illegible] brate the birth of the Central [illegible] Association. In speeches [illegible] nificent feast it was predicted [illegible] Indiana and Ohio [illegible] includes the association of [illegible] Michigan. It was pointed out [illegible] much benefit is to be enjoyed [illegible] of the Middle West from the merger [illegible] will include all the interurban [illegible] Middle States.

A. W. Brady acted as toastmaster. [illegible] speaker was Charles L. Henry, president of the Indiana association. Mr. Henry reviewed the traction industry of Indiana, and said it was interesting to know that, as a rule, Indiana traction lines were promoted by Indianians. "Much has been said about outside capital," he said, "and much credit is due to outside capital in the development of the interurbans in our state, but I take pleasure in calling attention to the fact that Indiana men first lent Indiana money to begin the development of interurban roads. Looking back and looking forward," Mr. Henry said, "if I am to judge the future by the past, we have a right to expect that while wonderful progress has been made in the last eight years, even greater progress will be made in the coming eight years. The various lines will be linked up, better tracks and roadbeds will be in use and cars more comfortable and substantial will be constructed; higher speed and greater safety will be attained."

E. C. Spring, president of the Ohio association, spoke modestly of the development in Ohio and said he was gratified with his visit to Indiana. He concluded by predicting great things of the amalgamated association. The other speakers were F. B. Carpenter, C. A. Baldwin, H. S. Drake and Ernest Bross.

Northwestern Electrical Association.

The fourteenth annual convention of the Northwestern Electrical Association was begun in the Great Northern Hotel in Chicago on January 17th, the meeting being called to order by President Charles H. Williams of La Crosse, Wis. The convention was held in Chicago this year, instead of in Milwaukee as in previous years, on account of the Electrical Show, which many of the members wished to attend. A fair proportion of the members were present at the opening meeting.

President Williams read a short address, which was to the point. Touching on the subject of the appointment of committees, he said that it was his belief that committees should not be appointed for investigating any question of operation or policy which might be investigated by individual members. He did not believe it good policy to appoint committees on a lot of subjects simply because other representative organizations of the kind were in the habit of doing so. When some really very important problem comes up, however, let a committee be appointed, that committee to expend its best efforts and get results that count.

Secretary Thomas R. Mercein was present, but said that he would be unable to present his report on financial matters until the next day, owing to the press of work which he has had as manager of the Electrical Show. He read the report of the committee on legislation, of which Mr. S. B. Livermore of La Crosse, Wis., is general chairman.

Considerable discussion arose concerning the legislative committee, and it was deemed wise by some that an attorney be appointed in each state covered by the association to look after the central-station interests at the various state capitals. Some believed this step was hardly necessary in states other than Wisconsin, since they each had their own individual association to look after the central-station interests. In Wisconsin, however, there is no state association, and it was believed that there an attorney was greatly needed. Work thus far in that state needing the services of a lawyer has been done gratuitously by one of the central stations operating there. The point was brought up in this connection that the attorney be appointed by some central station, acting, however, for the interests of the association, for in that way the arguments of the attorney, it seems, have more weight. The whole matter was, upon motion, left to the executive committee, which was to report before the close of the convention.

Mr. H. D. Goodwin, official stenographer of the association, was appointed assistant secretary during the convention to act for Mr. Mercein, who would be compelled to be absent much of the time on other business.

As a committee on membership the president appointed J. H. Harding of La Porte, Ind. W. H. [illegible]

[illegible]

Magnetic Wells.

[illegible] as nail [illegible] filled [illegible] [illegible] would then be [illegible] magnetism. If [illegible] then be placed [illegible] glass vessel and [illegible] minutes, after which it should [illegible] again tested.

The officers of the United States Geological Survey would be pleased to [illegible] the subject of magnetic wells [illegible] owners and others who have knowledge of [illegible] this character.

Year's Earnings of Chicago Freight Tunnels.

The Illinois Tunnel Company has [illegible] report of earnings to the comptroller of Chicago for the year 1905, as required by the ordinance granted the Illinois Telephone and Telegraph Company on June 15, 1903. The report places the [illegible] for the year at $108,300.68. This amount the company does not consider large for so [illegible] a system of tunnels, but it states that the plant is not yet in practical operation, and the report goes on to show the reason why.

In November, 1904, the report says, the company changed its plans and decided to [illegible] tunnels to connect with all the freight [illegible] located in the district north of Eighteenth Street, east of Halsted Street and south of Indiana Street. To do this the company was compelled to complete 20 miles of additional tunnels to make the connections. During the period of this construction it was found impractical to put the plant in operation. Therefore no business was done except hauling excavation from a number of new buildings.

The report says that on November 1, 1904, the company had completed 103,[illegible] feet of tunnel. From November 1, 1904, to December 31, 1905, it constructed 109,109 feet additional, making a total completed on December 31, 1905, of 212,771 feet, or 40.3 miles. An interesting clause in the report is the statement that in the next few months the plant will be in practical operation. Of the total gross earnings, amounting, as stated, to $108,300.68, the city received five per cent. compensation.

Electrical Trades Association of Chicago.

The annual meeting and dinner of the Electrical Trades Association of Chicago will be held in the Coliseum Annex, Chicago, on the evening of January 24th. Unusual interest is being manifested at this time and the anticipation is the largest meeting of credit men in the electrical trade ever held. Many electrical manufacturers and jobbers, from Cleveland to Denver, and from Detroit to New Orleans, will be in attendance.

At the dinner James Wolff, Chicago representative of the New York Insulated Wire Company, will act as toastmaster, and the programme includes responses to be made by representative manufacturers and jobbers from the central, western and southern territories. The Chicago association numbers 155 members, and the records for the last year will show remarkable work accomplished for its members through co-operative [illegible] credits.

Fred P. Vose, Marquette Building, Chicago, is secretary and general counsel for the association, and further details with reference to the meeting may be had on application to him.

Northwestern Cedarmen's Association.

The tenth annual meeting of the Northwestern Cedarmen's Association was held at the Nicollet Hotel, Minneapolis, Tuesday, January 9th. The meeting was well attended and the business was transacted in a rapid manner. This has been the first year under the reorganization, and the results accomplished by a permanent secretary have satisfied the members that the benefits received are worth the added expense. The decision to co-operate with the northern pine associations in handling overweight claims was an important result of the meeting.

The meeting was called to order at 10 a. m. by President M. K. Bissell. Secretary M. O. Nelson presented his report on the year's work. The following facts, taken from the report, will be found of interest. Under the present conditions of cedarmen's records it was impossible to get uniform reports of the sales for 1904, the stocks cut and purchased for 1905 and the stocks on hand January 1st. In the summary of sales for 1904, the reports that cannot be reduced to detail make up a total of about 603,000 seven-foot to 18-foot posts and 290,000 20-foot and up poles.

It was the wish of the association last April that the canvass for green stocks put in for 1905 be continued throughout the year, or until every producer and wholesaler had made report. This canvass has been pursued with the same relentlessness with which the others have been pushed. It has been suggested that each wholesale concern provide a special clerk to take care of the demands of the association secretary, but it is not known that this has been acted on as yet by any member.

To the request for report of sales for 1904 have come 74 responses; to that for stocks for 1905, 63 responses, and to the call for dry stocks on hand January 1st, 50 responses. The fact that 50 wholesalers responded to the call within a single week is very good proof that the cedarmen want this information and are willing to co-operate in giving it. The plan, whereby the estimate of posts and poles put in the current winter was obtained, is one suggested at the last April meeting, and discussed previous to that time by the association. This is to divide the cedar-producing territory into districts, giving to some wholesaler, who is familiar with that district, the task of estimating the cut of the winter there and the cut of the previous year. This obviates the overlapping of estimates and covers all the territory, though in a rough way. These estimates are based on average logging weather. Last year the estimate was made up from reports of individuals, each operator giving a report of his own cut only. In the report at the end of the logging season the secretary is ready to use either or both methods, as the association may think best.

Three important committees have been called on to act during the year. In May the trades relations committee met a similar committee of the Lumber Secretaries' Bureau of Information in Chicago and formulated a reciprocal trade agreement that later was abrogated by the retailers' associations, and nothing further has been done in the case.

A meeting of the railroad committee with Mr. Becker of the Western Weighing Association, to bring about a better understanding regarding the treatment of overweight claims in his office, was held, with results known to most of the members.

The third committee to report is a special committee appointed to act in conjunction with the allied lumbermen's associations of the country in bringing a complaint before the Interstate Commerce Commission to compel the railways to make an allowance for the cost of equipping their flat or gondola cars for the carrying of lumber, and to compel them also to make allowance in weight for this equipment.

Another matter spoken of by the secretary in closing was the death of two members during the year. "Never in the history of this association have we been called on to mourn the death in one year of two so prominent and almost indispensable members as were E. E. Naugle and Daniel MacGillis."

In the afternoon session the committee, on recommendations for the "eastern classification book," consisting of A. T. Naugle, H. S. Gilkey and George J. Backus, made the following report:

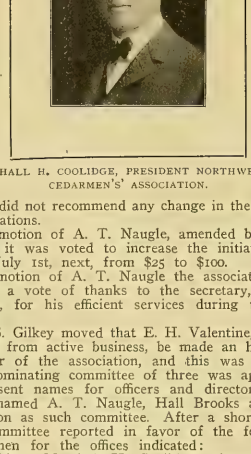
"Your committee recommends that the secretary, in making his classification of freights for the states of Indiana and Ohio, be instructed to name the rate from Hermansville; also the proportional rate from Chicago to all points in the above-named states, and in making the rates for Illinois and Wisconsin to name the Hermansville rates and also the rates from the Minnesota transfer. In naming the rates from the Minnesota transfer we have taken into consideration the fact that a large number of cedar poles are being produced in Northwestern Minnesota along the Minnesota and International railway, and as these points have no outlet through Duluth the interests of the Minnesota shippers will be better served by giving the rates from the Minnesota transfer than from Duluth." The report was adopted.

President Bissell read an invitation to the association to hold its next annual meeting in Chicago at the time of the electrical show.

J. E. Rhodes, secretary of the Mississippi Valley Lumbermen's Association, was introduced to make a brief statement of the workings of the new bureau for the conduct of freight claims before the Western Weighing Association. He stated that excellent results had been secured in this way, reducing the number of claims and causing a reform in the method of weighing practiced formerly, as the association's inspector, J. F. Chambers, had discovered and called attention to several abuses.

H. S. Gilkey moved that the Northwestern Cedarmen's Association co-operate with the Mississippi Valley Lumbermen's Association for the next six months in handling freight claims. This was carried unanimously.

The report of the pole committee was presented by H. W. Reade. M. H. Coolidge, for the inspection committee, reported that inspectors had been called upon during the year by members in three or four cases to adjust differences, and had succeeded in each case. Similar requests from persons outside the association had been refused. The committee did not recommend any change in the present specifications.



MARSHALL H. COOLIDGE, PRESIDENT NORTHWESTERN CEDARMEN'S' ASSOCIATION.

On motion of A. T. Naugle, amended by E. L. Clark, it was voted to increase the initiation fee after July 1st, next, from $25 to $100.

On motion of A. T. Naugle the association extended a vote of thanks to the secretary, M. O. Nelson, for his efficient services during the last year.

H. S. Gilkey moved that E. H. Valentine, having retired from active business, be made an honorary member of the association, and this was carried.

A nominating committee of three was appointed to present names for officers and directors. The chair named A. T. Naugle, Hall Brooks and Ole Erickson as such committee. After a short recess the committee reported in favor of the following gentlemen for the offices indicated:

President, Marshall H. Coolidge; vice-president, P. W. Raber; treasurer, W. B. Thomas; directors for three years, A. T. Naugle and W. T. Watkins.

The report of the committee was adopted and the ballot cast for those named. President-elect Coolidge took the chair, and thanked the association for the honor. A rising vote of thanks to the retiring president, M. K. Bissell, was ordered.

H. S. Gilkey was called on to give his views on the market situation. Mr. Gilkey said it was needless to state that conditions in the market were the best for a number of years, probably the best ever known. Post prices have not been wholly satisfactory, but a good demand recently had reduced the surplus, and prices are firmer. The outlook for business for a coming year never was better. Conditions in the woods, on the other hand, are as bad as ever known, with no freezeup until the snow came, which has left the bottoms soft, and hauling is very slow and difficult. It probably means an earlier breakup in the spring. After this the convention adjourned

After adjournment the directors held a brief meeting and re-elected M. O. Nelson as secretary for the ensuing year.

Among those in attendance at the meeting were the following-named gentlemen:

Backus, George J., Dumas-Backus Lumber Company, Minneapolis.
Bissell, M. K., Erickson & Bissell, Escanaba, Mich.
Bliss, A. S., R. Connor Company, Marshfield, Wis.
Bowring, W. P., C. H. Worcester Company, Chicago.
Bradley, T. P., Duluth Log Company, Duluth, Minn.
Brooks, Hall L., Tomahawk, Wis.
Clark, E. L., Valentine-Clark Company, Chicago.
Coolidge, Marshall H., Marshall H. Coolidge Company, Minneapolis.
Dixon, H. M., Cloquet Tie and Post Company, Cloquet, Minn.
Erickson, Ole, Erickson & Bissell, Escanaba, Mich.
Genge, R. R., Francis Beidler & Co., Chicago.
Gerich, J. E., MacGillis & Gibbs Lumber Company.
Gilkey, H. S., Pendleton & Gilkey, Minneapolis.
Hayden, J. F., Mississippi Valley Lumberman, Minneapolis.
Huser, E., Beaver Dam Lumber Company, Cumberland, Wis.
Leitch, J. G., Francis Beidler & Co., Escanaba, Mich.
Martin, L. R., Duluth, Minn.
McDevitt, J. A., Cloquet Tie and Post Company, Cloquet, Minn.
McNeal, H. B., Telephony, Chicago.
Miller, J. P., Minneapolis Cedar and Lumber Company, Minneapolis.
Miller, William, Minneapolis Cedar and Lumber Company, Minneapolis.
Mueller, William, William Mueller Company, Chicago.
Naugle, A. T., E. E. Naugle Tie Company, Chicago.
Naugle, Joseph, E. E. Naugle Tie Company, Chicago.
Nelson, M. O., secretary Northwestern Cedarmen's Association, Minneapolis.
Olcott, F. L., Beaver Dam Lumber Company, Cumberland, Wis.
Olson, L. E., Dumas-Backus Lumber Company, Minneapolis.
Page, L. A., Page & Hill Company, Minneapolis.
Partridge, H. F., T. M. Partridge Lumber Company, Minneapolis.
Paulson, Lester, Duluth Log Company, Duluth, Minn.
Raber, P. W., Raber & Watson, Chicago.
Reade, H. W., Pittsburg and Lake Superior Iron Company.
Schalck, Frank R., Western Electrician, Chicago.
Shaw, G. B., E. E. Naugle Tie Company, Chicago.
Thomas, W. B., Manistique, Mich.
Watkins, W. T., Pillsbury-Watkins Company, Minneapolis.
Wells, Daniel, Ford River Lumber Company, Wells, Mich.
Werner, F. W., Pillsbury-Watkins Company, Minneapolis.

Convention Notes.

The Valentine-Clark Company was well represented by E. L. Clark.

L. A. Page of the Page & Hill Company of Minneapolis was on hand.

J. E. Gerich of the McGillis & Gibbs Company of Milwaukee was much in evidence.

The Minneapolis Cedar and Lumber Company was represented by Messrs. William and J. P. Miller.

T. P. Bradley and L. C. Paulson of the Duluth Log Company came down from Duluth to attend the convention.

H. F. Partridge represented the T. M. Partridge Lumber Company of Minneapolis, and was in constant attendance.

The convention did not fail to bring from Tomahawk, Wis., one of the popular men of the business—Hall L. Brooks.

The Cloquet Tie and Post Company of Cloquet, Minn., again sent its welcome representatives—J. A. McDevitt and H. M. Dixon.

The popularity of Marshall H. Coolidge was demonstrated by the satisfaction felt by his election as president of the association.

The Dumas-Backus Lumber Company of Minneapolis was well represented in the persons of George J. Backus and L. E. Olson.

R. R. Genge of the Francis Beidler Company of Chicago was present in the interests of his company, as was also J. G. Leitch of the Escanaba yards.

One of those present who always takes a prominent part in the meetings of the association was A. T. Naugle of the E. E. Naugle Tie Company of Chicago.

H. S. Gilkey of the Pendelton & Gilkey Company, without whom no cedarmen's convention would be complete, took his usual active part in the proceedings.

The ever good-natured and jovial "Mueller" of the William Mueller Company, Chicago, was on hand to help brighten the occasion—an accomplishment at which he has no equal.

The C. H. Worcester Company was naturally represented at the convention, Secretary W. P. Bowring attending. Mr. Bowring was engaged much of the time in greeting his many friends.

W. T. Watkins, president of the Pillsbury-Watkins Company of Minneapolis, was one of the men present who is always sure of a warm welcome at these meetings. In attendance with Mr. Watkins was F. W. Werner of the same company.

H. W. Reade, secretary and treasurer of the Pittsburg and Lake Superior Iron Company of Escanaba, was one of the heartily welcomed members who was constantly in demand. Mr. Reade is one of those gentlemen whom to know is a real pleasure.

Electric Power for Large Iron Mine.

The Penn Iron Mining Company of Marquette, Mich., has contracted for a complete hydro-electric plant to be installed at the Sturgeon Falls. The first contract is for apparatus that will furnish 2,000 horsepower, later to be followed by an additional 2,000 horsepower. The current used will be for the purpose of operating hoists, compressors and pumps at East Vulcan, West Vulcan and Curry mines. The motor size will range from 450 horsepower down to 15 horsepower. Pumping will be taken care of by two centrifugal pumping sets of capacity for 1,800 gallons per minute, directly connected to motors. The dam at which electricity is to be generated is located six miles from the more distant mines, and the transmission lines will be erected for the total capacity of 4,000 horsepower, 13,200 volts, three-phase current. The dam is now under construction. It is to be of concrete across the mouth of Sturgeon River, where its banks come within 175 feet of each other. The dam is anchored in the rock of the river bed. It will be 31 feet thick and will give a head of 22 feet. This change to electricity will mean an expenditure of about $250,000 and will give the Penn company probably the most complete and up-to-date electrical plant in the Lake Superior region.

Further Details of Sarnia Tunnel Equipment.

Further details of the single-phase equipment for the Sarnia Tunnel, which was described in outline in the Western Electrician last week, will be read with interest. The single-phase Westinghouse locomotives were briefly described in the preceding article, but some further features of their construction may now be given.

The principal dimensions will be approximately as follows: Length over end sills, 27 feet nine inches; rigid wheel base, 12 feet; width over all, nine feet six inches; height from top of rail to top of cab, 12 feet six inches; diameter of driving wheels, 62 inches.

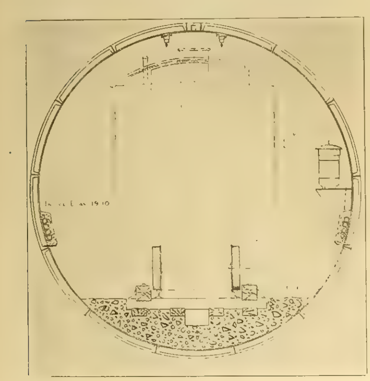
The operating apparatus will be arranged along the sides of the cab, leaving a free passageway 3½ feet wide the entire length. The cab will be lighted and heated by electricity, arrangement being made to screen the instrument lights while the locomotive is running.

Westinghouse combination automatic and straight air and American driver brakes will be used. The air supply will be provided by a two-cylinder motor-driven air compressor, having, with a five-inch stroke and speed of 190 revolutions per minute, a capacity of 45 cubic feet of air per minute. Air reservoirs, signal outfits, whistle, bell with pneumatic ringers, automatic pump governor, tools, instruments, gauges, headlights, push poles and other details complete the auxiliary equipment.

A motor will be geared to each axle, giving each unit an aggregate rated capacity of 750 horsepower. They are of the Westinghouse single-phase alternating-current series-wound compensated type, whose successful development was first publicly announced in the notable paper read by Mr. B. G. Lamme before the American Institute of Electrical Engineers in New York, September 26, 1902. They are of the same general character as the motors selected by the New York, New Haven and Hartford Railroad Company for the operation of its line between New Haven and New York. Each motor will weigh complete approximately 14,500 pounds, the armature weighing about 5,600 pounds.

The motors are swung between the locomotive frame and the driving axles by a flexible nose suspension from two hangers supported by a truck transom, and passing through heavy lugs with helical springs above and below the lug. The motors are held to the axle by means of caps which are split at an angle of 35 degrees with the perpendicular, so that the greater part of the weight is borne by solid projections from the motor frame, which extend over the axle, rather than by the cap bolts. Large openings above and below provide access to the commutator and brush holders.

Within the cylinder of the motor frame there is built up a core of soft-steel punchings, forming a complete laminated field. The punchings dovetail into the frame and clamp between end rings of cast-steel. The field coils are wound with copper



SECTION OF SARNIA TUNNEL.

strap, insulated between turns and about the coils by mica and finished by taping and dipping, and are impregnated in the best grade of varnishes, providing a sealed coil which can withstand the most severe internal heat and is practically indestructible under the usual conditions of heavy-railway service.

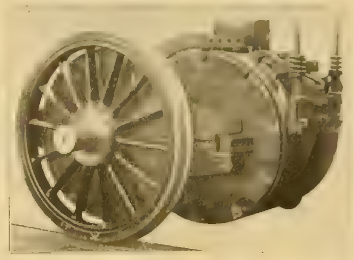
In addition to the main coils, the field carries a neutralizing winding, which consists of copper bars placed in slots in the pole faces and joined at the ends by connectors of copper strap, so as to form one continuous winding, which is connected in series with the main field winding and with the armature circuit.

The armature cores are formed of slotted soft-steel punchings, built up upon a spider and keyed in place. The spider is forced upon the shaft with heavy pressure and secured by a steel key.

During operation a forced circulation of air, supplied by motor-driven blowers, [illegible] distributed [illegible] and [illegible] the commutator.

The [illegible] of the [illegible] include the [illegible] [illegible] switches and circuit-breakers, [illegible] circuit, and other [illegible] Westinghouse practice. Any unit may be [illegible] from either end, and two or more units may be coupled together and operated from a [illegible], and by a single crew.

Speed control of the driving motors [illegible] by variation of the voltage at the motors [illegible] by means of taps taken from the windings of the auto-transformer, which receives current from the trolley at 3,300 volts and reduces it to 250 [illegible] or lower, according to the tap employed. These



WESTINGHOUSE SINGLE-PHASE COMPENSATED MOTOR FOR SARNIA TUNNEL.

taps are connected to unit switches, from which current is led through the preventive coils to the motors. Four unit switches serve to reverse the field of each motor. The unit switches are of standard Westinghouse design and are, in effect, pneumatically operated circuit-breakers of great power and reliability.

Each locomotive unit will be equipped with a pneumatically operated pantagraph trolley to collect current from the overhead lines outside the tunnel and throughout the yards. The proportions of the pantagraph will be such that, when extended, it will make contact with the trolley wire, 22 feet above the rail, and, when closed down, the contact shoe will not extend more than 18 inches above the roof of the locomotive. The pantagraph will have a broad base and will be constructed of light and stiff material.

A No. 000 grooved overhead trolley wire will be suspended from a single five-eighths-inch, high-strength, double-galvanized, steel-strand, messenger cable by hangers of varying length in such a manner that the trolley wire will be approximately horizontal. The messenger cable will be swung from structural-iron bridges, located throughout the yards, and are of suitable length to span the proper number of tracks. There will also be a small section of track equipped with a trolley line swung by catenary suspension from bracket arms, which are supported on lattice-work poles.

The new equipment will handle that portion of the Grand Trunk railway system which connects the divisions terminating at Port Huron, Mich., and Sarnia, Ont., on opposite sides of the St. Clair River. The tunnel proper is 6,032 feet long and the line to be electrically operated measures 19,348 feet from terminal to terminal.

A pair of the new units will be capable of hauling a thousand-ton train through the tunnel without division. Mechanical considerations limit the advisable weight of train in the tunnel to these figures. Heavier trains can be divided or sent through together, with locomotives in front and behind. The service requires that each unit shall take a train of 500 tons through the tunnel block from summit to summit in 15 minutes.

Six of these locomotives are to be furnished by the Westinghouse company. It is expected that the electric equipment will greatly relieve the traffic congestion now existing and due in a large measure to the necessity of dividing trains at the terminal points, and to greatly simplify the operation of the road. Its opening will mark the progress of electrical methods in the railway field under conditions which seem peculiarly fitted to demonstrate its practical advantages in heavy service.

The work of installation will be conducted under the supervision of Mr. Bion J. Arnold of Chicago, consulting engineer for the tunnel company, by whom the plans and specifications were prepared. Mr. Arnold, as is well known, was one of the first engineers in America to advocate the employment of the single-phase alternating-current system in railway service, and is at present a member of the commission in charge of the electrification of the New York Central Railroad system in New York, and has been closely identified with many electrical developments of great importance.

The Dynelectron.

[illegible]

[illegible]

[illegible] The two outer chambers [illegible] sodium hydrate [illegible] half of one per cent. of ferric oxide. The central chamber is air tight and the electrolyte cannot pass into it. Into the central chamber air is forced at a pressure of 10 pounds to the square inch, and the air passes into the hollowed centers of the rods and through the pores of the carbon into the electrolyte. At the same time the electrolyte is heated to about 300° Fahrenheit, and when the cell is thus arranged, an electric current is generated and continues as long as the air pressure and temperature are maintained.

Current obtained from each unit is approximately 600 amperes at 0.9 volt, this being equal theoretically to 540 watts, or about three-quarters of an electrical horsepower. In practice there are heat losses to be considered, and part of the current is normally used to drive the air compressor, so that a unit such as just described is to be considered for practical purposes as equivalent to one-half horsepower. The current is proportional to the carbon surface, and since in the evolution of the present design the relation between the carbon surface and the dimensions of the cell have been continually improved, it may be ultimately possible, without increasing the amount of the heat, to reduce the size of the cell still further.

The electrical action of the dynelectron is cata-

PARTS OF THE DYNELECTRON.

lytic. The current is obtained from the constant dissociation and recombination of oxygen and hydrogen as represented in the form of water and air. When the cell is working there is a constant interchange of molecules and atoms, but without any consumption of the electrodes, nor any permanent change in the character of the electrolyte. The process is cyclic. When the air, that is to say, the oxygen, contained in it, is forced through the pores of the carbon rods from the central airtight chamber, into the outer compartments containing the electrolyte, a thermo-electric action is set up, and the sodium hydrate becomes sodium dioxide, and water. The water is decomposed, with the additional assistance of the heat, into hydrogen and oxygen, the oxygen escaping into the atmosphere with other by-products of a gaseous nature. The excess of hydrogen reduces the ferric oxide to ferrous oxide, and the ferrous oxide is at once oxidized again by the action of the air, forced through the carbons.

Theoretically, it might be an improvement to supply pure oxygen, but in practice the oxygen contained in the air is found sufficient. There is an evaporation of water equivalent to one pint per horsepower per hour, and this loss is supplied and kept regulated by an automatic float. The incoming water acts upon the sodium dioxide and forms sodium hydrate and free oxygen. Thus the process taking place in the cell is analogous to that going

on in a storage battery. In the storage battery PbO is raised to Pb_2O_5. In the dynelectron cell FeO is raised to Fe_2O_5, and possibly to a still more unstable compound. Reduced to chemical formula, the process in the dynelectron cell appears to be: $Fe_2O_5 + 2NaOH + heat = 2FeO + Na_2O + H_2O$.

Mr. Reid's experiments have extended over 14 years. One of the chief difficulties encountered was inability to obtain a carbon of such a grade that it would withstand the combined action of air pressure and heated liquid, and two years were spent in perfecting a process of manufacturing carbon in an electric furnace, when Mr. Reid discovered that a new grade of carbon was being made at Buffalo. This carbon is now purchased in sheets and cut up into rods at Newark

Every part of the apparatus and every step in the process has been subjected to continuous tests and analysis. These tests are said absolutely to demonstrate that there is no disintegration either of the carbon or of the iron electrodes, nor any secular change in the chemical composition of the electrolyte, despite the continuous generation of current over a long period. A very refined test shows in some cases that there is a deposit of one-tenth of one per cent. of sodium carbonate on the surface of the carbon rods, but this deposit does not at all impair the efficiency of the cell.

In the working of the cell an ingenious way is provided for the escape of gases. This consists of a number of fine-wire disks enclosed in a threaded cylinder attached to the top of the iron cell, and through which the gases can pass without permitting any water to be ejected under the air pressure. Readers in search of information as to the electrolytic action of hydrates in solution are referred to a paper on this subject read at the meeting of the Faraday Society, London, England, May 16, 1905.

5,000 Kilowatts in Steam Turbines Ready for Shipment.

To the ordinary observer the accompanying illustration, which shows a string of flat cars loaded at the West Allis (Milwaukee) Works of the Allis-Chalmers Company, would convey no especial meaning; but to the experienced engineer it is significant of a revolution which is taking place in the equipment of many power stations throughout the world, for foremost in the train are the bodies of two steam turbines, each of them occupying not more than one-half the floor space of its car, yet representing

STEAM TURBINES READY FOR SHIPMENT.

in their combined capacity the delivery, under normal conditions, of nearly 5,000 horsepower.

The development of this modern type of the rotary engine, in which the Allis-Chalmers Company has recently taken a leading part, has come about so rapidly that the possibilities of yesterday become the probabilities of today and the assured facts of tomorrow. Engineers everywhere are vitally interested in solving the problem of the most economical generation of power, not merely in the quantity of fuel consumed but also in the floor space required for the machinery, the cost of skilled attendance, efficiency in transmission and the other factors which must be reckoned in when computing the total expense incurred for each unit of power delivered. To these the steam turbine seems to offer a practical solution of the problem under certain conditions, which are not to be confounded with those in which reciprocating engines can be most successfully operated, and they are taking careful note of every installation where the necessary data can be obtained.

The Allis-Chalmers Company is turning out these machines as rapidly as its present shop facilities will permit, and the large extensions to its already great plant at West Allis have been dictated largely by the necessity of providing more room for this branch of manufacture.

Meanwhile, the company asserts, orders for reciprocating engines have not ceased to come in, and the capacity of the company's works is being taxed to the utmost to keep up with the demand for its standard Corliss types. Most of the sales at present, both of turbines and reciprocating engines, include orders for Bullock generators to be direct connected to them. The electrical apparatus is now built at the company's works in Cincinnati, but when the new West Allis shops are finished complete power units of all kinds will be constructed there.

The New "Poke Bonnet" Reflector.

A show-window lighting device that is high-class, adequate and economical, and at the same time can be handled with satisfactory profit is represented by the New "Poke Bonnet" reflector, illustrated herewith, which is an improvement of the reflector of this type described in the Western Electrician of January 6th.

This reflector is constructed in sections and on the trough principle. The sections are 14 inches in length and may be used singly or in series. Because of the unusual brilliancy of the reflected light the sections can be mounted so as to leave open spaces between, thereby effecting a saving

TWO TYPES OF THE NEW "POKE BONNET" REFLECTOR.

upon the initial cost of the outfit, as well as for the later expense for operation.

As each unit is adjustable, the various sections of the continuous installation can be arranged at any desired angle or angles, so as to throw the light rays in any direction, and where they are most needed. The reflectors can be located at the top, back, ends or front perpendicular corners of the window, whichever way may suit the taste or accord with the judgment of the individual merchant. However, the company recommends that the reflectors be placed at the top front of window, or just back of the transom bar, but in no case where the lamps themselves will be within the range of vision.

These reflectors will also be found useful for illuminating the pictures in an art gallery, as the sections can be distributed in units, pairs, or any larger number, as they are most needed.

The unusual strength of the reflected light from these reflectors is obtained by the use of a heavy spiral corrugated glass, having a silver-plated surface. In the estimation of those who have made a study of the subject, the reflected light which comes from the use of silver is more brilliant than that which is reflected from any other surface.

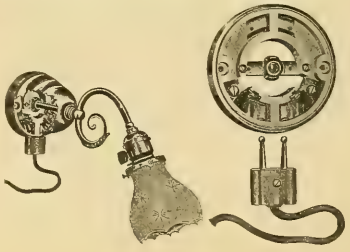
The purpose of the corrugated surface is to break and distribute the rays of light so there will be no possibility of any shadows being thrown.

Each of the 14-inch sections is equipped with twin sockets, and lamps of eight, 16 and 32 candlepower can be used. Just how many of these sections would be required for a show window will depend upon the size of the window, its shape, and the class of goods which is to be exhibited therein, but as indicating what these reflectors are supposed to do, it may be said that four of the sections equipped with eight 16-candlepower lamps will adequately light a window measuring 12 by six feet, filled with ordinary dry-goods merchandise.

The fact that these complete sectional reflectors can be carried in stock, can be easily installed makes them a valuable article for the dealer and jobber to handle, as is pointed out by the manufacturer, the National X-ray Reflector Company of Chicago.

The Connectome.

In large buildings portables are extensively used as well as fan motors. These ordinarily require a flush receptacle, or else are attached in a lighting socket, thereby rendering the latter useless for the duty which it was originally intended to perform. The illustration shown herewith represents a new



THE CONNECTOME.

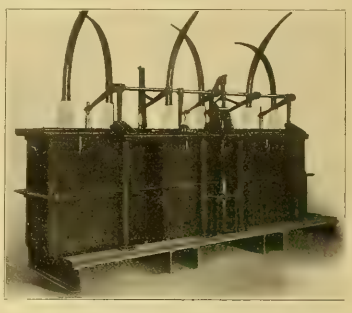
device, the connectome, manufactured by the Dale Company of New York, which furnishes a connection for the portable which is at once convenient and at the same time does away with the flush receptacle.

The illustration shows the construction of the device so plainly that little description is needed. It will be seen that the connectome furnishes at once a connection for the portable and for a lighting fixture. It can be fastened to the wall or outlet box and is neat in appearance, becoming part of the fixture when installed. It does away with the necessity of splicing, soldering and taping wires, enabling a connection to be made from a point which is neatly concealed. It is made for straight electric or combination fixtures, for either single or double connections.

High-voltage Electrically Operated Oil Circuit-breaker.

The circuit-breaker shown in the illustration herewith was designed by the Westinghouse Electric

and Manufacturing Company primarily for the Ontario Power Company's work. It is intended to handle energy up to 60,000 horsepower per three-phase circuit, and will open a circuit under any conditions of overload or short-circuit which may occur with a power house capable of delivering 200,000 horsepower. The insulation to ground and between terminals is designed to withstand a break-



HIGH-VOLTAGE ELECTRICALLY OPERATED OIL SWITCH.

down test of 150,000 volts, and the insulation between poles is twice that amount, since the poles are electrically separate.

All three poles of the switch are closed together by means of a toggle joint operated by a single direct-pull solenoid. The switch is held in a closed position by the toggle being carried just beyond the center, and is tripped out by the tripping-coil armature striking this toggle and knocking it backward, allowing the switch to open by gravity. Each pole of the switch gives a double break, each break being approximately 17 inches. The closing magnets require approximately 5,000 watts direct current, while the tripping magnets require about 300 watts.

There are three oil tanks, made of boiler iron, lined with an insulating material, with barriers interposed between the stationary contacts. The contact parts are of the company's standard type C construction, having renewable arcing tips and contacts. The leads, with their insulation and the upper porcelain insulators may be readily removed from the switch, giving access to the contact parts for inspection and repairs. The top covers of the tanks are made of treated soapstone slabs, part of which are also removable. Each tank is provided with an oil drain, opening in the bottom, and an overflow just above the normal oil level. These openings are provided with standard three-inch pipe-flange threads, but no pipe is provided. Each tank has an oil-level gauge, and requires approximately 160 gallons of oil.

The total weight of each three-pole switch complete, the tanks being filled with oil, is approximately 15,000 pounds. The oil alone weighs approximately 4,000 pounds.

A two-pole double-throw indicating switch is provided upon each three-pole oil switch for use in connection with the controlling and indicating devices. The circuit-breaker is not automatic in

itself, an overload relay operated from the transformers being necessary.

Something about Hard-drawn Copper Wire.

Thomas B. Doolittle describes in an interesting manner in the Harvard Engineering Journal the history, manufacture and properties of hard-drawn copper. The writer was familiar with the phenomenon of the hardening of drawn copper at the time he entered the field of electricity, therefore, when it was disclosed to him that copper was not only one of the best conductors of electricity but was the cheapest in conductivity, or per mile ohm, it was only left for him to determine whether or not this hardening process could be made available in order that copper wire should be comparable to iron in its ability to stand the strain of its own weight when strung on poles, and, in addition thereto, the weight of sleet or snow and wind pressure. There was no mathematical road to determine this factor; therefore it was simply a case of "cut and try."

First, the size of the finished product was fixed upon (No. 12 B. & S. gauge); then it became a matter of experiment to determine the size of the annealed copper rod which, when drawn to this predetermined size, should possess the proper tensile strength and the required torsional property. It was also necessary to determine the number of "holes" or reductions that should intervene in the process of drawing in order that the structure or fiber of the metal should not be injured during the process. Too much force would result in granulating the metal and thereby impairing its tensile strength. The experiments proved all that could be anticipated, and a sufficient amount of hard-drawn copper wire was manufactured to equip the lines necessary to connect all of the mills, offices and residences of officers of the Ansonia Brass and Copper Company, in whose wire mill these experiments were made. A telephone switchboard was set up in the brass mill of that company and an operator answered calls and made connections. This work was begun in November, 1877.

Although the product is known in the trade as hard-drawn copper wire, and properly so known—as the name indicates its property of hardness and the method of manufacture—the name has no antonym or contra-term because soft-drawn copper is a misnomer; the very process of drawing eliminates the quality of softness and makes it hard.

Prior to its introduction for aerial electrical conductors there was very little, if any, call for the hard product. Copper wire was usually annealed after drawing and sold in that form. Copper alloyed with other metal was and is now used in the manufacture of hard or "spring wire."

Skepticism on the part of electricians and generally in scientific circles, as to the practical value of this adaptation, prevented its being adopted to any extent, except the few circuits that Mr. Doolittle introduced into the Bridgeport (Conn.) telephone exchange until seven years afterward.

In 1884 Mr. Doolittle was commissioned to construct an experimental metallic circuit of copper between New York and Boston. The wire for this circuit was drawn under his personal supervision in the wire mill of the Bridgeport Brass Company. The total cost of this experiment was, in round numbers, $70,000. After the experiment was concluded the wires were turned over to the intervening telephone companies for local use and immediate steps were taken to build the New York and Philadelphia long-distance telephone line. The miles of hard-drawn copper wire now in use for all electrical purposes are counted by millions.

The first recorded employment of copper as a line conductor was its use by Prof. Morse in his experimental telegraph lines between Washington and Baltimore. The ordinary market wire was used but for the reason that it would not sustain its own weight, it was abandoned and iron wire was substituted. The next of record was strung by the Western Union Telegraph Company in New Jersey. In this case also the ordinary copper wire was used, but an attempt was made to increase its tensile strength by twisting a pair of wires into the form of a rope. This did not prove a success and was abandoned for the same reason as the other.

In the early seventies many experiments were tried in attempts to make available for aerial line conductors the superior conductivity of copper. In each case a steel wire was employed for tensile strength. In one case a copper ribbon was wound spirally around the steel wire. On exposure to the elements a chemical action was set up that quickly destroyed the steel core. This ribbon was afterward tinned, but with unsatisfactory result. In another experiment the copper ribbon was folded longitudinally. The last and most successful in this line of experiment was the process of electroplating the steel wire with copper. This was put in service by the American Rapid Telegraph Company, but in a few years it also proved unsatisfactory and was abandoned. Therefore it will be seen

[illegible]

COMMUNICATIONS.

Long-distance W[illegible]

[illegible]

American Energy Triumphing over Misfortune.

[illegible]

Relative to the dam[illegible]

[illegible]

The fire w[illegible] the factory [illegible] at 11:45 p. m. [illegible] flagration gaining [illegible] soon entirely [illegible] the back and [illegible] Both was on [illegible] of Cincinnati was [illegible]

Even while the fire was [illegible] a meeting of as many [illegible] holders and directors [illegible] and a resolution unanimously [illegible] only a new but a larger factory [illegible] and resume business [illegible] The committee appointed [illegible] the corner of Ninth and Sycamore streets [illegible] 100 feet on the ground, with six stories and basement. The company luckily had [illegible] tery material in transit, and further orders [illegible] once placed for additional material. [illegible] by the time the new building is ready [illegible] ped, which will be about February 1st. The Rock Island Battery Company will have everything in hand for business. We can, therefore, assure the trade that we will be ready promptly to fill all orders not later than February 16th. Orders will be filled in the order which they are received. The company's temporary offices are at the corner of Third and Vine streets, Cincinnati, Ohio.

ROCK ISLAND BATTERY COMPANY.
By M. A. Loeb, Secretary and Treasurer.
Cincinnati, January 16, 1906.

Co-operative Insurance for Electric Railway and Lighting Properties.

The incorporation of the American Railway Insurance Company and the Associated Railway Companies' Insurance Company of Cleveland, each with a capital stock of $200,000, has been completed. The incorporators are the same in both cases, as follows: Horace E. Andrews, Henry A. Everett, A. E. Akins, Warren S. Bicknell, Charles W. Wasson, John J. Stanley, all of Cleveland; C. G. Goodrich of Minneapolis, Minn., J. C. Hutchins of Detroit, Mich., J. H. Hogsett and Henry N. Staats. The companies will write on both sprinkler and unprotected risks, including all properties of electric-railway and light companies, such as car-houses, power houses, rolling stock and lighting plants. The rates will be made as low as possible and will be determined by an inspection and rating bureau, of which Mr. Staats is manager. The business, in fact, will be conducted upon a co-operative basis entirely in the interests of the railroad and lighting companies. The stock has been largely arranged for, subscriptions being received from various portions of the country, all by railroad and lighting people.

Opening of the Simplon Tunnel Postponed.

The official opening of the new international railway line through the Simplon tunnel, after having been advertised for April 1, 1906, is now reported by Consul Keene of Geneva as being postponed until May 1st, by action of the Swiss authorities. After having been for a considerable time under discussion, the mode of traction between Brigue and Domo d'Ossola is to be electrical, in accordance with a decision recently made by the federal department of Swiss railroads.

The Swiss system of traction now in use on the railroad Berthoud-Thoune, in the canton of Berne, will be applied with up-to-date improvements on the Simplon line. The Berthoud-Thoune system was illustrated and briefly described in the Western Electrician of January 6th. The first two electrical engines will be tried on the Italian electrical lines of Varzellina.

Finest Ever Printed in the United States.

In a letter to the Western Electrician, dated January 13th, the Farr Telephone and Construction Supply Company uses this appreciative language: "We also wish to compliment you on the New Years number of the Western Electrician, which is certainly the finest-appearing electrical journal that was ever printed in the United States. You certainly deserve great credit for getting out such an edition."

Electricity in Irrigating Large Sugar Plantation.

Sugar is manufactured extensively on the Island of Kausi, Hawaiian Territory, where there are a number of large plantations, which, however, must in some cases be irrigated. Following is a description of an electrically operated irrigating system to be installed on one of these plantations.

The primary driver will consist of a specially designed impulse waterwheel operating under a fall of 400 feet of water conveyed in penstock pipes from a mountain stream and delivering its power continuously to a Bullock alternating-current generator, direct connected, at six maximum speeds, which are secured by the use of six different sets of buckets arranged on wheels of varying diameters.

Mountain streams are not very numerous in the Hawaiian Islands and are usually in comparatively inaccessible places, rendering it impossible to lead the water by means of flumes or ditching to the land to be irrigated. Furthermore, it is frequently the case that, while the quantity of water available is small, the head is comparatively great, thus enabling a large amount of power to be obtained. Under such conditions an electric generator driven by a waterwheel may be installed at the falls and the power generated transmitted from there to a distant pumping plant located but a few feet above sea level, which obtains its supply from wells or underground tunnels. At such points the quantity of water available is usually abundant. The fundamental engineering problem is therefore to utilize a small quantity of water under a high head to raise a large quantity of water to a comparatively low head.

As is the experience with mountain streams elsewhere, the quantity of water available for power varies considerably at different seasons; hence it is desired at all times to utilize, as far as practicable, the maximum water supply, and in order to get the full benefit from the quantity available at any time it has been necessary to evolve a scheme by which the speed of the pump can be varied in proportion to the flow at the source of power.

The head being constant the velocity of the water at the delivery nozzle is constant, and the horsepower varies directly with the water supply. By changing the dimensions of the wheel carrying the buckets the rotative speed of the generator is changed, while the speed of the water remains constant at all times. With constant field strength on the generator the voltage will be directly proportional to the rotative speed, and, as the cycles are also proportional to the rotative speed, it will be seen that the volts and cycles vary in a fixed ratio to each other.

The energy from the generator being delivered to an induction motor, the speed of the motor, and therefore of the pump, will change in the same proportion as the speed of the generator. As both the frequency and the voltage change in the same ratio, the induction motor will at all times be operating under conditions corresponding to those for which it has been designed. The generator is rated at 300 kilowatts, three-phase, 60 cycles, and will have a normal speed of 450 revolutions per minute.

About five miles from the power station will be located the pumping plant. Here is to be installed a Bullock induction motor of 225 horsepower and this, by means of rope transmission, will drive a duplex, double-acting Riedler pump, having a capacity, against 250 feet head (including friction), ranging from 1,750 gallons per minute, when the waterwheel has five cubic feet per second supply of water, to 2,800 gallons a minute (4,032,000 gallons per 24 hours), with a supply of eight cubic feet a second at the wheel. The speed of the pump, operated at its full capacity, will be 116 revolutions a minute.

The generator will have its exciter, of eight kilowatts, direct connected to it, and the exciter has been so designed that it can deliver the full voltage and current required for excitation even at the minimum speed. By means of an automatic regulator the exciter voltage will be maintained constant at all speeds of rotation, and it will, therefore, be unnecessary to change the adjustment of the generator rheostat when the speed of rotation is changed. In addition to the automatic regulator a hand-operated field regulator will be installed for use in an emergency. It was the original intention to use at the pumping station a synchronous motor which would require a 50-horsepower motor for starting, as well as an exciter, controllers and apparatus for throwing the starting motor in or out; but it was found that the sysem could be simplified by the use of an induction motor. The operation of the plant remains otherwise practically the same, and of course the induction motor requires neither a starting motor nor exciter, but merely controlling apparatus. The efficiency of the whole plant will be the same with an induction motor as with a synchronous motor, while in simplicity of construction, reliability of operation, small amount of attention required and also in the matter of first cost the induction motor has the advantage. Necessary by-pass valves are provided for use in starting up. Either side of the pump may be run separately when desired.

The plant was furnished and installed by the Allis-Chalmers Company.

Auxiliary Telephone Circuits.

By Charles H. Coar.

Demand for auxiliary interior telephone apparatus is growing, and it is not to be wondered at when one considers that the ordinary doorbell, the speaking tube, the errand boy and many other slower methods of communication are being gradually supplanted by this class of equipment. To describe the evolution and adoption of the many different systems would consume much space, so the purposes of the following is to bring to mind some of the possibilities and operating arrangements of

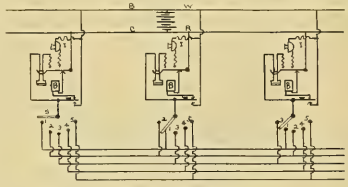


FIG. 1. AUXILIARY TELEPHONE CIRCUITS.

a few such circuits without discussing in any manner their commercial aspects.

Interior telephone systems are now usually designed to operate from a centralized battery which often furnishes the current for both ringing and talking purposes. In some circuits two centralized batteries are used—one for ringing and one for talking. It is the most common practice to utilize an ordinary vibrating bell for signaling, but when the distance between any two of the telephones in the one system is much over 1,000 feet the better practice is to use a magneto method of signaling. When it becomes necessary to use magneto current for ringing purposes the ordinary practice is to equip the telephones with local-battery talking apparatus. Some circuits are designed to operate in conjunction with trunk lines to a local telephone exchange in addition to other duties.

Fig. 1 illustrates one arrangement of an interior system which employs a centralized battery both for ringing and talking purposes. Switch contacts are provided for five stations, three of which are shown in the circuit. Each station is equipped with a transmitter and induction coil arranged in

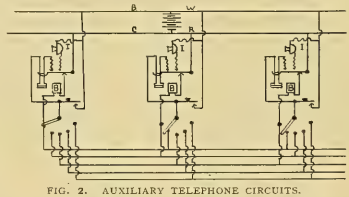


FIG. 2. AUXILIARY TELEPHONE CIRCUITS.

conjunction with a hook switch and receiver, also a vibrating bell or buzzer (B) associated with the push button and lower contact of the switch hook as shown. The switch (S) is provided to make connections to the various lines. An impedance coil (I) is arranged in series with the battery taps to each transmitter to obviate any cross talk and also to cut down the battery consumption.

The stations in this system call each other by placing the switch (S) on the numbered contact of the station desired and pressing the push button which closes the circuit through the battery and bell of the called station. Both persons then take down their receivers and talk. In the operation of this circuit it is necessary to return the switch lever (S) to the "home" contact after using the telephone, otherwise it will be impossible for this station to receive any incoming calls. It is also necessary that the receivers be in place. Both of these facts are made evident in Fig. 1.

To overcome the objection of returning the switch lever to the "home" contact manually, several mechanical devices have been perfected which operate when the receivers are hung up. In other circuits a rearrangement of the apparatus is effected in such manner that this detrimental feature is overcome.

A rearranged circuit is shown in Fig. 2, which, with the exception of the bell circuit, is identical with that shown in Fig. 1. It will be noticed in connection with the circuit shown in Fig. 2, that the bells are directly connected to the "home" contacts, in which position they can be actuated regardless of the position the switch lever may occupy. Therefore it is not necessary that the switch lever occupy the "home" contact in order to receive its calls properly. Otherwise the operation of the circuits shown in Figs. 1 and 2 is identical.

The circuit shown in Fig. 3 is employed on occasions where a subscriber wishes to have several extension telephones arranged in such manner that they can secure through connections to the telephone exchange at all times other than when he is using the telephone. This is also done in order that the conversations from the main telephone will be secret in so far as the extension telephones are concerned.

Fig. 3 shows an arrangement for connecting a main telephone to the exchange line in the usual manner, while the extension telephones (1), (2) and (3) are so connected that one side of the circuit to these instruments has its continuity dependent upon the position of the hook switch in the main telephone. It is necessary that the receiver be hung up at the main telephone before the extension telephones can utilize the line, as the connections depend on the lower switch hook contact in this telephone. The push buttons and bells are provided to summon persons to the different extension telephones should an arrangement of this kind be desired. This is often convenient when one person answers all the calls, and then by aid of the push buttons and bells calls the desired person to an extension telephone. As shown in the circuit, one side of the telephone line is used as a common return for the bell service. This should

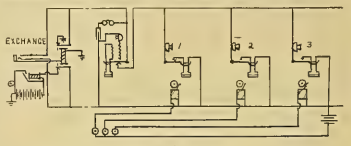


FIG. 3. AUXILIARY TELEPHONE CIRCUITS.

preferably be the side that is cut off when the main telephone is being used.

Fig. 4 illustrates one arrangement which is suitable for a private line of considerable length operating from a regular exchange battery, preferably centrally located with regard to the length of the line. This arrangement can be worked to good advantage between two stations situated in widely separated portions of a city. A regular central-energy telephone is used, and the sub-stations call each other by means of a push key located at the telephones. It is necessary that a line of this description extend through an office or exchange where ringing and talking currents are available.

In the circuit shown in Fig. 4, the apparatus located in the exchange consists of a retardation coil having two windings of 200 ohms each, these windings being associated in series with two 50-ohm windings of a balance relay and battery in such a manner that the current for talking purposes is fed through these windings to the line conductors at such times as the relay windings tend to neutralize each other. This relay neutralization occurs when the current flow through both windings is equal, as is the case when the receivers are off the hooks at the instruments, presuming of course that the line is well insulated. In this circuit when a push key is pressed at a sub-station it places a local ground on the sleeve or negative side of the line at this station, thus providing a path for the battery current to flow through one

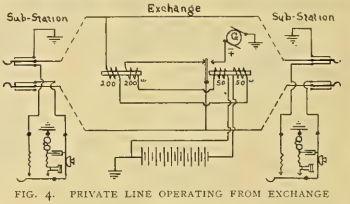


FIG. 4. PRIVATE LINE OPERATING FROM EXCHANGE BATTERY.

winding of the balanced relay which operates it, causing the armature to close contacts with the ringing generator (G). As the relay armature closes contact with the ringing current, both telephone bells which are connected to the tip side of the line are operated in multiple to local earth connections. A ground on the sleeve side of the line will, if it is of low resistance, allow sufficient current to flow through the relay winding to operate it and ring the bells, so it is absolutely necessary that the insulation be kept to a high standard.

If the local grounds pick up sufficient earth cur-

rents to cause noisy transmission these can be arranged in such manner that they will be disconnected when the switch hook is raised.

Sometimes it is desirable to have interior systems arranged in such manner that the different telephones have connection with a regular telephone exchange by means of a trunk line. This is accomplished in several different ways, but the better practice is to arrange the apparatus in such a way that the different interior telephones can call

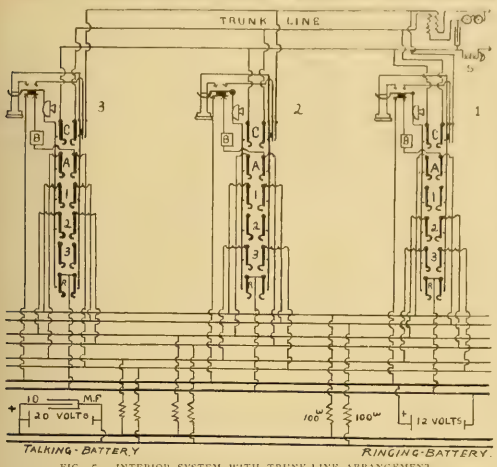


FIG. 5. INTERIOR SYSTEM WITH TRUNK-LINE ARRANGEMENT.

the exchange without receiving aid from any intermediate set.

It is also highly desirable for transmission purposes to retain the use of an induction coil for trunk-line conversations, and, unless all the telephones in the interior system be equipped with regular exchange apparatus, it becomes necessary to place the coil permanently in the trunk line. One system of this description is shown in Fig. 5, and is arranged in the following manner: Each interior telephone (1), (2) and (3) consists of a receiver and transmitter arranged to operate in series by means of the switch-hook contacts with the outer springs of the keys (C), (A), (1), (2), (3) and (R), associated with this telephone. The outer springs of these keys are bonded together in common, as shown in the diagram.

The keys at each telephone, with the exception of the (R) key, are arranged to be self-restoring, or in such manner that when one key is pressed it releases all other keys at this telephone to resume a normal position. This is accomplished by means of a sliding plate cam through which the key plungers operate. In the diagram the various keys at each telephone are for the following purposes: The key (C) is used in calling the exchange, as will be explained later; the key (A) is used in answering all calls; the keys (1), (2) and (3) are station keys and are used in calling the stations, and the (R) key is used for ringing.

In this system two separate batteries are used—one of 20 volts for talking purposes and one of 12 volts for ringing purposes. The talking battery has a bank of condensers equal to approximately 10 microfarads connected across its terminals to reduce cross talk, and the current supply is fed permanently to the various lines of the interior system through battery taps having 100 ohms retardation in series with them, as shown in the diagram in Fig. 5. These retardation coils reduce any cross talk and lessen the battery consumption.

The ringing battery is also supplied throughout by conductors common to all the telephones from which single taps are connected to the ringing keys (R), as shown. One ringing battery tap is brought up to a lower insulated switch-hook contact, where connection is made with the telephone bell when the switch hook is normal. As mentioned before, trunk-line connections are provided each telephone and the arrangement in this instance is to equip the trunk line with a suitable induction coil and apparatus in order that transmission over the trunk line be as nearly perfect as possible. During all conversations over the trunk line the telephones receive their current supply from the telephone exchange. The trunk line is also provided with a bell or other suitable means for receiving incoming calls in addition to a clearing-out signal (S), which is utilized to give notice of the completion of the trunk [illegible]

[illegible]

Pressing the [illegible] (R), while the [illegible] in contact, causes ringing current to flow over the side of the line (g) to the bell of station (3) and thence back to the ringing battery, thus causing the signal. The called person answers by pressing the (A), or answering button. The calling person can ring while his receiver is off the hook, in which position he is able to tell from ringing induction whether the bell of a called station is ringing or not. All the buttons and keys are automatically released by subsequent calls. In using the trunk line the key (C) is pressed, which connects the telephone apparatus by means of the key contacts through the induction coil properly for good transmission.

Incoming calls over the trunk line are answered first at the main interior telephone, which may be assumed to be station (1). From station (1) the desired person is called by means of the interior system, and after he has ascertained what is wanted he places his telephone in connection with the trunk line and completes the call. As

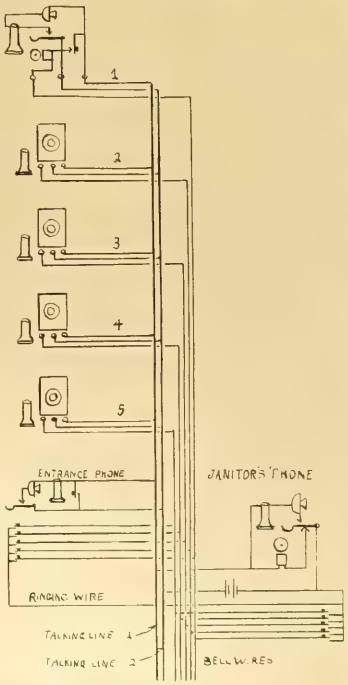


FIG. 6. TELEPHONE SYSTEM FOR APARTMENT HOUSE.

a precaution against confusion the trunk keys (C) should be normal at all times they are not in actual service.

One of the more modern uses that telephones are put to is in conjunction with flat buildings or apartment houses, where in some instances they have superseded the call bell and speaking tube [illegible]

[illegible]

[illegible] call when he is wanted [illegible]

A single [illegible] for both ringing and ringing purposes, and the [illegible] readily be located near the [illegible] where it can be maintained [illegible] In a system the tenants or [illegible] from the vestibule, and the latter can ring any of the tenants or be called by them. It is also possible for any two of the tenants to communicate with each other by calling the janitor, who can call the desired tenant and hold them in connection by means of his telephone apparatus. Systems of this kind can be designed and almost any condition. They are not expensive to install or maintain, and are a great improvement over any arrangement of speaking tubes.

Since the installation of interior systems necessitates the stringing of a comparatively large number of wires to each station connected, it is well to plan out a course of procedure which can be adopted to good advantage while doing the work. It is the usual practice to install wires of different color and adopt a color code by which the various lines can be easily identified. Such wires as are used for battery feeds are well insulated and usually have a higher carrying capacity unless the system be confined within a small space. It is good policy to use some form of a junction box or terminal strip where taps are taken from the main cables for the various telephones. These boxes or terminals will be the means of making a much more presentable and permanent installation, in addition to the advantages such construction offers in the location of any subsequent fault. The apparatus of these systems should be so installed that the least possible chance for trouble exists, especial care being exercised to avoid dampness or wearing effects. Much depends on the position chosen for the location of the batteries, which are usually dry cells. These should be located in a position free from dampness or any excessive heat.

TELEPHONE MEN.

J. J. Maloney has taken charge as manager of the local exchange at Albert Lea, Minn., of the Northwestern Telephone Exchange Company.

C. M. McClure becomes general manager of the Carolina Telephone Company at Tarboro, N. C., succeeding E. A. Holderness, who will continue as secretary. E. S. Paddison becomes auditor of the company.

N. O. Wood, manager of the Southern Bell Telephone Company in Greensboro, N. C., has resigned to go to Asheville, to take charge of the new plant of the Asheville Telephone Company. His successor is R. L. Boyd of Raleigh.

M. B. Overly has resigned as manager of the United States Telephone Company of Cleveland, to take charge of the construction of the Independent lines from Louisville to the gulf, which are being backed by a syndicate headed by Ed. L. Barber of Wauseon, Ohio.

The following promotions and appointements were made by the Bell Telephone Company of Canada, becoming effective on January 1st: L. B. Macfarlane has been appointed general manager, a new position; C. F. Sise, Jr., has been appointed general superintendent; W. H. Hayes has been named the district manager of the districts of Manitoba and Saskatchewan, and districts Nos. 3 and 4 will be combined under J. L. Richmond.

Telephone News from the Northwest.

The Osceola Farmers' Mutual Telephone Company of Osceola, Wis., has been organized with $25,000 capital stock.

The Grant County Telephone Company of Milbank, S. D., contemplates a bond issue of $30,000 for the purpose of extending and improving its line. The company has built 400 miles of wire since May last.

The Farmers' Telephone Company at Hecla, S. D., will build a line into Aberdeen.

The Minnesota Mutual Telephone Company has sold its lines at North Branch, Minn., and vicinity to the Tri-state Telephone Company.

The Bridgewater (S. D.) Union Telephone Company has sold its system to J. J. Henrich.

The Ettrick (Wis.) Telephone Company has filed articles of incorporation with a capital stock of $8,000. K. A. Knutson heads the list of stockholders.

K. McLean and others propose to build a telephone line from Miles City, Mont., down the Yellowstone River to Shirley.

The Mutual Telephone Company of Des Moines, Ia., has announced that it will spend $30,000 in improvements to its system in that city during the ensuing year. The company expended $375,000 on its system in 1905.

The Western Electric Telephone Company has authorized the expenditure of $200,000 in improvements to its lines during the year. The company's headquarters are at Des Moines, Iowa, and B. C. Way is secretary. R.

Indiana Telephone Items.

The Pocket Telephone Company of Evansville has applied for a franchise in Evansville. It is generally believed that franchises will be granted to both the Cumberland Telephone Company and the Pocket Telephone Company on equal terms.

The city attorney of Princeton insists that the Cumberland Telephone Company is without legal rights in the city, and the City Council has asked the company to accept a franchise, the terms of which the company says are far too exacting and burdensome. In the meantime the Independent interests are preparing to contest for the field.

The report that the Hope Telephone Company of Hope had been taken over by the Bell interests is denied by the officials of the Hope company. The officials say that they had a proposition from the Bell interests, but nothing was done to warrant the report given out.

The telephone situation in Indianapolis remains unchanged, although the indications point to a strenuous efforts to increase rates and otherwise modify the existing franchise. The people are not opposing the wishes of the Indianapolis company so generally as when the proposition was first made. They freely admit that the greatly extended service is worth more now than when it was first installed with a few thousand patrons. The new Board of Public Works, it is said, will increase the rate, and if so the council, it is thought, will ratify the increase. S.

Ohio Telephone Notes.

City Solicitor Northup of Toledo has prepared a bill for introduction in the General Assembly at Columbus, which will give city councils power to regulate telephone rates and readjust them every seven years. This bill has been brought about through the decision of the courts that city councils cannot fix a price for telephone service under present laws and that where a company voluntarily agrees upon a price it cannot be held.

Owners of the Oberlin Telephone Company of Oberlin are considering the advisability of installing an automatic board in their exchange.

The annual meeting of the Cuyahoga Telephone Company will be held on February 7th.

The Parkman Telephone Company has been taken into the Geauga County Telephone Association, which makes it possible for Chardon to give service over almost the entire county.

Owners of the Queen City Home Telephone Company of Cincinnati will endeavor to secure a franchise at Hamilton. A fight has been made by the Independents for a franchise in that city several times, but they have not been successful in getting the rights they desire. C.

Southeastern Telephone Developments.

The Asheville (N. C.) Telephone Company has prepared plans for a handsome new plant and building in that city, which will provide offices, rooms for switchboards and general storage space, the structure being three stories.

The Southern Bell Telephone Company is cutting in its new $200,000 plant in Lynchburg, Va., just completed. The plant is one of the most modern in the South, and will be ready for operation in a few weeks.

At the semi-annual meeting of the stockholders of the Georgia Telephone Company at Savannah, Ga., the directors declared a semi-annual dividend of 2½ per cent.

The Thomasville (Ga.) Telephone Company has been bought out by the municipality, and the town authorities will operate the system in the future. L.

Oregon Independent Telephone Association.

Independent telephone companies owning a network of telephone wires spreading throughout the state of Oregon giving connection between the principal cities and towns and focussing in Portland were united under the name of the Oregon Independent Telephone Association in Portland on January 4th. The purpose is to work as a unit to improve the Independent service in Oregon and to compete for business against the Pacific States Telephone Company, owner of the Bell lines.

For several years the Independent companies throughout the state have been trying to gain an entrance into Portland and have repeatedly applied for franchises. The construction of the automatic system now being installed by the Home Telephone Company has settled the difficulty. This company will be the chief factor in the new organization and will give to the other Independents the Portland connection of which they are desirous.

At the meeting the following men were present: F. H. Stow, Home Telephone Company; W. D. DeVarney, Corvallis Telephone Company; S. C. Hughes, Forest Grove Telephone Company; O. G. Wilkes, Hillsboro Telephone Company; J. W. Condon, Dalles Telephone Company; P. L. Brown, Silverton Telephone Company; Henry C. Chappelle, Woodburn Telephone Company; A. B. Flint, Scholls Telephone Company, and C. H. Morris, Dalles Telephone Company. There are also Independent systems at McMinnville, Albany, Browneville, Lebanon, Scio, Stayton, Turner, Chemawa, Newborg, Dayton and Sheridan. All of these companies will be asked to join the association. In addition to these the Home Telephone Company has been granted a franchise in Salem, and has applied for franchises in Eugene, Baker City and Pendleton, and these cities will also be connected with the Independent system as soon as the lines are installed.

The meeting was called at the instigation of W. D. DeVarney of Corvallis. A constitution was drawn up and adopted and the following officers were elected: President, F. H. Stow; vice-president, S. C. Hughes; secretary and treasurer, P. L. Brown. The executive board is composed of F. H. Stowe, P. L. Brown, J. W. Condon, C. H. Morris and O. G. Wilkes. The constitution is modeled after that of the Indiana Independent Telephone Association. The executive board is composed of F. H. Stow, panies owning 3,888 telephones actually in use. It is estimated that there are about 14,000 Independent telephones in the Willamette Valley alone.

GENERAL TELEPHONE NEWS.

L. R. Olson and others have organized a rural telephone company at Rake, Ia.

The Kansas Independent Telephone Association will meet in Wichita, Kan., on January 22d and 23d.

The Western Independent Telephone Company, Kansas City, Mo., has been incorporated, with a capital stock of $50,000.

The Ridley Telephone Company of Davenport, Okla., has been incorporated with a capital stock of $5,000 by R. C. Ridley, W. R. Ridley and others.

The board of regents of the University of California has decided to place a complete private telephone exchange in the university at Berkeley, connecting all departments.

The Palisade Mining Company, through R. F. Grisby, president, has petitioned the town authorities of Calistoga, Cal., for a franchise to maintain and operate a telephone line in Calistoga.

At the annual stockholders' meeting of the Morenci (Mich.) Telephone Company directors were elected and W. W. Crabbs was chosen president and manager. The secretary's report showed a substantial growth.

The following-named telephone companies have been incorporated recently: Rice Telephone Company, Hill City, Kan.; Palco Telephone Company, Palco, Kan.; Atlanta and Naples Telephone Company, Bryan's Mill, Texas; Adele Telephone Company, Adele, Mont.; Neola Mutual Telephone Company, Neola, Kan.

A strong remonstrance has been filed by the Citizens' Telephone Company of Grand Rapids, Mich., against the license ordinance now before the council, which provides that all local corporations shall pay a tax of 10 cents per year per pole. This will affect the street-railway company, the telegraph and the telephone companies. It has been estimated that there are from 35,000 to 40,000 poles involved.

A New York dispatch says that Attorney-general Mayer, after a hearing in New York, denied the application to have the attorney general begin legal proceedings to annul the charter and franchise of the New York Electric Lines Company, which was incorporated in 1882 to do a general telephone business. This company, with a franchise granted to it by the 1883 Board of Aldermen, was acquired recently by the Greater Eastern Telephone Company, which desires to use the franchise for business in Manhattan and the Bronx.

CORRESPONDENCE.

Great Britain.

London, January 3.—Although not coming within the general purview of such notes as these, the political situation in Great Britain at the present time is not without interest to engineers generally and electrical engineers in particular. The late Conservative government for the first time since 1888 made an attempt to deal with the law relating to electric supply in 1903, again in 1904 and yet again in 1905. The net result of all three attempts was to engender a feeling of disgust at the obvious manner in which the whole proceedings were carried out, viz., with no intention of accomplishing anything, and, as has been repeatedly pointed out, in 1905 we were working under the same general laws that governed us in 1888. In so far as the various public departments have been concerned, praiseworthy efforts have been made to bring things up to date; but naturally such efforts are limited with the old laws still in force. In addition there are many directions in which legislation, as it affects the electrical industry, needs reform.

Therefore the policy of the new government is being watched with interest, and a few indications have so far been given as to the intentions of the Liberal party in this connection. Apart from legislation of a general character, much needs to be done. The compilation of municipal accounts is an important item, and the ease with which the real condition of affairs can be hidden from the general public has often been drawn attention to. Therefore, from the municipal electric-supply point of view, one views with interest and satisfaction that the new president of the Local Government Board has drawn a reference and is appointing a committee so that ratepayers and taxpayers shall have their accounts presented in such a manner that he who runs may read and may have the knowledge which is not now always revealed as it should be.

A further interesting point raised by the new prime minister himself has reference to a more practical use of the waterways of Great Britain. The promise of a royal commission to inquire into the matter demonstrates a desire to deal with pressing home affairs, which has not altogether been in evidence for some years past. There is not a single instance of any magnitude in which mechanical traction of any kind in Great Britain has been adopted, in spite of the considerable mileage of canals which exists, and yet British electrical engineers are fully acquainted with the results of experiments with electric haulage and towing upon canals in America and on the Continent. It is not wholly legislation that has prevented the development of the use of our canals in the past, but no government hitherto has taken the initiative toward giving the manufacturer the full advantage of freight carriage by these waterways.

The first subway tramway in London is now complete and has been inspected by the Board of Trade. The line is less than a mile in length and runs under the new thoroughfare in the heart of London known as Kingsway. When it reaches the end of the new street it emerges to the surface and will continue as such to the northern part of London, as far as the horse lines in these districts have been reconstructed for electric traction. The whole of the northern horse lines will not come into the hands of the council until April this year, but certain new lines have been laid which will enable a service to be run from the center of London—where hitherto no tramway has penetrated—to a very populous district in the north. Single-deck cars will be used.

Everyone here interested in traction matters regrets exceedingly to hear of the death of Mr. Yerkes at a time when he was almost on the verge of witnessing the final fruits of his labors to introduce some law and order into the very chaotic condition of locomotion in London a few years ago. As has been reported in these notes, a complete electric service of trains is now being run upon the Inner Circle, a problem to which Mr. Yerkes specially devoted himself. And so successful has he been that with a headway of but a few minutes there is excessive overcrowding during the "rush" hours night and morning, when the trains carry double as many passengers standing as there are sitting.

But a still further triumph for Mr. Yerkes would have been for him to witness the opening of the several tube railways in London which he undertook to finance after they had lain for many years practically derelict. The two longest of these lines give most important cross-country connection between the north and the west, southwest and south of London. Some new all-steel cars for these tube railways have recently attracted some notice, and a few figures will be interesting when compared with the rolling stock now used upon the Inner Circle. The steel cars have an over-all length of 41 feet 8½ inches, an extreme width of 8 feet 8 inches, a height from floor to roof of 7 feet 6 inches, wheel-base 5 feet, seating capacity 54, weight 35,550 pounds, and weight per passenger seated of 657 pounds. Similar figures for the Inner Circle rolling stock, which is mainly wood, are, over-all length, 35 feet 8 inches, an extreme width of 8 feet 9 inches, height from floor to roof 8 feet 5 inches,

wheel base 6 feet 6 inches, seating capacity 52, weight of 47,600 pounds, and weight per passenger seated 918 pounds. Some of these new steel cars have just been delivered.

A winter sports club was opened in London in Christmas week, where all kinds of game are nightly held—thanks to the good service of the electric arc. G.

New York.

New York city, January 13.—It is unequivocally denied that there are no pending negotiations for the purchase of the Brooklyn Rapid Transit by the Interborough Rapid Transit Company. At the same time neither August Belmont nor Anthony N. Brady can be induced to talk on the matter.

The appraisers appointed to ascertain the damages to adjacent property caused by the construction of the Brooklyn subway have made an award of $1 against "an unknown property owner" in order that a test case may be taken to a superior court with respect to an instance of disputed ownership. Awards to the total amount of $33,000 have been announced in other cases.

An organization of citizens at Prospect Hill, a Brooklyn suburb, is taking steps to secure the placing of all wires underground and to regulate the conditions of any new traction franchises affecting their locality. They even think that the Rapid Transit Commission should be abolished. A similar organization in the Bedford district is fighting a proposal to run a surface line down Bedford Avenue and is preparing an appeal to the Legislature. The Bedford residents state that "while street railways are factors in the upbuilding of a city, they are usually a bar to its improvement." On the other hand, the Ridgewood Board of Trade has adopted resolutions calling for the construction of a subway to Jamaica via Myrtle Avenue and Richmond Hill.

The Behr Monorail Company has applied for a franchise to construct a line for suspended cars from Flatbush Avenue to Coney Island.

Senator Page on Wednesday introduced at Albany a new bill to regulate the price, quality and pressure of gas sold in New York city. The bill, which has some prospect of success this time, fixes the price of gas at 80 cents per thousand feet in nearly all parts of the Greater city.

Arthur Williams, general inspector of the New York Edison Company, after investigation of some complaints that since the price of electricity was reduced in July the monthly bills have increased to small consumers, avers that his company is entirely willing to investigate free of charge any inaccuracies, but at the same time he states that since the new tariff came into operation the company has been losing a large share of is income. Mr. Williams produced data gathered by his clerks. Comparisons were made in batches of 50 patrons in different localities. The chief object was to see whether these patrons were adding to their consumption of current. Fifty customers in the East Sixties showed a reduction in the bills amounting to 25 per cent. In another section an increased consumption of 12 per cent. was shown, with a decrease in the bills of 19 per cent. Fifty West Side houses showed an increased consumption of 11 per cent., and a decrease of 22 per cent. in the bills. Another batch of 50 patrons showed that there was less than one per cent. increase in the use of electricity, and that the decrease in the money paid the company was fully 33 per cent. Mr. Williams said there were two facts which could not be denied. One was that only the legal rate was being charged, and the other was that his company was willing to correct any error in a bill as the result of a meter being out of order.

The New York Edison Company reports an aggregate motor installation connected with its mains of 106,126 horsepower. The estimated number of motors is 40,000.

A bronze statuette of the late Samuel F. B. Morse has been presented to the Metropolitan Museum of Art.

Jacob Curtis, for 30 years telegraph and telephone operator at Bellevue Hospital, died at the hospital on Friday. He was an expert operator and did some extraordinary work in coding names during the Westfield disaster of 1871.

A. A. Ernst, E. Beckman and others have incorporated the Engineering, Light and Illumination Company of this city, with a capital of $20,000.

The Duplex Ignition Company, to manufacture electrical spark plugs, has been incorporated with a capital of $3,450.

H. L. Doherty, J. C. Andrews and H. C. Dreyer have incorporated as the Gas Securities Company of New York for the purpose of promoting gas and electric companies. The authorized capital is $1,100,000. D. W. W.

Dominion of Canada.

Winnipeg, Man., January 13.—A proposal has been made to the city of Winnipeg that an issue of bonds be put on the market to raise money to cover the expenditure of the city's electrical department. A new power house will shortly be required. The Winnipeg high-pressure system is about to become a certainty, as the city has selected the site for the pumping station, and work will be pushed immediately. The proposed pump and engine [illegible] gas engine [illegible]. The total cost [illegible] $150,000 [illegible] of two generators.

The Winnipeg [illegible] the Railway Company [illegible] ment to [illegible] way Company [illegible] applied to the Winnipeg City Council [illegible] tion to be laid on the street [illegible] tem into the heart of the city. The [illegible] been referred to the legislative committee.

The Niagara Power Company has promised the Toronto Street Railway Company to [illegible] for its use by April 1st. The [illegible] been ready for it for months [illegible] promise to furnish the power [illegible]. A total of $125,000 has been expended on the [illegible] to transmit the new power.

Orillia, Ont., has been granted permission by the Ontario Legislature to issue $[illegible] of debentures this year for the improvement of its electric light plant and to make additions to the same. This plant is run by the municipality.

The City Council of Toronto has entered into a contract with the Toronto Electric Company to light the streets with open arc lamps for a term of five years at $69.35 per light per annum. The present price is $74.82.

The location and plans for the Western Ontario extension of the Toronto, Hamilton and Niagara Power Company have been filed with the minister of railways for approval. The proposed extension does not at present go west of London; it touches Brantford, Galt, Paris, Woodstock, Ingersoll and other manufacturing centers between Hamilton and London.

Willis Chipman of Toronto has prepared complete plans and estimates to develop waterpower situated 12 miles from Prince Albert and to convey it to Prince Albert for light, heat and power purposes. Plans will be shortly submitted to manufacturers for estimates on necessary electric equipment. H.

Ottawa, Ont., January 13.—For the last four years the town of Almonte, Ont., has owned and operated the electric-light system of the town, furnishing business and domestic light as well as street lamps. During this period the yearly profit is said to have been about $1,500 after providing for operating expenses, interest, repairs and a sinking fund. In addition to this the citizens are getting their lights at prices 25 per cent. less than what they formerly paid the private company.

One of the most interesting papers read before the Dominion forestry convention, held at Ottawa on the 10th, 11th and 12th inst., was that of Mr. C. B. Smith of the Temiskaming railway, respecting waterpowers. Referring to damage to forests by sparks from the locomotive, he said that the remedy lay in the substitution of electrical energy for steam, and he ventured the opinion that such would be the policy of many of the railroads within a short time. He showed the economic advantages of electrical operation, particularly in the vast saving in coal. This not only applied to railways but to manufacturing industries, the development of which has been retarded by the great lack of fuel and the great cost of importing coal. In southwestern Ontario the lands are now cleared for farm purposes, thus rendering almost useless the waterpowers on the rivers. As this land is too valuable to permit reforestation, the district will have to depend on Niagara for its electrical energy.

Negotiations are stated to be in progress between the management of the Canadian Pacific railway and a leading electrical power-development company in the province of Quebec with a view to supplying the electrical energy which the railway will require when it begins to operate its trains by electricity. W.

[illegible]

The Dayton [illegible] Company [illegible] has been [illegible] $100,000 [illegible]

The capital [illegible] Light and Power Company [illegible] creased from $20,000 to $[illegible]

Ohio.

Cleveland, January 12.—G. M. Pierce, an official of the Cleveland and Sharon Traction Company, states that the road from Middlefield, Ohio, to Sharon, Pa., will be completed the coming summer and that a line will be built between Warren and Jefferson, as planned.

Judge A. C. Thompson of the United States District Court has entered decrees of foreclosure against five of the roads in the Appleyard system, and unless certain judgments are satisfied within five days from that time, they will be sold. General B. R. Cowan, clerk of the United States court, and Attorney A. B. Vorhies were appointed commissioners to conduct the sales. The upset prices fixed upon the various roads are as follows: Urbana, Bellefontaine and Northern, $175,000; Dayton, Springfield and Urbana, $300,000; Columbus, London and Springfield, $250,000; Central Market Street railway of Columbus, $150,000; Columbus, Grove City and Southwestern, $35,000.

At the meeting of the mayors of Ohio in Columbus a few days ago it was recommended that a bill be passed by the present Legislature permitting the renewal of street-railway franchises to other than existing companies. This is for the purpose of getting around the trouble encountered a short time ago in attempting to grant a renewal

Michigan.

Grand Rapids, Mich., January [illegible].—The long-standing dispute over the [illegible] Company's franchise has been [illegible]. M. B. Wheeler has filed [illegible] amended franchise, which [illegible] increases the present $100 franchise [illegible] mate franchise fee of $500.

The building committee of the [illegible] has decided to install a new [illegible] the City Hall and will soon advertise for bids. The estimated cost has been placed at $[illegible].

The Grand Rapids-Muskegon Water Power Electric Company has taken out a permit for the erection of a brick substation for power purposes. The cost is given at $6,000.

The M. B. Wheeler Electric Company has been awarded the contract for the electrical equipment of the Michigan Plaster Company's plant at Grandville. The company will install a generator, switchboard and six large motors. The company has also secured the contract for installing an electric plant at Hackley, Wis., for the Hackley-Phelps-Bonell Company. This will consist of a 15-kilowatt generator, engine, switchboard, and wiring for 200 incandescent lamps.

M. Fitzpatrick of the Globe Hotel of Alpena has contracted for machinery for a private lighting plant, which is to be installed at once. A 15-horsepower gasoline engine and dynamo are included in the outfit.

Judge Fred W. Mayne of Charlevoix proposes, in behalf of a syndicate, to furnish electricity to Petoskey at the rate of four cents a kilowatt for lighting and 2½ cents for commercial purposes, the distribution to be in the hands of the city. He also proposes to buy the Petoskey lighting plant, if it is offered for sale. The power is to be generated at a dam on the Pigeon River, in Cheboygan County. Though the rate offered is lower than Petoskey can produce it, the proposition will be opposed, it is said, by those who believe in municipal ownership.

The Port Huron Light and Power Company announces a decided reduction in the rate for commercial lighting. Last spring the company made a cut in its rates for residence lighting, amounting to a reduction of 20 per cent. January 1st a differential rate was made to apply to all lighting service except residence lighting. The new rate will be 15 cents a kilowatt-hour for the first 30 hours used per month for lamps, and five cents a kilowatt-hour for all current used in excess of that amount. The present rate is straight 15 cents.

The Pere Marquette Light and Power Company has given notice that its officers will appear before the Shelby council and ask for a franchise to sell electricity for lighting and power purposes. The company already controls the lighting system at Pentwater and has asked the Hart council for a franchise and contract. The company is capitalized at $150,000. If there is not enough demand to use up its 1,100 horsepower, another company will be organized, it is said, to operate an electric road between Hart and Pentwater. B.

Indiana.

Indianapolis, January 13.—The Indianapolis, New Castle and Toledo Electric Railway Company has opened a suite of offices in the Traction Terminal Building in Indianapolis. The company will begin the construction of a through line from Indianapolis to Toledo, with radiating branches to several Indiana towns early in the spring. The preliminary work and financing is all done. D. M. Perry is president and C. S. Hernley secretary.

Franchises were secured during the last week

through Tipton and Clinton counties for an electric railway between Tipton and Frankfort.

A 15-mile electric line is to be built at once to connect Matthews and Marion. The line will be built by the Marion, Matthews and Muncie Traction Company.

The Louisville and Southern Indiana Traction Company closed a deal this week for a site in Jeffersonville on which to build a large plant for generating electricity. The site adjoins the building now used to supply the electricity for the various utilities controlled by the traction people in Jeffersonville and New Albany.

The Wabash Valley Traction Company has surveyed a route on each side of the Wabash River for the extension of the company's line from Logansport to Lafayette, and there is now a spirited fight between the citizens of the east and west side of the river for the road. The same condition exists in the case of the Indianapolis, Columbus and Southern Traction Company, which has surveyed a route on each side of White River for its Seymour extension.

The Holland Palace Car Company of Indianapolis has been placed in the hands of a receiver. The company was organized in 1903 to manufacture sleeping and buffet cars for use on traction lines. After building two elegant cars disputes arose over patent rights and the company became insolvent. In this connection it is the belief of several prominent traction men that sleeping cars are impractical on electric railways for many reasons. They say cars are too narrow for double berths. There will be, however, elegant parlor and cafe cars run on the Indiana and Ohio system.

The electric railways operating in the city of Indianapolis pay taxes on a valuation of more than $4,228,740.

The final survey of the Vincennes, West Baden and Petersburg traction line has been completed and the company will remove its office from Vincennes to South Bend. Work on the construction of the road will begin February 1st.

The American Window Glass Company of Hartford City has combined the five electric switchboards formerly operated on each side of the tank, and now one man can operate 10 blowing machines, whereas 10 men were required before. Other changes have been made through the introduction of electricity that will greatly reduce the cost of making glass.

The lighting plant of the new Federal Building in Indianapolis was completed last week and for the first time the whole building from basement to garret was brilliantly illuminated. Government Inspector Fourcha was greatly pleased with the plant.

A special course of lectures on "Alternating-current Electricity," covering 10 weeks, has been arranged by the Indianapolis Young Men's Christian Association, the first to be given this week by P. G. Winter, electrical engineer for the Jenny Electric Company. There will be an elementary class and an advanced class. S. S.

Southeastern States.

Charlotte, N. C., January 13.—A policy is being worked up by commercial and other bodies in Baltimore, Md., to provide for all future times against litigations and misunderstandings relative to the entry into the city of interurban lines. The Washington, Baltimore and Annapolis electric railway has sought such entrance into the city, while the United Railways and Electric Company operates all of the city lines and routes. The new arrangement is said to be of broad principles and in no way antagonistic to any existing corporation.

At a meeting of the directors of the Macon (Ga.) Electric Railway and Light Company, contracts were confirmed for about $85,000 improvements in the local system. New machinery will be installed and the capacity of the plant enlarged.

The Georgia Manufacturing and Public Works Company of Marietta has been organized to take charge of the Marietta Electric Company and other utilities, the capital being $600,000. Moultrie Sessions is president of the company.

The town of Yorkville, S. C., is to be lighted by electricity from the Catawba Power Company's plants on the Catawba River.

The Southern Light and Power Company of Atlanta, Ga., has applied for the right to do business in that city and a number of surrounding points. The company may increase its capital at will to $1,000,000, and proposes to furnish light, heat, etc., and do a general electrical business.

The United Railways Company and the Washington, Baltimore and Annapolis railway have settled their differences regarding the use of the third rail, and a bill has been introduced in the second branch of the City Council of Baltimore providing for a third rail on the disputed streets. The Washington, Baltimore and Annapolis has secured property in the heart of the business section of Baltimore for terminals, it is said, and if the desired ordinances are passed it is believed that the proposed improvements will be forthcoming. L.

Texas.

Austin, January 11.—The proposition to build an interurban electric railway between Austin and Lockhart is still under consideration by a syndicate of New York men. Engineer C. P. Scrivener has completed the preliminary survey. The principal difficulty is in providing means for crossing the Colorado River.

J. W. Russell and associates who recently obtained control of the street-railway system at Bonham are preparing to make important improvements and extensions.

It is said that the Houston-Galveston interurban electric-railway project is now on a solid financial footing and that the road is finally to be built. The original plan of running the line direct to Virginia Point, across the bay from Galveston, has been changed and the road will run from Houston to Laporte via Genoa.

The project of building an electric railway from Brenham to some point on the Missouri, Kansas and Texas railroad has assumed definite shape. The citizens of Industry have organized for the purpose of lending substantial encouragement to secure the building of the proposed line to that place. B. E. Knolle of Industry can give information in regard to the proposed line.

Emmett Landry is promoting the organization of a new electric-light and power plant for Beaumont.

McCarthy, Starnes & Co. of Lufkin will install an electric-light and power plant in that place.

The Houston Lighting and Power Company, with a capital stock of $1,000,000, has obtained its charter. The incorporators include A. H. Ford of New York, Henry P. Dart of New Orleans and J. W. Terry of Galveston. W. H. Chapman remains with the new company as general manager. H.

Mexico.

City of Mexico, January 10.—The installation of a hydro-electric plant at the falls of the Piaxtla River in the state of Sinaloa is to be made by the Compania Minera Guadalupe de los Reyes, which owns several mines in the Cosala district. The plant will have a capacity of 5,000 horsepower and will cost about $800,000. The plans for the plant were prepared by Robert McF. Doble, an electrical and hydraulic engineer of San Francisco.

It is announced that engineers of La Electra, S. A., the Spanish light and power company of Guadalajara, are studying a project to utilize the power of the Santiago River between Las Juntas and San Cristobal and transmit the current to Aguascalientes, a distance of more than 100 miles.

Miguel A. Lopez of the City of Mexico has obtained a concession from the federal government for the erection of a large electric power plant on the Yaui River near Sahuaripa. It is stated that the proposed plant is to provide power for mines and industries of the Sahuaripa district.

Paul Ginther of Santa Rosalia has gone to Paris, France, on business connected with the organization of a French company to develop his hydro-electric plant on the Conchos River, 27 miles above Santa Rosalia. About $50,000 has been expended upon the preliminary work. A large amount of engineering work, such as surveys, maps, plans and estimates, has been done.

The concession of L. Iwansky of Parral for an electric power plant in the Parral district has been taken over by Pittsburg men and a company is being organized. The company will also erect ore-reduction plants in the Parral district with an aggregate capacity of at least 1,000 tons daily. The work of installing a temporary electric power plant near Parral has been started.

James H. Lasdon, an electrical engineer, has been investigating the situation in Durango on behalf of an American syndicate with the view of installing a new electric-light and power plant for the city of Durango. It is also proposed to construct an electric street-railway system in Durango.

The authoritive announcement is made that La Electra, the light and power company of Guadalajara, in which Spanish capital is principally interested, will issue additional bonds to the amount of $2,000,000. It is estimated that the rebuilding and equipping of the company's street railway, the construction of a new power house at the falls of Juanacatlan and the construction of a central station in Guadalajara will cost bout $3,000,000.

W. D. H.

Northwestern States.

Minneapolis, January 13.—The Twin City Rapid Transit Company will construct a new transformer station at Lake Street and Chicago Avenue, Minneapolis, which will distribute power to all car lines south of Lake Street, including the new interurban line to St. Paul. The new building will be of brick and concrete, 40x72 feet in size.

The St. Anthony Falls Power Company has begun work in connection with the project of establishing a big electric plant at St. Anthony Falls, Minneapolis, and developing about 6,000 more horsepower for manufacturing purposes. William de la Barre, chief engineer of the company, will have charge of the work.

The City Council at Muscatine, Iowa, has granted track and terminal facilities to the Cedar Rapids and Iowa City Railway and Light Company for a line from Iowa City to Muscatine. This insures the building of the road and work will be started early in the spring.

Two franchises for electric street-railway lines have been asked of the Milwaukee council. The Milwaukee Northern Railway Company proposes to build into the city from the north and the Chicago and Milwaukee Electric Railway Company from the south. The former company has also asked for franchises at Sheboygan, Fond du Lac and other towns.

Noah Newbanks of Pierre, S. D., and Frank Fischer of Fort Pierre have applied for franchises in the two cities for an electric railway which will connect the two towns.

The Westinghouse Electric and Manufacturing Company is preparing plans for the West Side Heat and Light Company, which proposes to build a 3,000-horsepower light and power plant in the West Side of St. Paul.

C. W. Heckel of Prescott, Wis., will apply for a franchise for an electric-light plant at Farmington, Minn.

A stock company has been formed at Waterville, Minn., and will incorporate for the purpose of building an electric-light plant to cost about $8,000. C. H. Birch is president of the new company and C. A. Backman, secretary. R.

Pacific Slope.

San Francisco, January 12.—The first of the nine space-telegraph plants to be installed in the near future on the Pacific Coast has been shipped to Point Arguello, Cal., where it will be erected by electricians from the Mare Island Navy Yard. The Union Gas Engine Company of San Francisco has constructed for the Navy Department eight gas engines for the new stations. Each of the generating sets consists of a Westinghouse 150-volt direct-current generator direct connected to a Union gas engine using kerosene. The installations will vary from a three-kilowatt generator driven by a seven-horsepower double-cylinder engine to a 15-kilowatt generator driven by a 30-horsepower three-cylinder engine. A sectional mast 150 feet high will be erected at Point Arguello Station.

The Metropolitan Laundry Company of San Francisco is to have one of the largest plants in the United States, covering a lot of 275 feet square. All of the machinery will be electrically driven by motors taking current from a direct-generating plant to be installed in a power house separate from the main building. The contract for the complete oil-burning steam-driven generating plant has been awarded to the Risdon Iron Works of San Francisco for $41,025. This includes two 150-kilowatt generators, switchboards and all electrical work except the motors and wiring.

The North Mountain Power Company of San Francisco, which has a hydro-electric plant near Junction City, Trinity County, Cal., and transmits power to Eureka at 30,000 volts, has closed a contract with Hunt, Mirk & Co. for an additional generating unit. This will be installed in the auxiliary steam plant at Eureka, which carries a good deal of the lighting load of Eureka. The additional installation includes a 500-kilowatt Westinghouse-Parsons turbo-generator set, three-phase, 2,400 volts and 60 cycles.

The Town Trustees of Palo Alto, Cal., have called for an election on Janury 24th to vote upon the proposition of issuing bonds to the amount of $90,000, of which $50,000 will be used in improving the municipal lighting plant and water system.

The Mono Power Company has been incorporated in San Francisco with a capital stock of $3,000,000 by J. G. Quinn, J. P. Allen and associates.

The City Trustees of San Luis Obispo, Cal., are advertising for bids for a franchise to construct and operate an electric-lighting and distributing system in San Luis Obispo. Bids will be opened on February 6th.

John L. Murray of Olympia, Wash., has applied to the Olympia municipal authorities for a franchise to construct a pole line and lay conduits for the distribution of light, power and heat in that city. Mr. Murray plans to erect a plant at a cost of $10,000.

A. Welch of Salem, Ore., has been granted a franchise to construct and operate an electric-light and power system in Corvallis, Ore.

The Washington Water Power Company of Spokane, Wash., is arranging to double-track all its important street-railway lines in Spokane.

The Spokane Electric Railway Company has been incorporated at Spokane, Wash., with a capital stock of $250,000. The incorporators are Francis H. Cook, D. C. Cook and Austin Gubson.

H. W. Goode of Portland, Ore., has purchased the entire corporate stock of the Vancouver Electric Light and Power Company of Vancouver, B. C. About $50,000 will be spent in improving the system during the present year.

W. D. Valentine, J. M. Duke, M. V. Kellogg, S. L. Phillips, John H. Marble, J. D. Lederman and others of San Francisco are promoting the organization of a company to construct and operate space-telegraph systems. The company will have a large capital stock and will be incorporated under the laws of Oregon. A.

PERSONAL.

Bernard Hartley, for 10 years manufacturer of electrical apparatus, has accepted a position with W. Scheidel & Co. of Chicago, manufacturers of X-ray apparatus. Mr. Hartley is well known

throughout the West, and his friends will wish him success in his new work.

Charles W. Hurd has been appointed city electrician at Stillwater, Minn.

R. H. Sharp has resigned as general manager of the People's Light, Heat and Power Company of Springfield, Ohio.

Owing to ill health, Mr. A. P. Seymour, vice president and treasurer of Pass & Seymour, Inc., Solvay, N. Y., has retired from business and will hereafter make his home in Southern California. Mr. Seymour's stock has been acquired by the interests which have been identified with the company since its inception 15 years ago.

Irving Moultrop of the Boston Edison Company, representing the steam-turbine committee of the National Electric Light Association, has sailed for Europe to investigate turbines. It is the intention of the committee this year to report on the progress of the steam turbine here and abroad; also to include in its work an investigation of gas turbines.

Friends of William J. Hammer of 153 West Forty-sixth Street, New York, will be grieved to learn of the death of his wife, Mrs. Alice M. White Hammer, which occurred on January 12th. Mrs. Hammer was in her forty-third year and had been suffering from a tubercular complaint for two years. The funeral took place at Cleveland, Ohio.

Warren Bicknell, president of the Lake Shore Electric Railway Company, was presented at his home in Cleveland with a handsome hall clock. Every man in any way connected with the company had contributed to the fund for the purchase. Mr. Bicknell retired from the presidency of the company on January 16th. He has served in the office two years and a half. Mr. Bicknell has been elected president of the Cleveland Construction Company of Akron, and the headquarters of the company will be moved to Cleveland.

E. W. Lloyd has been made contract agent of the Chicago Edison Company, succeeding John F. Gilchrist, promoted to be assistant to the president. Mr. Lloyd has been assistant superintendent of construction, and takes high rank in the staff of capable men which has made the Chicago Edison Company successful. He is an authority on the sale of electricity for industrial purposes, and as chairman of the committee on "Purchased Electric Power in Factories" his reports to the National Electric Light Association have permanent value.

Friends of James G. Pomeroy, western sales manager of the Adams-Bagnall Electric Company, will be sorry to hear that Mrs. Pomeroy and daughter Catherine were injured in a wreck near the terminal station at St. Louis last week. Mr. Pomeroy, with his wife and daughter, were starting on a trip to the Pacific Coast. They were in the Pullman car Harcourt, attached to a Wabash train, and in the wreck the car they occupied fell 15 feet to the granite pavement. Mrs. Pomeroy was badly injured, but her condition is now reported as not serious. Miss Catherine received some painful cuts in the face and Mr. Pomeroy escaped uninjured.

Marshall Field, who died on January 16th, was the foremost citizen of Chicago, and perhaps the world's greatest merchant. He leaves a vast fortune and a name synonymous with business honor and integrity. While not directly connected with electrical pursuits, he took a lively interest in the progress and development of the electrical industry. Among the earliest isolated electrical plants in Chicago were those installed in his retail and wholesale establishments, although subsequently central-station service was substituted. Mr. Field was a large stockholder in the Chicago Edison Company. With him in New York when the end came was Robert T. Lincoln, first vice-president of the Chicago Edison Company, and an intimate friend.

The electrical fraternity will be pleased by the knowledge that Governor Deneen of Illinois, in his effort to rid the state charitable institutions of politics and place them on a thorough business basis, has chosen Bernard E. Sunny of Chicago, western manager for the General Electric Company, to be president of the board of trustees of the Kankakee Insane Asylum. The acceptance of Mr. Sunny, who is a very busy man, was only secured after much persuasion on the part of the governor. Mr. Sunny is not without experience in public affairs. He was formerly president of the Civic Federation of Chicago, was prominent in the charter-amendment movement and is a delegate to the present charter convention. He was also at one time a trustee of the St. Charles Home for Boys.

B. E. SUNNY.

ELECTRIC LIGHTING.

St. Benedict's Academy at St. Joseph, Minn., will install an electric-light plant.

Fire in Beresford, S. D., [illegible] the electric-light plant [illegible]

[illegible] J. N. Smith and [illegible] plant.

The Hay City (Kan.) Electric Light Company has been incorporated, with [illegible] $12,000.

The Riverside Light and Power Company of Abilene, Kan., has been incorporated with a capital stock of $50,000.

The Hennessey (Okla.) Electric Light, Power and Ice Company has been incorporated with a capital of $15,000.

It is reported that the Metropolitan Street Railway Company of Kansas City, Mo., will [illegible] an electric-light plant for Burlington Junction, Mo.

Lake City, Fla., will install waterworks and an electric-light plant for a population of 10,000 to 15,000. J. C. Sheffield is chairman of the Board of Public Works.

F. A. Platt, W. L. Jenks and H. L. Handley of Hoopeston, Ill., have incorporated as the Hoopeston Gas and Electric Company. The capital is placed at $200,000.

The Empire Construction Company of Birmingham, Ala., has been incorporated to operate electric-light plant, waterworks and steam-heating plant. Ross C. Smith is president.

The electric-light plant, gas plant and street car system in Muscatine, Iowa, belonging to local persons, has been sold, it is reported, to a syndicate represented by J. H. Brown and George Mayer of Chicago, for $750,000.

A conspicuous departure in the lighting of canals is that of the Welland Canal, near St. Catherine, Ont. Over 600 alternating-current series arc lamps have been provided by the Canadian Westinghouse Company, and these have been in operation for the last few months, and have given good service.

The Pere Marquette Railroad Company is preparing to light its own premises in Bay City, Mich., by electricity. Dynamos and boilers will be installed in the new warehouse now being constructed to light warehouse, passenger depot and yards. The lights in use will be the equivalent of 700 16-candlepower incandescent lamps.

It is rumored in electrical circles in Grand Rapids, Mich., that there is a strong possibility of a consolidation between the Edison company and the Grand Rapids-Muskegon Electric Water Power Company. This rumor has not been confirmed, but it is said that the latter company has not shown any particular anxiety about securing a franchise into Grand Rapids, in spite of the fact that the company has promised to deliver power in the city by the end of February.

ELECTRIC RAILWAYS

The Omaha (Neb.), Bellevue and Southern Interurban Company has been incorporated to build a trolley line from Bellevue to Fort Cook, Neb.

The Butte Electric and Gas Company of Butte, Mont., is having plans drawn for the construction of an electric railway to the Galliton mining district.

Hugh Holmes, president of the Ottawa (Kan.) Finance Company, is promoter of the electric road to be built from Olathe to Ottawa. The road will be built in 10-mile sections. Contracts will be let at once.

The stockholders of the York (Pa.) Street Railway Company and its 10 affiliated companies have re-elected Captain W. H. Lanius as president, and the following-named directors: J. W. Stacey, George Billmeyer, W. F. Bay Stewart, George P. Smyser, Grier Hersh and W. A. Himes.

Hodenpyl, Walbridge & Co. of New York, who bought the Bloomington and Normal street railway, heating and lighting system for $1,000,000, have sold the property to the McKinley syndicate, which is building and operating interurban lines throughout Illinois. The purchasers already own the Consumers' heat and light system and interurban franchises in Bloomington.

Arguments have been concluded in the Supreme Court at Washington, D. C., on the Chicago traction cases. Owing to the length of the record and many of the legal questions involved the court is likely to take some time over the case. The Chicago City Council at its meeting this week voted to take up the various ordinances and amendments, in committee of the whole on Thursday of this week.

H. H. Vreeland, president, and Orin Root, general manager of the New York City Railway Company, declare that the Madison Avenue surface line, which is an underground-trolley system, instead of having proved a failure during times of storm in winter, has been more capable of handling its traf-

[illegible]

At a meeting of the directors of the Metropolitan West Side Elevated Railroad Company, [illegible] committee [illegible] H. G. [illegible] and Charles H. [illegible] began an immediate investigation [illegible] securing additional power for the road. [illegible] mittee will report the result [illegible] at a special meeting of the directors [illegible] committee will decide between a new [illegible] to cost $200,000 or a contract [illegible] Edison Company. The latter [illegible] equipment in addition to supply power [illegible] the Metropolitan requires.

The report of the gross earnings of the United Railways Company of St. Louis for the fiscal year shows an aggregate of $8,436,044. While this represents a decrease of about $1,500,000 from the 1904 figures, it shows a big gain over the earnings for 1903, which may be regarded as a normal year. The 1904 earnings were exceptionally large because of the heavy traffic on the St. Louis street railways incident to the World's Fair. The earnings for the last year have shown a gain of about 15 per cent. over the 1903 figures. The common stock of the United Railways Company of St. Louis, $18,000,000 of which was purchased by the North American Company last spring, representing the control, has nearly doubled in market value since the North American Company bought it.

POWER TRANSMISSION.

The Niagara Falls Electrical Transmission Company is asking leave to increase its capital from $1,000,000 to $5,000,000, and to construct transmission lines of capacity sufficient for at least 50,000 electrical horsepower. The company distributes the current generated by the Electrical Development Company of Ontario, Canada, among the contiguous counties in New York state.

Articles of incorporation for five companies will be filed soon in San Diego, Cal., it is said, the capital aggregating $6,000,000. The companies have been formed for the purpose of developing the waters of the San Luis Rey River, and building dams and reservoirs to generate electric power for the Pacific Light and Power Company of Los Angeles. It is planned to complete the first dam in 14 months.

The Coosa River Electric Power Company of Anniston, Ala., will issue $300,000 of 25-year bonds for development work. The plans have been made so that the work of building dam and powerhouse and contracting for the electric and hydraulic equipment for a capacity of 7,500 horsepower can be proceeded with at once in order to have plant in operation by January 1, 1907. Robert R. Zell is engineer in charge. The company's office is in the First National Bank Building, Birmingham, Ala.

Water has been turned onto the two large turbines in the power plant of the Animas Power and Water Company of Durango, Colo. After an expenditure of two years of time or more and $1,000,000 in money, the plant is at last supplying its customers in Silverton, and as far as Ouray, with electric power. The plant is located on the Animas River, at a point about 12 miles from Durango, and is destined to be one of the largest electric generating plants in the West. H. T. Henderson, who originated all the plans for the plant and who is the general superintendent of the company, says that even now they have orders for much more power than can be delivered. The company will increase the present height of its dam to 100 feet, which will enable the reservoir to hold 3½ billion cubic feet of water. This will cover an area of 1,160 acres. When the plant is finally complete it will generate 40,000 horsepower. This will involve the expenditure of $3,000,000 and five years of time. The plant will supply power for the mines of the entire southwestern portion of Colorado.

PUBLICATIONS.

The Westinghouse Electric and Manufacturing Company is distributing a large assortment of advertising blotters of pleasing design.

The Allis-Chalmers Company of Milwaukee has issued a new bulletin on the Tremain steam stamp. Other machinery described includes ore crushers, vanning machines, etc.

A circular has been issued by the Indiana Dynelectron Company of Indianapolis which explains accurately what the dynelectron is and the possibilities which the future may hold for it.

Direct-current generators made by the Robbins & Myers Company of Springfield, Ohio, are described in a recent bulletin. These generators are designed with special reference to their use in small isolated incandescent lighting plants.

The National Electric Company of Milwaukee has issued another of its tasteful mailing cards, this time devoted to the type N motor. The motor illustrated is one of the 1,000 built for the Union Electric Light and Power Company of St. Louis.

Single-phase induction motors of one-tenth to one-eighth horsepower, built by the Emerson Electric Manufacturing Company of St. Louis, form the subject of a new bulletin. These motors are of the "condensed" type, full-load automatic start. The bulletin tells all about them.

The H. T. Paiste Company of Philadelphia, Pa., is distributing bulletin No. 28, which is devoted to fusible hanger boards, Paiste panelettes and Paiste taplets. Some interesting illustrations of these devices are contained in the bulletin, together with clear and accurate descriptions of the parts.

Sprague direct-current type-D motors are made the subject of an unusually attractive bulletin issued by the Sprague Electric Company of New York. The type-D machines are described in detail, with dimension drawings, and a few examples of their use shown by several half-tone illustrations in the back of the bulletin.

The Westinghouse Electric and Manufacturing Company has placed on the market a new line of core-type transformers, known as the type C., which are described in circular No. 1126. They are simply an addition to the many standard forms, so that Westinghouse transformers of any desired form and construction may be obtained to meet the varying demands of present-day light and power service.

Bulletin No. 265 of the Stanley-G. I. Electric Manufacturing Company, on the subject of the Paragon factory-type electric sewing-machine transmitter, has just been issued. The Paragon transmitter embodies a device in which the drive between the sewing machine and the transmitter itself is positive. A gentle pressure on the treadle opens a switch and starts the motor. Further pressure gradually speeds up the machine.

An assortment of new advertising literature is being distributed by the General Electric Company of Schenectady, N. Y., one of the most attractive pieces being a catalogue describing varnished cambric cables. The frontispiece of this book is a reproduction in colors of a panel bearing samples of General Electric cables. There are also contained some valuable tables relating to wire and its properties. Illuminating engineering as applied to interior lighting is the subject of a special bulletin which contains some attractive illustrations, showing efficiently lighted interiors. Other literature describes 220-volt direct-current enclosed arc lamps, double push-button flush pocket switches, competition knife switches, field coils, pole-line oil switches, etc.

SOCIETIES AND SCHOOLS.

Prof. George Davidson, president of the Geographical Society of the Pacific Coast, and a member of the faculty of the University of California, has received a telegram from Raoul Amundsen, who made his way through the Northwest Passage, asking about the facilities for making his final magnetic observations in San Francisco. A reply has been sent that facilities and help will be given by the University of California and the California Academy of Science, the Technical Society and the Geographical Society of the Pacific Coast.

The two-hundred-and-third meeting of the American Institute of Electrical Engineers will be held in the assembly room of the New York Edison Company, 44 West Twenty-seventh Street, New York, on January 26th, at 8:15 p. m. The following papers will be presented and discussed: "Central-station Economics," by Henry G. Stott, superintendent of motive power, Interborough Rapid Transit Company; "A Self-exciting Alternator," by E. F. Alexanderson, electrical engineer of the General Electric Company, Schenectady, N. Y.

At the annual dinner of the Pike's Peak Polytechnic Society, held in the Antlers Hotel in Colorado Springs recently, Bion J. Arnold of Chicago was the guest of honor. Professor William Strieby, president of the society, introduced Mr. Arnold, who, as the speaker of the evening, talked on the electrification of steam railroads. On this subject, with which Mr. Arnold is so familiar, he spoke very encouragingly of the future for electric power on steam railroads. His remarks were largely along the line of his presidential address at the convention of the Institute in St. Louis, and he repeated that, with the single-phase motor and the steam turbine a reality, the transmission problem is about solved. He gave an interesting description of the work of electrifying the terminals of the New York Central and the Pennsylvania lines in New York city.

The tenth annual meeting of the National Fire Protection Association is to be held in Chicago, May 22d to 24th. In addition to the usual programme covering discussion and adoption of rules and specifications covering fire-protection topics, a commemorative address on the organization, aims and purposes of the association will be delivered by Uberto C. Crosby, United States manager of the Royal Exchange Assurance, who is one of the founders of the association, its only honorary life member, and who has been identified with fire-protection work covering a longer period than is represented by the history of the organization. An additional feature of interest in connection with the meeting will be the demonstrations to be given in the new testing station of the Underwriters' Laboratories.

The thirty-sixth annual catalogue of the Worcester Polytechnic Institute has just been issued, containing the usual information regarding courses of study, teaching force, equipment, students and alumni. The addition of courses in electrical engineering, having to do especially with electric-railway and power-plant engineering is noted, together with the addition to the faculty of Albert S. Richey as assistant professor of electric-railway engineering, under whose direction these new courses have been developed. The catalogue shows that over 70 scholarships are available for the students of the Institute, that the total registration is 388, an increase of over 40 per cent. in two years, and that of the 1,034 living graduates, scattered well over the civilized world, by far the great majority are engaged in work for which they were fitted by their institute course.

MISCELLANEOUS.

The first space-telegraph station in Montana is to be erected in Great Falls. Later other stations are to be set up in the state and at points in Idaho, Wyoming and the Dakotas. These stations will be part of the transcontinental system which, it is said, the De Forest company is putting in.

The Chicago automobile show will be held in the Coliseum and First Regiment Armory February 3d to 10th. In order not to be outdone by the managers of automobile shows in other cities, Samuel A. Miles, who is directing the local exhibition, has arranged for columns of plaster paris with cross-pieces and huge electric globes, which will be touched up with green and gold and installed in the two big buildings.

The cable vessel Burnside, which has been doing valuable service under the Army signal office, will be equipped with a $23,000 pick-up gear, which will enable the ship to pick up an injured cable at a depth of one and one-half miles. The Burnside will remain at Seattle during the coming winter, pending the installation of the improved mechanism, and in the meantime will be held in readiness to answer emergency calls for repairs along the Alaskan cable line.

The public ownership commission of the National Civic Federation met in New York city on January 10th and made final arrangements for the investigation which it will undertake in this country and in Europe as to the comparative merits of public and private ownership of water supply, electric light and gas lighting and street railways. It was decided by the commission to investigate public and private plants in a great many towns and cities in the United States.

There is said to be an unusual building boom in Kansas City, Mo. Most of the new houses are being wired for electricity, as it has become commonly known that houses so built command better rents and better prices if put for sale. W. L. Hutchison of the Kansas City Electrical Construction Company says: "It is a fact that the custom of wiring a house for electricity is becoming more general. During the last year we wired over 500 single houses and apartment buildings. It costs about $40 to wire an ordinary eight-room house and about $30 for an apartment of the same size. This includes speaking tubes, bells and switches. Steel conduits are being used quite generally in electrical work. They are more expensive, of course, but the wiring when so constructed lasts indefinitely."

In the region of McCall's Ferry, Pa., where the work preliminary to that of constructing a large power plant and dam by the McCall's Ferry Water and Power Company is in progress, flowing ice in the river recently interfered with the engineers and workmen in crossing the stream. The Susquehanna River at that point is a quarter of a mile wide and the volume of water which descends from the upper regions of Pennsylvania and from valleys in New York state is at a point known as "The Neck" thrown into a narrow space, rock-bound on either shore. When the ice is floating it is impossible to cross the river. A one-inch cable was taken from the company's equipment and dragged across the river, a majestic chestnut tree on each side being selected for fastening the cable. Two hundred men at either end and 50 horses were used in making the cable taut. A basket was then rigged to the cable with a roller attachment for its operation. In this tiny car, swinging high above the surface of the treacherous river, the engineers and workmen make their transits across the stream.

TRADE NEWS.

The Electric Cable Company of Bridgeport, Conn., has filed articles of incorporation. The authorized capital is $500,000. The incorporators are Edwin W. Moore of New York, F. H. Cowles of Greenwich, and J. N. Shreve of Scarsdale, N. Y.

The Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass., has established an office at 505 Postal Telegraph Building, Kansas City, Mo., for the purpose of more conveniently and more quickly taking care of its many customers in the state of Kansas.

The increasing business of the Westinghouse Electric and Manufacturing Company in the territory covered by its Columbus (Ohio) office has necessitated its moving into larger quarters. The company is now located in Room 923 Columbus Savings and Trust Building.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until January 30th for furnishing the Boston navy yard with nine electric motors and 13 controlling panels of 220 volts, embraced in schedule 323, obtainable at the navy pay office in New York or upon application to the bureau at Washington.

On account of the great increase in the demand for its Bijur "High-duty" elements, the General Storage Battery Company has decided to enlarge its factory at Boonton, N. J., by erecting buildings furnishing an additional 48,000 square feet of floor space, and to install hydraulic and steam or gas-generating machinery, aggregating over 1,000 horsepower.

The New York Central Railroad is reported to have awarded to the General Railway Signaling Company of Rochester, N. Y., a contract for interlocking and block signals amounting to $2,000,000. The equipment is intended for the zone of electric motive power extending about 25 miles from the Grand Central Station. The system of signals is said to be the most comprehensive ever devised by any railroad. It is designed to insure the highest possible degree of safety to the traveling public.

The National Engineering Company, successor to McGrew & Bruning, consulting engineers, announces its incorporation. The new company has its headquarters in the Brunson Building, Columbus, Ohio. The personnel of the company is J. A. McGrew, president, H. D. Bruning, vice-president and general manager, and F. C. Caldwell, secretary and treasurer. The company does a general engineering, construction and architectural business. J. N. Bradford is chief architect, E. A. Hitchcock chief engineer of the mechanical department, Mr. Caldwell chief engineer of the electrical department, C. E. Sherman chief engineer of the railway and municipal department, A. H. Heller, construction engineer of the bridge and structural department, and Frank Haas chief engineer and fuel expert of the mining department.

BUSINESS.

The Boston Incandescent Lamp Company, Danvers, Mass., maker of incandescent lamps, supplied the lights exclusively for Steeplechase Island, Bridgeport, Conn., also a large number of lamps to Steeplechase Park, Coney Island.

The Chicago Pneumatic Tool Company states that, on account of the compressor business being offered it exceeding its manufacturing capacity (amounting to only 400 compressors during the year 1905), arrangements are now under way for increasing the capacity of its compressor works at Franklin, Pa., so as to give it an annual output of between 650 and 700 compressors. The machines this company manufactures are gradually taking the lead, thus necessitating increased facilities for taking care of the business offered. A large volume of business was lost to the company during 1905 on account of inability to make deliveries.

An important order recently secured by the Canadian Westinghouse Company was obtained from the Vancouver Power Company of Vancouver, B. C. This order included a 1,500-horsepower 2,200-volt revolving-field engine-type generator, which will be direct connected to a Pelton waterwheel. This is a duplicate of the generators now in operation in the power plant of this company, and will operate in multiple therewith. The order includes switchboards and air-blast transformers of 550-kilowatt capacity. There is also included in the

order a 1,000-kilowatt 60-cycle rotary converter to operate at 550 volts. This converter will furnish power for railway work and will be controlled direct from the switchboard.

The Green Fuel Economizer Company of Matteawan, N. Y., originator and builder of the fuel economizer, some time ago began the manufacture of fans, blowers and exhausters on a large scale. The company reports a large number of sales of such apparatus recently, among the largest of which are two 310-inch induced-draft fans to the American District Steam Heating Company of Minneapolis, Minn., a 280-inch heating and ventilating fan and heater for Kimberly & Clark, Kimberly, Wis., and two ventilating sets for Public School No. [illegible], New York [illegible]. The company reports [illegible] other [illegible] heating and ventilating apparatus [illegible] installations of economizers.

The wonderful thing about [illegible] motor drive, says the Northern Electrical Manufacturing Company of Madison, Wis., [illegible] with which the machine hand can alter the [illegible] speed of his equipment, whether it be [illegible] horsepower drive or [illegible] drive. The manipulation of the motor-controller [illegible]

[illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 9, 1906.

809,300. Switch Plug with Electrical Fuse. Alexander Hepke and Kurt Diener, Berlin, Germany. Application filed July 20, 1904.

Two contact bodies are fixed to the plug body, through which contact bodies the current enters and leaves the plug. Fuses are placed within the plug body.

809,301. Electric Multiple Fuse Plug. Alexander Hepke and Kurt Diener, Berlin, Germany. Application filed July 20, 1904.

A plug body has two outside contact bodies, through which the current enters and leaves the plug, fuses being situated within the plug body.

809,302. Transformer Cut-out. John P. Hetherington, Logansport, Ind. Application filed January 27, 1905.

A primary circuit, a secondary circuit, a transformer connected to receive current from the primary circuit and to deliver the transformed current to the secondary circuit, an auxiliary transformer and means for automatically introducing the auxiliary transformer into the system in parallel with the first transformer and cutting it out therefrom are the essential parts of the system.

809,309. Electroplating Apparatus. Arthur W. L'Hommedieu, Chicago, Ill., assignor to Charles F. L'Hommedieu, Chicago, Ill. Application filed April 22, 1905.

Combined with a plating tub adapted to contain a plating solution and arranged to be rotated upon an upwardly extending axis are anodes arranged around the inside surface of the tub, a resident cathode arranged near the axis of the tub, a non-conducting support for the material to be plated, electric connections for the anode and resident cathode and means for rotating the tub.

809,311. Fireproof Wire. Amanda M. Lougee, Boston, Mass. Application filed November 5, 1903.

A permanently flexible armored electric conductor of indeterminate length has an external size adapted to the usual requirements of office buildings. Its component parts are held integrally and permanently together by adhesion, the parts including a wire, an asbestos jacket for the wire rendered moisture proof by an enveloping coating of cement, inclosed by a tightly woven jacket of wire embedded on both sides in waterproof and fireproof insulation.

809,312. Process of Making Fireproof Conductors. Amanda M. Lougee, Boston, Mass. Application filed May 23, 1904.

The method of manufacturing a fireproof electric conductor cable is described.

809,313. Protected Conductor. Amanda M. Lougee, Boston, Mass. Application filed May 23, 1904.

An inner conductor wire is enveloped by a vulcanizable compound containing a maximum quantity of insulating ingredients adjacent the wire, and an increasing quantity of fireproofing ingredients toward its outer side. A coarse mesh woven-wire jacket filled and permeated on both sides with a vulcanizable compound contains fireproofing and insulating ingredients, a superimposed fine mesh woven-wire jacket, permeated on both sides with a vulcanizable compound containing also fireproofing, insulating and waterproofing ingredients, the whole being vulcanized together as a one-piece article.

809,356. Oscillating Electric Fan. Herbert S. Brown, New York, N. Y. Application filed July 27, 1904.

The fan and motor are suspended from a bracket so as to rotate and deliver the air in all directions.

809,379. Adjustable Support for Telephones. Herbert L. Knight and Burton W. Sweet, Cleveland, Ohio, assignors to the Williams-Abbott Electric Company, Cleveland, Ohio. Application filed April 15, 1905.

An adjustable device for supporting the parts of a telephone is described in the patent.

809,394. Electrically Operated Portable Drill. Adolph Pedersen, Cleveland, Ohio, assignor to the Van Dorn-Elliott Electric Company, Cleveland, Ohio. Application filed September 19, 1904.

A multipolar motor within a hollow casing drives the drill shaft.

809,423. Telephone. Charles G. Burke, Brooklyn, N. Y., assignor of one-half to John Q. A. Whittemore, Boston, Mass. Application filed September 16, 1901.

A local transmitter comprising a battery and a transmitting circuit is connected to a main-line circuit. The receiver comprises a diaphragm, a core for operating the diaphragm being provided; also an induction coil surrounding the core for magnetically affecting the core and having two coils, one of the coils formed of coarse wire of few turns and connected in series with the local circuit, the other of the coils formed of fine wire of many turns and connected in series with the coil of coarse wire and the main line.

809,433. Rotary Electric Switch. John Dugdill, Failsworth, Manchester, England. Application filed March 15, 1905.

A rotary switch comprises a spring drum, a support, contacts on each of the parts and means for permitting the contacts to engage each other when the drum rotates in one direction and for preventing engagement when the drum rotates in the other direction.

809,453. High-tension Current Distributer for Internal-combustion Engines. Leon J. Le Pontois, New Rochelle, N. Y., assignor to the Polyphase Ignition System Company. Application filed December 13, 1904.

Elements of a sparking device for internal-combustion engines are described.

809,460. Motor Controller. Adolph Pedersen, Cleveland, Ohio, assignor to the Van Dorn-Elliott Electric Company, Cleveland. Application filed May 26, 1905.

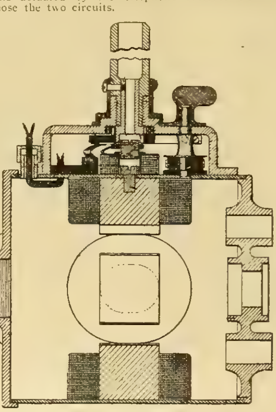
Means for automatically breaking the armature circuit when the magnetic flux of the motor reaches a predetermined quantity are described. A manually operable switch disk is adapted, when it is actuated to its "off" position, to close the break in the circuit made by the automatically operating means. A short-circuiting switch is included in the circuit and rendered operative during the actuation of the switch disk to its "on" position. (See cut.)

809,468. Flexible Electrical Conductor. Georg E. Schmidmer, Nuremberg, Germany. Application filed May 4, 1904.

An inner or central flexible core and an outer conducting cord wound about the core in spaced helical convolutions, the cord being composed of a central flexible core and a conductor wound about the core in close helical convolutions, make up the conductor.

809,515. Electrical Railway Signaling System. Milton H. Loudon, Kansas City, Mo. Application filed June 29, 1905.

An electrical railway signaling system embodies a normally closed main circuit including a source of electrical energy, a rheostat, visual and audible signaling mechanism and a solenoid magnet operatively connected with the engineer's brake valve. A normally open local circuit includes a telephone and a Morse sounder. Means actuated by the telephone receiver either open or close the two circuits.



NO. 809,460.—MOTOR CONTROLLER.

809,529. Electric Laundry Iron. Earl H. Richardson, Ontario, Cal., assignor to the Pacific Electric Heating Company, Ontario, Cal. Application filed April 25, 1905.

A laundry iron having a hollow body with extra metal portions in each corner and means in the metal at each corner for directly heating the exposed corners of the iron is described.

809,560. Combined Sparker and Governor for Gas Engines. David F. Graham and Frank A. Fox, Stamford, Conn., assignors to the Eisenhuth Horseless Vehicle Company, Middletown, Conn. Application filed March 11, 1903.

Details are described.

809,578. Sparking Plug. William Ottaway, Aurora, Ill., assignor to the Aurora Automatic Machinery Company, Aurora, Ill. Application filed February 15, 1904.

The stem of the sparking arrangement passes through an insulated sleeve to the interior of the cylinder.

809,595. Bell Push, Pull, Etc. Lawrence S. Wilks, Whipps Cross, England. Application filed May 1, 1905.

A form of illuminated push-button for door bells is described.

809,[illegible]. [illegible] Wire Clamp. [illegible] L. [illegible], [illegible]. Application filed February 24, 1905.

[illegible]

809,[illegible]. Trolley Attachment. [illegible] D. [illegible], Bristol, Conn. Application filed May 17, 1905.

[illegible]

809,[illegible]. Means for Controlling Mercury-vapor Electric Lamps. Percy H. Thomas, East Orange, N. J., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed April 23, 1904.

[illegible] the [illegible], the ballast having a positive temperature coefficient.

809,672. Automatic Indicating and Regulating Hygrometer. Stuart W. Cramer, Charlotte, N. C. Application filed January 9, 1905.

A hygrometer provided with an expansible and contractible member has the following essential parts. A shaft, an arm on the shaft connected to the member, a crank arm secured to the shaft, a [illegible] supported and connected to the crank arm, [illegible] support, a finger for making contact [illegible], a graduated scale, an electromagnet for [illegible], a source of electrical energy and electrical connections between the needle of the hygrometer, the magnet and the source of electrical energy.

809,693. Mechanical Movement. Gray W. Johnston, New York, N. Y. Application filed March 27, 1905.

A solenoid disposed upon a frame carrying contacts is associated with a member pivoted upon the frame to swing into engagement with the contacts alternately. A core is slidably mounted in solenoid and a link is pivoted to the core and having a part engaging cam surfaces on the frame. Frictional means hold the pivoted member in either of its extreme positions, whereby the pivoted link is cammed into engagement with alternate cam surfaces upon the pivoted member at successive actuations of the core of the solenoid.

809,700. Thermostatic Switch for Incandescent Electric Lamps. John V. A. Kimmey, Jr., New Haven, Conn. Application filed April 1, 1905.

A bracket is connected with an incandescent electric lamp, a bowed plate being secured at both ends to one face of the bracket. A contact screw is mounted in the bracket and normally in contact with the bowed plate, electric connection being made between the bowed plate and one wire of the lighting circuit and between the bowed plate and the bracket, the bowed plate adapted under heat developed directly by the power of the current of the lighting circuit to expand and move out of electric contact with the bracket whereby the circuit is broken. (See cut on next page.)

809,706. Electric Alternating-current Machine. Karl A. Lindström, Vesteras, Sweden. Application filed June 29, 1905.

An alternating-current machine has the armature winding placed in more or less open slots in the armature core, and poles of the magnetic field so placed in relation to the two halves of an armature winding that the waves of tension of higher order, the so-called overtones, induced by certain of the poles in the armature circuit on account of the discontinuity of the magnetic field caused by the slots in the armature core, are displaced practically half a period in relation to the corresponding overtones induced by the other poles.

809,707. Pneumatic Train-control System. John B. Linn, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 16, 1902.

A motor controller of the separately actuated contact type comprises successively operating contactors adapted to be operated by fluid pressure, means for admitting the compressed fluid to the first of the contactors, means whereby each contactor automatically admits the compressed fluid to the next, a pneumatic valve controlling the flow of compressed fluid to each contactor and means for operating the valve to check the progression of the contactors.

809,728. Electrical Heating System. Arthur D. Newton, Hartford, Conn., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 9, 1904.

The method of arranging the heating circuits of an electric car are described in the patent.

809,742. Storage-battery Plate. David P. Perry, Chicago, Ill. Application filed June 8, 1903.

A storage-battery grid is composed of [illegible] having outwardly extending projections adapted to [illegible] the battery [illegible] and having also strengthening or reinforcing portions [illegible] terminal.

809,743. Cross-arm for Carrying High-tension Wires. Evan E. P. Petery, Indianapolis, Ind., assignor of one-half to Samuel Bowsher, Indianapolis, Ind. Application filed August 19, 1904.

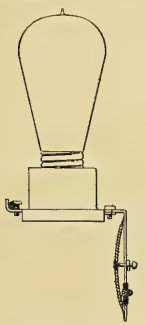
The cross arm is made entirely of glass, the arm having holes for bolting it to the pole, and having integral pins terminating with integral insulator knobs, the knobs having circumferential grooves and downwardly and outwardly flaring flanges integral with the knobs between the grooves and the arm.

809,747. Hanger or Ear for Overhead Electric Trolley Wires. Abraham Richardson and Thomas S. Jones, Blackpool, England, assignors of six-eights to Joseph Heap, Henry Heap, James Bailey, Thomas Brierley, Robert Billington and James Haydock, Blackpool, England. Application filed February 6, 1905.

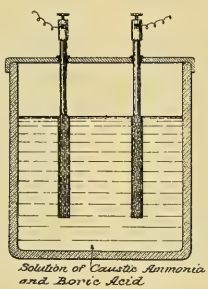
An ear or hanger for supporting or holding up electric conductor wires, constructed with two jaws to grip the wires has upwardly extending shanks to the jaws with an inclined recess, a loose nut placed in the recess, a collar placed over the shanks and the insulator bolt fitting into the nut and a flange thereon abutting against the collar to draw the nut up and force the collar down.

809,762. Telautographic and Other Electric Circuits. George S. Tiffany, New York, N. Y., assignor to the Gray National Telautograph Company, New York, N. Y. Application filed April 22, 1901.

A reversing switch, the contacts of which are in connection with the positive and negative poles of the source of electrical energy, is one feature. There are also a shunt forming a connection between the poles of the source of electrical energy, a circuit connecting to the reversing switch and to the shunt, the shunt having a resistance on each side of its point of connection to the circuit and an adjusting resistance between one of the poles of the source of electrical energy and the point of connection of the shunt and the reversing switch to the line leading to the pole.



NO. 809,700.—THERMOSTATIC SWITCH FOR INCANDESCENT LAMP.



NO. 809,770.—ASYMMETRIC CELL.

809,770. Asymmetric Cell. Max Büttner, Wilmersdorf-Berlin, Germany. Application filed August 4, 1904.

In an asymmetric cell are an aluminium anode and a cathode of any metal and an electrolyte consisting of a solution of caustic ammonia and boric acid. (See cut.)

809,774. System of Control. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 12, 1905.

In combination with a motor circuit are a pneumatic controlling system, a circuit breaker in the motor circuit and means operable upon the exhaustion of the pneumatic controlling system while the motor circuit remains energized to trip the circuit breaker.

809,787. Alternating-current Motor. Max Déri, Vienna, Austria-Hungary, assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed May 2, 1904.

In an alternating-current motor are a single-phase primary winding, a rotor winding short circuited at a number of points indivisible by the number of poles of the motor, commutator brushes arranged on a line at an angle to the line of magnetization produced by the primary winding and connections from the brushes to the source of current substantially in phase with the primary current.

809,793. Electrostatic Voltmeter. James Ferguson, Glasgow, Scotland, assignor to Kelvin & James White, Ltd., Glasgow, Scotland. Application March 29, 1904.

A voltmeter of the electrostatic type comprises a case, a coating of insulating material on the interior surface of the case, a coating of conductive material on the interior surface of the insulating coating, a fixed system of cells within the case, vertical back of insulating material fitted to each set of fixed cells, a coating of conductive material on the exposed surface of the back and a movable system of vanes to which the conductive coating of the backs is permanently connected.

809,794. Railroad System. Hannibal C. Ford, Jamaica, N. Y. Application filed September 12, 1905.

The track is divided into sections, and electrical connections for setting a train-stop absolutely to enforce a home or danger signal, but releasably to enforce a caution signal depending on the speed of a following train are embodied in the system.

809,796. Electric Target-setting Apparatus. Gustav Grabosch, Berlin, Germany, assignor to the Phœnix Elektrotechnische Gesellschaft M. B. H., Berlin, Germany. Application filed July 1, 1905.

In a target-setting apparatus is an electromagnet, a core slidable therein and a target shiftable directly by the core.

809,798. Means for Controlling Overhead Electric Carriers. Henry M. Harding, New York, N. Y. Application filed April 21, 1902.

A means for controlling overhead electric carriers consists of a main conductor, a section at each end thereof, a resistance between each of the sections and the main line of such a character that insufficient current flows through the sections to move the loaded carrier, and means for fully energizing the sections.

809,799. Overhead Electric Carrier. Henry M. Harding, New York, N. Y. Application filed October 12, 1903.

Details of an electric telpher system are set forth.

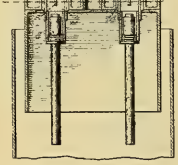
809,825. Electric Meter. William J. Lloyd, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed May 10, 1904.

In an alternating-current meter are a U-shaped core, potential coils carried thereby, a C-shaped core having intermediate projecting poles facing the poles of the first core and its ends extending into proximity to the poles of the first core, a current coil carried between the projecting poles and a conducting disk disposed between the cores.

809,831. Telephone Transmitter. John Z. Miller, Erie, Pa. Application filed October 19, 1904.

In a telephone transmitter there is a non-vibrating back plate, a washer of fibrous and non-conducting material forming a container, a dampener mounted on the back plate and an electrode arranged within the washer, the electrode being of less thickness than the washer. Granulated conducting material is placed in the cavity with the electrode, a ring of conducting material being arranged outside of the washer and mounted within the case but insulated from the case and back plate. A diaphragm is mounted on the ring and in electric contact with the ring, being connected with the back plate through the electrode and material in the cavity and the washer.

809,835. Alternating-current Machinery. Addams S. McAllister, New York, N. Y. Application filed March 2, 1905.



NO. 809,842.—ELECTRIC CALCIUM-CARBIDE FURNACE.

Combined with an alternating-current machine having a rotor provided with a commutator are a field winding, a compensating winding adapted to nullify the rotor magnetism, and means for controlling the power factor of the machine at different speeds.

809,842. Apparatus for the Production of Calcium Carbide. Edgar F. Price, George E. Cox and James G. Marshall, Niagara Falls, N. Y., assignor to the Union Carbide Company, Niagara Falls, N. Y. Application filed October 19, 1904.

In an electric furnace for the production of calcium carbide and in combination with a feed supply of lime and carbon are electrodes consisting of graphite rods of reduced cross section, means for supplying to the electrodes an electric current of sufficient amperage to give a high current density in the electrodes and effect the reduction of the charge, means for substantially excluding oxidizing gases within the charge from the sides of the rods and means for withdrawing heat from the ends of the electrodes remote from the zone of reduction. (See cut.)

809,847. Controller for Turbines. Frederick Samuelson, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed July 3, 1905.

In an electric circuit controller there is a cam cylinder, switch members adapted to be actuated by the cam cylinder in predetermined order and means for causing the switch members to open the circuit with a quick movement.

809,852. Ball-bearing Trolley-wheel Bushing. Mahlon Shaaber, Reading, Pa. Application filed April 4, 1905.

Details are described.

809,864. Insulated Receptacle for Panel and Switchboards. William C. Tregoning, Plainville, Conn., assignor to the Trumbull Electric Manufacturing Company, Plainville, Conn. Application filed February 18, 1905.

In combination with a panel or switchboard provided with circuit terminals are a pair of contact members removably attached to a panel and connected respectively with the circuit terminals, a tubular insulating casing inclosing the contacts and resting upon the panel and a locking member intermediate one of the contacts and the tubular insulating member for locking the latter in position upon the panel.

809,865. Combined Telegraph and Telephone System. Carlo Turchi, Ferrara, Italy. Application filed April 15, 1903.

Combined with a telegraph and telephone system are a single main wire, telegraph instruments in circuit with the main wire, a winding in the main wire, a closed circuit having a winding adjacent the winding of the main wire and divided into two branches, a core having the branches of the closed circuit wound about it in opposite directions, a receiving circuit, a winding in the receiver circuit receiving the magnetic flux from the core of the closed circuit, a microphone circuit and a winding in the microphone circuit adjacent the winding in the main wire. (See cut.)

809,873. Panel Cut-out and Receptacle. Frank T. Wheeler, Plainville, Conn., assignor to the Trumbull Electric Manufacturing Company, Plainville, Conn. Application filed February 18, 1905.

Associated with a panel or switchboard provided with circuit terminals are a pair of contact members removably secured to the base and connected respectively with the circuit terminals, one of the contacts clamping the other in position upon the panel, and an insulating casing inclosing the contacts removably interlocked with respect to one of them and resting against the panel.

809,878. Starting Device for Electric Motors. Howard B. Wilson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 10, 1904.

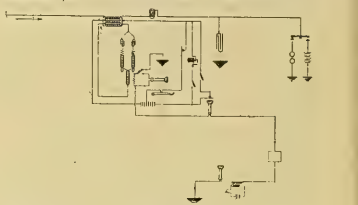
An electric motor and means for starting it comprise a self-reducing resistance connected in the motor circuit and automatic means for cutting the resistance out of circuit when its ohmic value is reduced to a predetermined amount.

809,904. Emergency Electric-lighting Arrangement for Theaters and Similar Buildings. Fritz Brand, Berlin, Germany. Application filed March 21, 1905.

An electric emergency lighting system for buildings consists of several sources of energy located in the basement of a building, a number of circuits extending from floor to floor throughout the building, the circuits being removed from and being independent of each other throughout their length and lamps connected in the circuits in the respective stages or floors of the building.

809,908. System of Control. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 1, 1904.

Motor controllers include means for determining the direction of rotation of the motors upon one or more cars, controller actuating means including a source of power local to each car. A pneumatic train system governs the action of the controller actuating means, the train system being operative to give proper motor connections upon the reversal of one or more cars of a train.



NO. 809,865.—COMBINED TELEGRAPH AND TELEPHONE SYSTEM.

809,917. Electric Heater for Oil Wells and Method of Making Same. Benjamin F. Gardner, Chicago, Ill., assignor to the Petroleum Electric Producing Company, Chicago, Ill. Application filed April 5, 1905.

An electric heater comprises a metallic pipe, a non-vitreous insulating covering on the pipe, a layer of non-metallic resistance material incased in the insulating material and electrodes embedded in the resistance material, one of the electrodes being connected to the source of electric current and the other being grounded.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on January 15, 1906:

396,086. Synchronizing Device for Dynamo-electric Machines. Carl Hoffman, Berlin, Germany.

396,121. Thermo-magnetic Motor. Nikola Tesla, Smiljan, Lika, Austria-Hungary.

396,124. Suspended Switch for Electric Railways. Clark H. Wells, Kansas City, Mo.

396,149. Unipolar Dynamo-electric Machinery. Rudolph Eickemeyer, Yonkers, N. Y.

396,176. Electric Coupling for Hose Pipes. David J. Simpson, Pittsburg, Pa.

396,195. Armature for Dynamo-electric Machines. Leo Daft, Plainfield, N. J.

396,196. Insulator Support for Electric Conductors. Leo Daft, Plainfield, N. J.

396,199. Electric Appliance for Discharging Guns. Bradley A. Fiske, U. S. Navy.

396,207. Electric Signaling Apparatus. William Henion, Ritchey, Ill.

396,212. Electrical Body Wear. John V. Long, Jersey City, N. J.

396,213. Secondary Battery. Orazio Lugo, New York, N. Y.

396,214. Secondary Battery. Orazio Lugo, New York, N. Y.

396,269. Electro-dynamic Machine. Carl Coerper, Cologne, Prussia.

396,270. Process of Electric Welding. Charles L. Coffin, Detroit, Mich.

396,310. Traveler for Electric Railway. C. J. Vandepoele, Chicago, Ill.

396,311. Hooked Suspender for Electric-railway Conductors. C. J. Vandepoele, Lynn, Mass.

396,312. Suspension Device for Electric-railway Conductors. C. J. Vandepoele, Lynn, Mass.

396,313. Adjustable Crossing and Switch for Overhead Conductors. C. J. Vandepoele, Lynn, Mass.

396,314. Commutator Brush Carrier for Electric Motors. C. J. Vandepoele, Lynn, Mass.

396,326. Galvanic Battery. Paul R. De F. D'Humy, Clapham Rise, County of Surrey, England.

396,342. Galvanic Battery. Bernhard Scheithauer, Hale-on-the-Saale, Germany.

396,355. Dynamo-electric Machinery. Isaac T. Dyer, Chicago, Ill.

396,356. Magnetic Separator. Thomas A. Edison, Llewellyn Park, N. J.

396,365. Railway Signal. W. C. Paul and Oscar D. Kleinsteuber, Milwaukee, Wis.

396,367, 396,368, 396,369. Secondary Battery. I. L. Roberts, Brooklyn, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Steam-turbine Power Station in the Clyde Valley Near Glasgow.

By Frank C. Perkins.

Of the four leading British power schemes which were begun during 1905 the Clyde Valley power plants, near Glasgow in Scotland, form one of the most interesting examples. An electric power plant using steam turbines directly coupled to electrical generators of 2,000 kilowatts capacity each, has recently been constructed at Yoker and another at Motherwell, the latter 15 miles from Glasgow, and the former about five miles from Glasgow, with a number of sub-stations for supplying an area of several hundred square miles along the Clyde Valley in Scotland. The Yoker electric power station, shown in the accompanying illustrations, was installed by the Clyde Valley Electric Power Company, Limited, supplying energy for light and power purposes for manufacturers, merchants and general commercial service in the territory above mentioned. For this distribution there are six feeders which leave the basement of the power station supplying current to the district between Scotstown and Clydebank, as well as Temple.

The turbine room, which is shown in Fig. 4, is about 43½ feet wide and more than 250 feet long, constructed of iron and steel, with glazed-brick walls and Italian mosaic floor. Fig. 2 is an exterior view of the plant. The turbine and generating room is equipped with two steam turbo-generators of the Westinghouse-Parsons type, each having a maximum capacity of 3,000 kilowatts and a normal output of 2,000 kilowatts. Each of these units operates at a speed of 1,500 revolutions per minutes, the turbines being of the double-flow type, with steam entering at the center and exhausting at the ends. The generators are of the Westinghouse three-phase design, with rotating field, supplying a current having a frequency of 25 cycles and a pressure of 11,000 volts. The current is conducted to the switchboard galleries, which are three in number, at one end of the generating room. The oil switches and feeders are arranged on the first floor and first gallery, while the upper gallery is devoted to the resistances, bus-bars and measuring instruments. The switches are electrically operated by the same current as is used for exciting the field of the alternator, the turbine units also being stopped and started from these points of control.

The engine room will ultimately accommodate another large unit of 3,500 kilowatts and another smaller unit of 2,000 kilowatts, making a total output for the station of nearly 10,000 kilowatts.

The turbo-alternator units are supplied with exciting current from [illegible] of 75 kilowatts each, consisting of a [illegible] vertical type engine 11 by 19 by 11 [illegible] coupled to a compound wound [illegible]. These units operate at a speed of [illegible] per minute, supplying a [illegible] current of [illegible] volts pressure. The [illegible] and operating bench board are mounted in a gallery as shown in Fig. 3.

The boiler room, supplying [illegible] turbines, is equipped with four water-tube boilers of the Babcock & Wilcox double-drum type, each having a heating surface of more than 4,000 square feet and provided with superheaters capable of raising the temperature of the steam to 140° F. The boilers are equipped with Roney mechanical stokers, driven by Westinghouse engines of five-horsepower capacity, operating at a speed of 400 revolutions a minute.

Turbine condensers are of the Mirrlees Watson vertical-surface design, having a cooling surface of 6,250 feet for each condenser, each turbine exhausting directly into its own condenser, the latter being provided with a steam-driven dry-air pump of the two-stage type.

Circulating water for the various condensers is taken from the Clyde River, passing into a well 18 feet in diameter by gravity, the depth of the

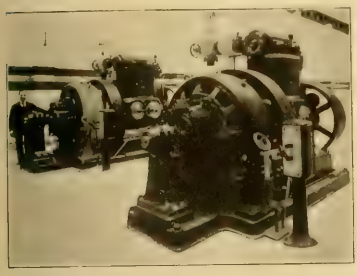


Fig. 1. Exciter Units in Clyde Valley Power Plant.

Fig. 2. Exterior of Clyde Valley Power Plant.

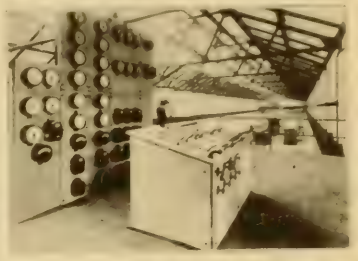


Fig. 3. Instrument Panel and Bench Board in Clyde Valley Power Plant.

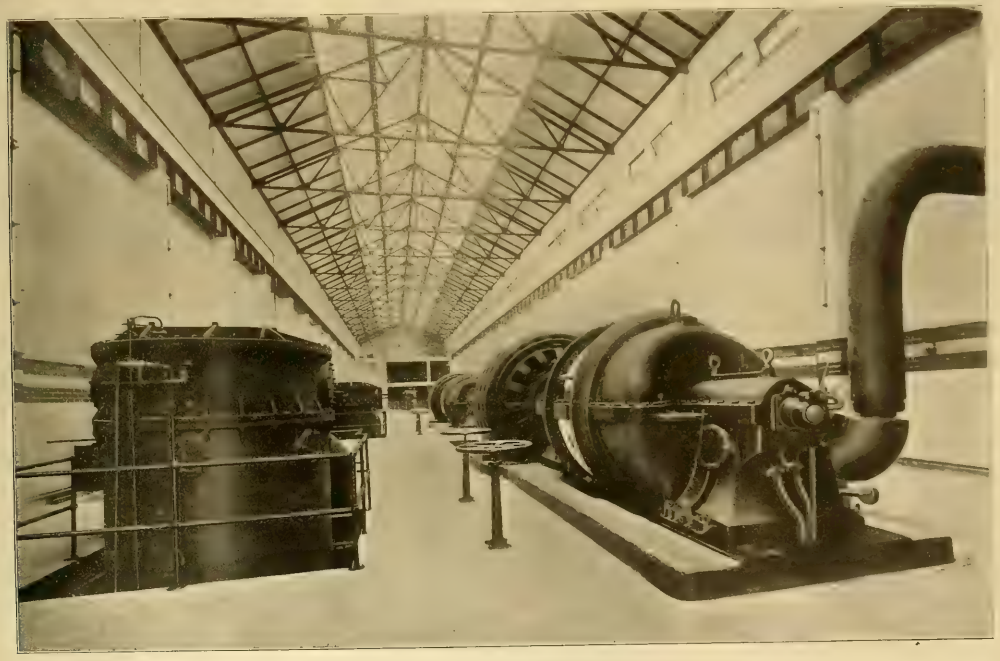


Fig. 4. 3000 Horsepower Turbo-generators in Clyde Valley Power Plant.

STEAM-TURBINE STATION OF THE CLYDE VALLEY ELECTRIC POWER COMPANY NEAR GLASGOW.

water being nine feet below, with two 30-inch pipes supplying the well from the river, and a three-foot pipe for drawing the water out by means of a steam-driven centrifugal pump. Into the hot well the condensed water is pumped by a motor-driven centrifugal pump, operating at a speed of 625 revolutions per minute, the motor having a capacity of six horsepower, and being of the shunt-wound type, with vertical shafts. The feed pumps each have a capacity of nearly 10,000 gallons an hour against a boiler pressure of 175 pounds to the square inch.

The Chicago Electrical Show.

The Chicago Electrical Show is a great success. As the days allotted for the exhibition passed, interest in the many new and interesting things to be seen at the Coliseum increased, and the spacious building was well filled with sightseers both afternoon and evening. So gratifying has been the patronage that the show has received, that the management without doubt will make it in the future an annual event. A review of the success of the exposition at the close of the first week showed that the benefit to electrical and allied trades had been marked, and many of the concerns had booked substantial orders through the interest aroused in their products by their exhibits at the Coliseum. To the "mere visitor" there was much to attract and hold the attention, and he who left the hall without a much wider understanding of the scope of the electrical industry did so because he had no inclination to learn.

One of the features of engineering interest at

ELECTRIC LIGHT FOR THE MODERN DINING ROOM, AS SHOWN AT CHICAGO ELECTRICAL SHOW.

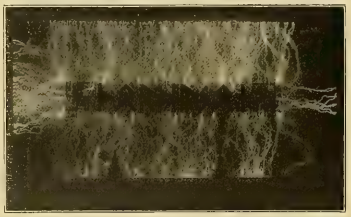
the show was the appearance of the new flame arc lamp, which as yet is not widely known in this country. There were two exhibits of this lamp made, one by the Siemens-Schuckert Company of Berlin, Germany, and one by the Manhattan Electric Supply Company of New York. The latter exhibited what is known as the Sarco light—a German lamp, for which the Manhattan company is agent in this country.

The Siemens flame arc was shown in two styles. The larger lamps, to the number of eight, were used in illuminating the hall, and there were also two of this size in the Siemens-Schuckert booth. At the latter exhibit there was also a smaller size, called the Liliput lamp. The large lamps operate two in series upon a 110-volt direct-current circuit, and when thus connected give from 4,000 to 5,000 candlepower each, with a current consumption of 11 amperes. The carbons are of the core type, made by a process which is a secret with the company. The arc is formed at the lower ends of the two carbons, which are placed at an inclination from the vertical position, the carbons passing through two openings in a refractory material, which serves to deflect the upward rays to a useful downward direction. The mechanism of the lamp is comparatively simple, more so than the ordinary arc lamp.

The length of time during which a lamp will operate at a single trimming depends upon the length of the carbons. Those exhibited at the Electrical Show were provided with 10-hour carbons. The company also builds lamps using 17-hour carbons. These lamps are being placed upon the American market by Felix Hamberger of New York city, who demonstrated the lamps at the Show.

Mr. Hamberger also showed, for the first time in this country, the Siemens Liliput lamp. This lamp is of the direct-current type, with a restricted supply of air, and is made with a single globe. A reliable clamping arrangement instead of a clock-work mechanism regulates the carbons, which are of the cored type, only one-fifth inch in diameter. The two-ampere size burns singly at 100 to 120 volts and in series at 200 to 240 volts. A three-ampere lamp is also made for use singly at 100 to 120 volts. The lamps are for indoor or outdoor service and are so simple that the carbons may readily be changed by the house servant. Their special application to workshop and factory lighting is said to have already been proved in Europe.

Two of the Sarco lights were displayed by the Manhattan Electric Supply Company. The light burns impregnated carbons having a metallic core



THORDARSON'S HIGH-POTENTIAL DISCHARGES AT THE CHICAGO ELECTRICAL SHOW.

running through them, and both carbons are fed from the top instead of the top and bottom, as the ordinary type of lamp feeds. The Sarco light burns two lamps in series and takes eight amperes on a 110-volt circuit and the two lights in series are said to give 7,800 candlepower by actual test. On account of its great brilliancy, the light is peculiarly adapted for advertising purposes, to illuminate store fronts, outsides of restaurants, theaters, etc., and a number of contracts have been taken for illuminating pleasure parks and outside amusement resorts.

The Electrical Show was opened to visitors early each morning and continued open until about 11 p. m. Naturally there were not many present in the forenoon, but after one o'clock the people began to arrive and in the evening the place was well filled. On Friday, the 19th, the day of the funeral of Marshall Field, everything was shut down and current turned off for a brief interval between noon and one o'clock in respect to his memory.

Electrical people took advantage of the opportunity to visit the Show and study the many things offered for inspection. Members of the Northwestern Electrical Association were prominent; also those of the Electrical Salesmen's Association. Tuesday, Wednesday and Thursday of this week

SIEMENS FLAME ARC LAMPS AT THE CHICAGO ELECTRICAL SHOW.

were "Independent telephone days" and Friday was "Thomas A. Edison day."

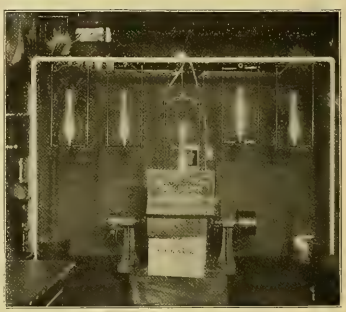
The Western Electrician was at home to its friends in a well located booth just north of the main entrance. College Row was much frequented by the alumni of the various institutions there represented, and presented a fine appearance, owing to the decorations with college colors.

C. H. Thordarson continued to interest the public by the electrical experiments which he performed at his booth under the north gallery, and Professor Clarke continued his popular demonstrations and lectures throughout the duration of the show. During the course of his lectures Professor Clarke passed high-frequency currents of 200,000 volts through his body.

Dynamos, Motors and General Electrical Machinery.

The General Electric Company occupied a large space near the main entrance to the show and seized the opportunity offered to arrange an attractive reception space, which, because of its location, made a convenient meeting place for visitors. This space was attractively illuminated by enclosed arc lamps with concentric diffusers and the new Gem lamps. This is the first public exhibition in Chicago of these new lamps, which consume only 2½ watts per candlepower. One of the most striking features of the General Electric Company's exhibit was the large space devoted to devices for heating and cooking by electricity. A description of the General Electric Company's exhibit would be incomplete without reference to the moving pictures shown. These showed, among other interesting views, the race between a steam train and the celebrated electric locomotive built by the American Locomotive Company and the General Electric Company for the New York Central.

The Westinghouse Electric and Manufacturing Company had on exhibition its graphic recording voltmeter as well as a full and complete line of Westinghouse current-measuring portable and precision instruments. There were also lines of wattmeters, circuit-breakers, transformers and also a five-kilowatt pipe-thawing transformer. Motors, fan motors for the season of 1906, and overhead rail-



FIRST ELECTRIC-LIGHT PLANT IN ILLINOIS.—HISTORICAL EXHIBIT AT CHICAGO ELECTRICAL SHOW.

way line material were shown. The exhibit was lighted on one side by Cooper Hewitt mercury vapor lamps and on the other by Nernst lamps. The following Westinghouse representatives were in attendance: From the Westinghouse Electric and Manufacturing Company—T. P. Gaylord, manager of the Chicago office; W. R. Pinckard, Malcolm MacNeil, J. W. Busch, Malcolm Carrington, C. A. Ross, Roy Schaulin, Charles Talbot, A. L. Millard, R. H. Moore, A. M. Miller, W. D. McDonald, C. W. Regester, Stephen Gardner, E. M. Bischoff, Norman Stewart, H. H. Caughlan, S. G. Peticolas, R. L. Radcliff, S. J. Moran, James P. Gardiner, Ivar Hennings, W. M. Oleen, B. J. Brown, George W. Canney; the Westinghouse Machine Company—J. B. Allen, western manager; Messrs. Wilkinson, Hinn, Simmons, Rosie, Johnson and Tripp; the Nernst Lamp Company—Max Harris, general sales manager; A. C. Wales, district sales manager, Chicago; Messrs. Griffith, Keene and Miller, and also Mr. G. C. Keech of the Cooper Hewitt Lamp Company, Chicago. J. C. McQuiston, superintendent of the Westinghouse Companies' publishing department, and J. W. Lewis of the sales department of the Westinghouse Electric and Manufacturing Company, were also in attendance.

The exhibit of the Crocker-Wheeler Company was located on the main aisle in the north end of the building and was tastefully furnished with green and black decorations and Mission furniture, together with numerous framed pictures of motors and generators in machine-shop service. The exhibit comprised a complete line of the company's alternating-current and direct-current apparatus. There was shown a 75-kilowatt 2,300-volt three-phase 60-cycle belt-driven alternator, sold to the Geary Electric Light and Power Company of Geary, Oklahoma. In addition were exhibited a 12-kilowatt form D generator, a five-horsepower 3 to 1 variable-speed form I F motor, a five-horsepower standard form F motor and a two-horsepower standard form L. All of the above apparatus was shown in its standard shop finish. The company called attention to its name in a large electric sign, which was surmounted by an illumined trade-mark, operated by a flasher. The exhibit was arranged by and in charge of Mr. Julian Roe, western manager of the company.

The Western Electric Company had a varied

exhibit. There were electric fan, 12 to 72 inches, a 50-kilowatt marine set for boats and restricted spaces, light power motors, direct current and alternating-current arc lamps which lighted the booth brilliantly, a line of box-type crane motors for heavy duty, an emery grinder carefully designed for proper height, an arc light regulator in circuit with the arc lamps, electric soldering iron, high tension insulators and batteries. One of the most interesting features of the exhibit was the motor-operated sewing machine. The motor and control arrangement is made by the company. Sitting down at the machine, one has only to press down the treadle slightly to start the motor; after that increasing pressure speeds up the motor. Removing pressure from the treadle stops the motor. Another feature of interest was a small transformer with an attachment for thawing water pipes.

Among the attractions, the Stanley-G. I. Electric Manufacturing Company's booth was prominent. On the west side of the booth a Challenge-Gordon press from the A. F. Wanner Company was belted to one of the new type L direct-current motors and was operated by the Unger Printing Company to turn out calendar cards with a very good cut of the Stanley-G. I. Works. Nearby an automatic stereopticon threw upon a screen at regular intervals reproductions of works of art interspersed with views of the company's factory and prominent installations or apparatus of special note. On the south side of the booth were a number of alternating-current induction motors of various types; both single and polyphase were displayed, and beside them a series arc panel and an arc lamp regulator, together with a type BO transformer. The latter has occasioned some discussion, it being the first shell-type transformer of small size to be built on precisely the same lines as the company's large power transformers, which have proved to be so successful. In the rear of the booth various types of arc lamps were suspended from a test rack, prominent among them being the L 4 or midget lamp and the K 31, the new lamp of crosshead construction. Supplies of various kinds were exhibited and the booth was lighted by three arc lamps suspended from corner posts and by an illuminated sign. Louis Friedmann, C. A. Cummings, C. A. Mann, Alexander Perry and A. A. Morton from the Chicago office, and W. M. Green were in attendance.

The Wagner Electric Manufacturing Company of St. Louis was located in Section D, space 10. It showed among other things 60-cycle single-phase 220-volt alternating-current motors in operation. There was also the new three-phase motor of 7½-horsepower size, built with semi-enclosed field slots. Other apparatus making up this exhibit were the standard type M transformers and a complete line of switchboard and portable voltmeters, ammeters and wattmeters. The exhibit was in charge of Frank N. Jewett, C. C. Warner and C. B. Richardson. Mr. Jewett will represent the Wagner company as district manager of the Chicago office after February 1st.

The Fort Wayne Electric Works' exhibit in C 13 was attractive and interesting. Prepayment induction meters were the features attracting central-station men. In addition the Wood revolving fans and arc lights and type-A oil transformers, in operation, received favorable comments on all sides. The Shelton Electric Vibrator Company and the Neostyle Company (motors for which are made by the Ft. Wayne Electric Works) were operated in connection with this exhibit. Connected with the exhibit were W. S. Goll (manager), J. H. Raymond, A. L. Bond, C. [illegible] and W. [illegible] of the Chicago office, and Earl [illegible].

Technical [illegible] in the race [illegible] steam turbine exhibited in [illegible] the Allis-Chalmers Company [illegible] formation of the [illegible] it. A section of a ring from one of [illegible] horsepower turbine now [illegible] shops of the Allis-Chalmers Company [illegible] on exhibition, as well as [illegible]

GENERAL ELECTRIC EXHIBIT AT CHICAGO ELECTRICAL SHOW.

The Allis-Chalmers Company was one of the first of the exhibitors to have apparatus actually in operation, and it was represented by C. A. Tupper and S. R. Kerr. Direct current transmitted to a 25-horsepower Bullock motor was used for driving a 60-kilowatt belted Bullock alternator, which, in turn, generated current for the operation of a line of Bullock induction motors, ranging in capacity from two to 30 horsepower. Each of the machines responded instantly to the turn of its switch, potential starters being used in connection with the induction motors. The booth was tastefully arranged, and light was furnished by a resplendent red, white and blue electric sign, from which hung clusters of incandescent lamps. Altogether, the exhibit created a very favorable impression.

WESTINGHOUSE EXHIBIT AT CHICAGO ELECTRICAL SHOW.

Electricity for Domestic Purposes.

Electricity for light, cooking and other domestic purposes was demonstrated at the booth of the Chicago Edison, Commonwealth Electric and North Shore electric companies. Last week a picture was shown of the north end of this booth, with the A. H. Burton of Marshall Field & Co. In the Edison booth was also a complete printing outfit, where a daily issue of the Electric City was printed, giving an example, incidently, of one of the important uses to which central-station power may be put. Electric signs were also demonstrated. Cables by which current is distributed in the Edison system, and other features of the operating end of a central station were among the many interesting things to be seen at this booth.

Practically all propositions for domestic and commercial use of electric heat were exemplified in the exhibit of the Simplex Electric Heating Company of Cambridgeport, Mass. There were shown three types of ovens, broilers, griddles, waffle irons, frying kettles, etc. One of the most interesting parts of the exhibit was the demonstration showing the use of the electric flatiron. The exhibit gave a very varied and interesting exposition of the state of perfection to which the art of electric heating has been brought.

In a booth adjoining the Edison dining room, the Brunswick Refrigerating Company of New Brunswick, N. J., exhibited a domestic refrigerator and ice machine which demonstrated the advantage of these small sets for household purposes.

Telegraph and Telephone Apparatus.

City and long-distance telephone service was given by the Chicago Telephone Company, at whose booth a completely appointed telephone switchboard, with two operators, was maintained. Several representatives of the company were present to explain the apparatus. On the walls of the exhibit space was shown a complete set of photographs of the company's exchange.

The exhibit of the Automatic Electric Company of Chicago was walled in at the back by mahogany finished panelled walls seven feet six inches high, with square posts at the corners. Above the wall rose two electrically illuminated signs, those on each side reading "Automatic Electric Company; Telephone Systems," these two being joined by a smaller panel with the familiar dial of the Automatic telephone cut out of wood and outlined by incandescent lamps. This dial was six feet high. Within the booth were located an Automatic switchboard, exhibit size, of the 10,000-type, to which were connected two straight-line wall telephones, two straight-line desk telephones and four party-line wall telephones. These were operated by the switchboard, and a ringing machine was mounted alongside of the board to furnish ringing power. Power for operating the Automatic telephone switches was furnished by a storage battery of 26 cells. The telephone department of the Illinois Tunnel Company had installed in the booth two Automatic desk telephones which were connected with the downtown exchange. The Automatic company distributed at the show a new booklet with cover of Japanese vellum, on which is reproduced in the original tints the grand prize

1. Universal Electric Storage Battery Company.
2. General Storage Battery Company.
3. House of Economy and Flexduct (J. A. Bennett).
4. Chicago Pneumatic Tool Company.
5. Safety-Armorite Conduit Company.
6. Rock Island Battery Company.
7. Stanley-G. I. Electric Manufacturing Company.
8. Mark Manufacturing Company.
9. College Row.
10. American Electric Sign Company.
11. Benjamin Electric Manufacturing Company.
12. American Electrical Novelty and Manufacturing Company, Chicago Compound Battery Company.
13. Roth Brothers.
14. Frank B. Cook.
15. Western Electrician.
16. Manhattan Electrical Supply Company.
17. William P. Crockett Company.
18. Peru Electric Manufacturing Company.
19. H. T. Paiste Company.
20. H. A. Petersen Manufacturing Company.

CHARACTERISTIC EXHIBITS AT CHIC

1. { Electric Appliance Company.
   { Sangamo Electric Company.
5. National Carbon Company.
9. { Acorn Shade and Reflector Company.
   { Reynolds Electric Flasher Company.
   { American Electrical Supply Company.
13. { Haller Machine Company.
    { Reynolds Dull Flasher Company.
17. India Rubber and Gutta Percha Insulating Company.

2. Central Electric Company
6. Volta Battery Company
10. { American Conduit Company
    { Belden Manufacturing Company
14. Lincoln Electric Manufacturing Company
18. Phoenix Glass Company.
19. Standard Electrical Manufacturing Company

3. Simplex Electric Heating Company
7. { Guarantee Electric Company
   { J. L. Schureman Company.
11. Federal Electric Company.
15. McRoy Clay Works.
20. H. Krantz Manufacturing Company

4. Wagner Electric Manufacturing Company
8. Central Electric Manufacturing Company
12. Bryan-Marsh Company.
16. { American Electric Fuse Company.
    { J. Lang Electric Company.
21. { H. B. Camp Company
    { G. M. Gest.

diploma which was awarded to the company at the St. Louis World's Fair. The booklet contains a brief description of the working of the system with pictures and data of the larger exchanges built by the company.

Interior telephones were shown in various designs by the Ackerman-Boland Telephone Company of Chicago, J. W. Liggett being in charge.

The Swedish-American Telephone Company of Chicago occupied spaces 11 and 12 in Section E, with a complete line of series exchange and bridging telephones as well as central-office equipment. Its exhibit was neatly and cleverly arranged. Many telephone men were in attendance at the show and several good orders were secured by this company. A handsome souvenir postal card was distributed to visitors. One of the features of this exhibit was a fac simile of the new factory building. It was made of papier maché and was illuminated, giving the effect of being in actual operation. This exhibit was among the best in the show and had the stamp of originality and "independence" throughout.

A unique booth was that of the Chicago and Milwaukee Telegraph Company. This booth was enclosed on two sides with a complete telegraph line—poles, guys, conductors, and all.

In a spacious booth a rack of guy anchors and boring tools were exhibited by the Miller Anchor Company.

Visitors were always welcome at the De Forest booth, where commercial space-telegraph messages were taken and where the apparatus for sending and receiving was to be seen.

Frank B. Cook's exhibit at the Electrical Show was not one to attract the general public. Were "Cook's" big double booth not directly in front of the band stand it is doubtful whether there would have been a crowd around it. But the exhibit in the booth to a telephone, electric-light or power man was a novelty and a treat. Of interest to the telephone man was a complete line of protective apparatus, from switchboard protectors to pole-

STROMBERG CARLSON TELEPHONE EXHIBIT AT CHICAGO ELECTRICAL SHOW.

cable terminals. One large main distributing frame had mounted on it the five different types of protective apparatus that Mr. Cook has made, the earliest type being the No. 4 with tubular coil, and the latest being the No. 8 self-soldering protector. Mr. Cook also showed a decided novelty in the way of a land anchor which bores its own way into any depth of earth desired by simply turning it to the right. A single turn to the left throws out two blades into the earth, obtaining a hold on practically 18 inches of undisturbed earth by the use of an anchor with a six-inch blade. Cook's self-welding wire joints for connecting copper wires also attracted attention.

Telephone men were attracted to the booth of the Stromberg-Carlson Telephone Manufacturing Company of Rochester by a full line of telephones and switchboard apparatus, the advantages of which were explained by a large corps of representatives from the company. The central feature was one section of a 12,500-line exchange switchboard. The multiple jacks on this board excited no little comment upon their small size, being only one-fourth inch in diameter. Another interesting part of the exhibit, about which little has been said heretofore, was the telephone for mine purposes. In mines the ordinary wooden telephone cabinet will decompose in a very short time, owing to the moisture in the atmosphere. The new set shown by the Stromberg-Carlson company is completely encased in an iron box, somewhat over a foot square, the door of which closes with a rubber gasket, making it entirely moisture-proof. The telephone set within the box is of special design, and the transmitter is supported between coil springs, so that the shock of blasting will not disarrange its delicate parts. The bell is in a compartment on top of the box, and a small opening into this compartment allows the sound to escape readily. Another interesting piece of apparatus was the company's intercommunicating telephone, which is constructed upon the same thorough principles as the regular exchange apparatus.

De Veau telephones, Diamond H flush receptacles by the William P. Crockett Company of Chicago, and Bossert specialties were attractively displayed.

Batteries and Accumulators.

What was shown principally by the Chicago Compound Battery Company was the compound primary battery, a new closed-circuit battery.

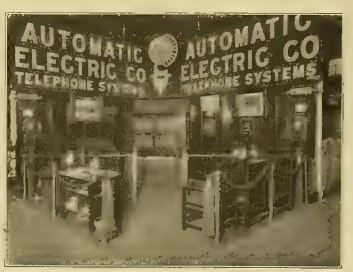
The General Storage Battery Company of New York made an interesting exhibit in which it not

EXCHANGE OF CHICAGO TELEPHONE COMPANY AT CHICAGO ELECTRICAL SHOW.

only showed a full line of the Bijur high-duty storage batteries and plates but also gave working demonstrations of a booster regulator and complete yacht-lighting equipment. The booster used in conjunction with the regulator was of the constant-current type, being driven by a shunt-wound motor. This machine was used to charge a Bijur storage battery, consisting of 15 plates of standard size F having a capacity of 672 ampere-hours at an eight-hour rate of discharge. Discharges of over 2,000 amperes, or three times the regulating rate, were taken from the cell by short-circuiting the cell through a low iron resistance. The charging current was maintained at approximately 100 amperes, the variation due to the 2,000-ampere jerk only producing an instantaneous variation not exceeding seven amperes in the current, after which it immediately returned to its former value, this giving regulation of less than one-half of one per cent. of the assumed load. The company was represented by President Joseph Bijur, R. C. Shaal, sales department; F. E. Booss, engineering department, and F. L. Merrill, Chicago representative.

In an artistically decorated booth the Chicago Battery Company exhibited the well-known Duro storage batteries and electrical lamps.

Various types of storage batteries, both the Chloride accumulator and the Exide accumulator, were shown by the Electric Storage Battery Company of Philadelphia. The largest cell exhibited at the Electrical Show, a type R-71 element in a type R-83 lead-lined tank, was to be seen here and was a duplicate of one of the 2544 cells now being installed by the New York Central and Hudson River railroad on its lines between New York and Poughkeepsie. Each cell has a capacity to discharge 4,200 amperes for a period of one hour. Other cells shown were a G-9 in lead-lined tank, an F-11 in glass tank and an E-11 in glass jar. A switchboard panel of blue Vermont marble had mounted upon it the standard instruments used in the operation of an electric-railway line battery.



AUTOMATIC TELEPHONE EXHIBIT AT CHICAGO ELECTRICAL SHOW.

Railroad car-lighting cells were shown. The Exide vehicle and sparking batteries occupied a prominent place. The exhibit was in charge of the company's Chicago office staff, consisting of G. H. Atkin, J. M. S. Waring, J. A. White, Irving Seaman and H. B. Marshall.

The Volta battery, an improved type of the Faure battery, was shown by the Volta Battery Company of Chicago. The smaller sizes are put up in metallic cells instead of the usual rubber boxes. This construction ensures durability and eliminates troubles, due to leakage of the electrolyte. This booth was artistically set off with signs in the form of silken banners and was in charge of Messrs. George Berger and Roderick Macrae. Over the desk in this exhibit was a large photograph of Lord Kelvin in his academic gown, underneath which were the words, "The Father of Electrical Engineers." On the side were shown autograph drawings in pencil and differential equations expressing the inductance in a solenoid ring with and without a soft iron core. These equations now of such importance in dealing with alternating-current problems are interesting from the fact that they were worked out before electricity was used, either for lighting or power, and before such things as voltmeters and ammeters were heard of, when inductance was known to a very few as "electromagnetic inertia" and when all measurements had to be taken with home-made galvanometers. It was from these equations that Lord Kelvin was able to tell in advance of the retardation of signals, due to electric capacity and inductance.

Black Hawk dry batteries were exhibited by the Central Electric Manufacturing Company of Rock Island, Ill. This battery is of a new type, and is said to be superior in regard to voltage and amperage.

The Universal Electric Storage Battery Company of Chicago showed as the main feature of its exhibit a 29-plate element of the type CX which was installed in one of the Chicago and Alton limited trains for electric lighting. This element weighs 138 pounds and is rated at 800 ampere-hours. It had been in constant service for the last eight months. One positive plate was removed and shown in section to illustrate the peculiar sectional construction and also to show the absence of deterioration and wear.

The Vesta Accumulator Company showed a line of Vesta accumulators for headlights, etc.

Many were interested in the Rock Island Battery Companys exhibit of dry batteries and Equipoise telephone arms. This company's factory in Cincinnati was recently burned down, but it now has a new factory in that city.

Schoenmehl primary batteries, made by the

SWEDISH-AMERICAN TELEPHONE EXHIBIT AT CHICAGO ELECTRICAL SHOW.

Waterbury Battery Company of Waterbury, Conn., were displayed by the Bryant Zinc Company, which is the Chicago agent for this apparatus.

Wires and Cables.

The American Steel and Wire Company's exhibit was an allegory in wire. A tall Corinthian pillar rose at the corner. This pillar was wound with one mile of large-gauge burnished copper wire. From the upper portion 36 copper wires shot out over the exhibit, carried by six-arm telegraph poles. The exhibit covered a double space and embraced a display of panels upon which were shown the different stages of manufacture of electrical wires; first, a copper-stranded core, then the first, second and third windings of the different layers of insulating composition. The main exhibit represented the Crown, United States and multi-terminal rail bonds and soldered rail bonds in different varieties, both singly and applied in all the different forms to the rails. Also appliances for installing rail bonds were to be seen, such as gasoline-driven grinding machines, hand and lever-worked drills, including the new multiple-spindle drill for installing the quadruple-terminal bonds. This bond is applied to the ball of the rail. Half-inch holes are drilled half an inch deep into the outer side of the ball of rail, into which the corresponding copper studs are firmly driven and anchored. No cumbersome tools or highly skilled labor is required. A picture gallery was another feature, showing application of the company's cables to the underground railway in New York and of other large installations. A picture of a remarkable occurrence was most noticeable—a rare species of humpbacked whale with a submarine cable wrapped around his jaw. This cable was being laid in the Pacific Ocean when one day it was discovered that the cable was leaking. It was rewound back a ways and raised to the surface, when this whale was discovered. It had bitten through the insulation in its struggles.

The India Rubber and Gutta Percha Insulating Company of New York was quartered in a spacious booth. Here were shown panels of various

types of insulated cables, insulated wires, photographs of the company's various products and sections of standard cables. J. B. Olson was courteous to visitors as he explained the merits of Habirshaw wires.

Samples of weatherproof iron wire, galvanized strand, guy wire, rubber-covered wire, etc., besides many specialties, went to make up the interesting exhibit of the Monarch Electric and Wire Company of Chicago.

Magnet wires in all sizes from No. 12 double cotton-covered to No. 40 silk covered; also braided and multiple conductors, were shown by the Belden Manufacturing Company of Chicago, which also distributed its new catalogue on electrical wires and cords. A machine that attracted considerable attention at this exhibit was a magnet winding machine. This machine is driven by a belt from a small motor or shafting. The winding spindle is fitted with a steel pulley, and is controlled by a rocker arm, having a friction driving pulley mounted on one end, and a brake on the other.

Conduit and Insulating Materials.

Immediately in front of the main entrance the visitor upon coming in was attracted by the display of Camp conduit of various sizes piled high in a manner to attract and hold attention. This was the exhibit of the H. B. Camp Company of New York. There was also displayed prominently the award ribbon given the H. B. Camp Company at the St. Louis Exposition.

G. M. Gest of Cincinnati and New York, contractor, who installs a great deal of underground conduit, had an exhibit in connection with the H. B. Camp Company. He exhibited a large number of interesting photographs showing underground construction work. The Gest cable rack was also prominently displayed. W. T. Jackson, manager of the Cincinnati office, was in charge.

The McRoy Clay Works of Chicago enclosed their space on two sides by a wall of clay conduit in large and small sizes. There were many handsome photographs on the wall of this booth showing conduit construction work.

Examples of fiber conduit were the feature of the exhibit of the American Conduit Company.

The Safety Armorite Conduit Company, of which M. B. Austin & Co. are [illegible] line of Loricated and Galvaduct [illegible] duit fittings, in charge of A. H. [illegible] traction of the exhibit was the [illegible] to show the smooth interior of the [illegible] was also a line of [illegible] and B [illegible]

In a very tastefully arranged [illegible] the American Circular Loom Company of [illegible], Mass., entertained its friends through its [illegible] representatives, H. B. Kirkland, general [illegible] ager, M. F. King, western manager, and [illegible] G. Grier. This company manufactures the [illegible] conduit known as Circular Loom and [illegible] conduit known as Electroduct.

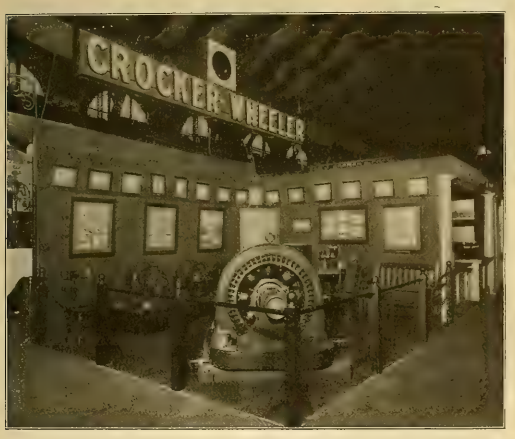
The Mark Manufacturing Company of Chicago exhibited Navalite conduit pipe. Its space was enclosed by a railing of two-inch conduit with an electric sign supported over the [illegible]

[illegible] men.

[illegible]

Allis-Chalmers Company.

Electric Storage Battery Company.



Crocker-Wheeler Company.

Western Electric Company.

FOUR INTERESTING EXHIBITS AT CHICAGO ELEECTRICAL SHOW.

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with a frame of conduit. D. L. Markle, manager of the conduit department, and C. E. Van Court were in charge.

An excellent exhibit was that of the H. A. Peterson Manufacturing Company of Chicago. Harvey-duct is one of the staple products of this company, and was prominent in the exhibit.

Near the entrance and on the main aisle of the Coliseum was a rather novel and at the same time artistic exhibit of Economy iron conduit and Flexduct flexible conduit. The opportunities presented to attractively display iron conduit are few, but this exhibit was popularly voted as very attractive, which speaks well for its designer. This exhibit was built in the shape of a cabin with walls made of iron conduit varying in size from one-half inch to three inches in diameter, making it a novel enclosure, 10 feet high, with a peak roof composed of 4,000 feet of Flexduct flexible conduit made practically in one piece, being looped at the eaves without a break, and making a good exhibit of the flexibility of Flexduct. Mr. I. A. Bennett, western manager, fitted the cabin with a complete office equipment in handsome Mission furniture, which is to be installed in the office of the company in Chicago. The exhibit was illuminated by several artistic fixtures, furnished by the Beardslee Chandelier Manufacturing Company, the entrance being

hibitors installed switchboards equipped with the latest types of these instruments.

Alpha H. Kling, sales manager of the Peru Electric Manufacturing Company of Peru, Ind., presided over his company's booth with his usual enthusiasm, talking particularly upon standard porcelain and National Electrical Code standard specialties, of which there was a tasteful display arranged at the back of the booth in the form of a great bullseye eight feet in diameter.

Eight different lines of electrical specialties were exhibited in the booth of the Thos. G. Grier Company of Chicago. Mr. Grier is the general sales manager for the Nungesser Electric Battery Company, and a number of dry batteries, from a big cell 34 inches high to small pocket batteries four inches high, occupied one corner of the booth. Other apparatus exhibited was the well-known 1900 telephone battery and the Acme ignition battery. The Hubbel specialties were shown; also those of McLeod, Ward & Co., who have put out a new line of desk lamps, reading lamps and a novel array of double-jointed fixtures. The Wotton extension telephone gong was exhibited in a variety of woods and finishes. The Wirt Electric Company had a new line of rheostats. The well-known line of tubes, knobs and cleats manufactured by the Brunt

Porcelain Works was in evidence, as was that of the Chase-Shawmut Company.

The American Electric Fuse Company exhibited samples of its well-known specialties.

Situated in one of the most prominent locations was the exhibit of the Manhattan Electrical Supply Company of New York and Chicago. The exhibit was in charge of Mr. A. O. Einstein. One of the features of the Manhattan's exhibit was that every article, with the exception of the Saco light, which is a European product, was made in the factory in Jersey City. The Manhattan company had a sign displayed in its exhibit offering the new catalogue free to those interested in the electrical business.

At the exhibit of the American Electrical Supply Company of Chicago were F. D. Phillips, E. J. Johnson and B. J. Mockenhaupt, who were glad to show and explain Colonial motors, De Veau telephones, Fostoria incandescent lamps and International meters.

The H. Krantz Company of Brooklyn, N. Y., made a very creditable showing in its commodious quarters by its display of switches, panels, switchboard accessories, etc.

Hylo lamps, switches, battery supplies and other accessories were shown by the Metropolitan Electrical Supply Company of Chicago.

The Sangamo Electric Company of Springfield, Ill., exhibited, in conjunction with the Electric Appliance Company, which handles its product. A highly ornamental panel carried a number of the Sangamo meters and requisite connections. There was besides a large case containing all the meter parts.

The International direct-current instruments made by the International Electric Meter Company of Chicago were much in evidence at the show. Considerable attention was shown them and many orders are said to have been taken. An attractive souvenir was distributed by the International Electric Meter Company in the shape of a small round pocket mirror having a cut of the instrument covering the entire back, producing the appearance of a miniature instrument. The companies which displayed their instruments were the American Electrical Supply Company of Chicago, Monarch Electric and Wire Company of Chicago, and the J. Lang Electric Company of Chicago. International instruments were used for measuring purposes by the following exhibitors: Crane Company, B. F. Sturtevant Company and the American Electrical Novelty and Manufacturing Company.

An extensive line of switchboard accessories and

FORT WAYNE EXHIBIT AT THE CHICAGO ELECTRICAL SHOW.

panel boards was to be seen at the headquarters of the J. Lang Electric Company of Chicago. A handsome switchboard panel was also part of the exhibit, carrying International meters, which are handled by this company.

Porter & Berg of Chicago exhibited a line of railway and mining supplies. Prominent also were the Locke insulators for high-tension work, some of those shown being for 50,000 and 60,000-volt service.

The Electric Appliance Company of Chicago was prominent near the main entrance to the Coliseum. Here were to be seen the varied lines of appliances and material which it handles. There was on exhibit insulated wire, fuses, pole-line accessories, lamps of all varieties, with frosted globes, clear globes and colored globes. Eaco series telephones were conspicuous; also batteries and other telephone appliances.

The display made by the H. T. Paiste Company was noticeable, not only as an electrical center during the two weeks, but as one of social prominence as well. Western Manager James Wolff of the Paiste company was constantly on hand, and during the "busy time" the booth was particularly well patronized by buyers. Mr. Wolff made a hit with his souvenir gilt pin, representing a Paiste socket. During the last week of the exhibition a change in the souvenir was made, and the exposition was literally flooded with a full-size representation in gold of a Paiste socket. This was attached to a red ribbon; and, as one man put it, if everyone bought a socket that wore a Paiste souvenir, Paiste sockets were flooding the country. Mr. Wolff, as one of the most prominent of the shows directors, certainly did his duty in the matter of not only increasing the attendance, but of entertaining as well the host of friends of the Paiste company. Mr. H. T. Paiste was in attendance part of the time.

Numerous new devices and specialties in the electrical line were a source of interest in the exhibit of the American Electrical Supply Company of Chicago, the booth being in conjunction with that of the Haller Machine Company, in the extreme southwest corner of the Coliseum.

Arc bursts and clusters were the most noticeable features of the display made by the Benjamin Electric Manufacturing Company of Chicago. There

AMERICAN STEEL AND WIRE COMPANY'S EXHIBIT AT CHICAGO ELECTRICAL SHOW.

was also on exhibit a cluster guard, which attracted much attention from its simplicity and the complete protection which it affords to cluster lights.

Signs and Flashers.

S. Newman was in charge of an interesting exhibit of fashion display signs manufactured by the Newman Manufacturing Company of Cincinnati.

At the booth of the Federal Electric Company, Chicago, the honors were done by James M. Gilchrist, R. B. Francis, G. C. Patterson and W. J. Devine. Samples of porcelain enameled steel panel and sectional-letter electric signs were in prominence at this booth; also Meridian and Federal clusters. A free word contest was instituted at the Federal exhibit, which took well, $25 in prizes being given away. Each person was given six cardboard boxes, each side of which contained a miniature Federal sign letter. Prizes were awarded for the best lists of words suitable for sign purposes which were formed out of the letters on the blocks. The company also had on exhibition samples of an advertising campaign intended for central stations.

Especially attractive on account of the life and motion given to the display by the Reco and improved Reynolds flashers and the Reco whirler, was the booth of the Reynolds Electric Flasher Manufacturing Company of Chicago. Mr. C. F. Ziegler, the president of the company, had personal charge of the display at night.

Outside of its regular line, the Haller Machine Company showed some entirely new schemes in sign lighting, among them a large grooved letter "O" flashed in three different colors. A great attraction, also, were the "jumping rabbits," designed for sign borders. Many other oddities in signs were on exhibit, and were explained by Carl Haller, William Goltz and Harvey Feltzer.

F. B. Badt & Co., with offices at 1503-04 Monadnock Block, Chicago, exhibited in the extreme southwest corner of the Coliseum an innovation in sign flashers. This flasher, called the Monadnock, runs without a motor, and was connected up to a large sign reading, "American." This flasher handles up to 100 amperes on each side of a sign, the flasher being so designed as to operate first one side of an illuminated sign and then the opposite side. The remarkable thing about this flasher is the low current consumption for its operation, the fact being that a Weston instrument placed in circuit with it indicates but two-tenths of an ampere average at 110 volts, as being the actual consumption for the operation of the flasher. The actual break of the 100 amperes on this flasher is made between two three-fourths-inch carbons, and the break is so rapid that no arc is set up, and at the end of three months it is stated that there was no depreciable difference in the length of the carbon rods used. This would seem to indicate that the flasher would last for a very long time, as claimed by the inventor. This flasher was exhibited jointly with the Haller Machine Company of Chicago, and was patented by Professor Badt, who also owns the basic patent on "skedoodle" devices. F. B. Badt & Co., who are western agents for Weston instruments, will be glad to send their complete pocket catalogue and also their new pocket telegraph code to any address.

Electric signs of a highly ornamental nature made the booth of the American Electric Sign Company not only attractive, but at the same time advanced several new ideas in this line.

Shades and Reflectors.

An extensive line of reflectors were on exhibition by Overbagh & Ayres, both of the glass and aluminum types.

Shades, reflectors and portables of all kinds were exhibited by the Chicago Lamp and Reflector Company of Chicago in one of the most artistic booths at the Show.

Shades of a highly artistic order were exhibited in an artistic display made by the Acorn Shade and Reflector Company. The booth was one to attract more than passing attention on account of the beauty of the products shown and their arrangement.

Delicate tints and handsome designs in ornamental lighting glassware attracted many to the booth of the Phœnix Glass Company of New York. E. H. Fox, western manager, was in charge, assisted by C. C. Fricke. A. H. Patterson, vice-president of the company, was also in attendance part of the time, having come on from New York.

Novelties.

Electrical novelties and fixtures were displayed in an artistic booth by the Adams-Arthurs Company.

Holcomb & Co. of Chicago showed many new and interesting things in the line of electrical novelties, sockets, small batteries, etc.

Vibrators, massage apparatus, etc., were demonstrated by Sam J. Gorman & Co.

S. B. Geen and A. Anderson were in charge of the exhibits of the Geen Electric Novelty and Manufacturing Company, which showed a complete line of electrical novelties, decorative lamps and the Genco dry battery.

Electrical novelties, heating and cooking devices, etc., were exhibited in the handsomely decorated booth of the McFell Electric Company of Chicago. Electric Gas Lighting Company of Boston, Bishop Gutta Percha Company of New York, Dayton Electrical Manufacturing Company of Dayton, Ohio.

W. H. SCHOTT'S EXHIBIT AT CHICAGO ELECTRICAL SHOW.

American Electrical Heater Company of Detroit and the Schwarze Electric Company of Adrian, Mich. One of the interesting features in this exhibit was the McFell fire-alarm system; also the Schwarze Universal bell, which is a radical departure from the old methods of gong and bell ringing.

Novelties in the electrical line were displayed in a pleasing manner by the American Electric Novelty and Manufacturing Company of New York.

Motor-control Systems.

The Electro-Dynamic Company of Bayonne, N. J., gave an interesting exhibit, consisting of a series of tests made on an Inter-pole motor, demonstrating that the claims made for this motor are well within its ability. Among the tests made were: Reversibility at any speed and at all loads, including 100 per cent. overload; constant speed from no load to full load at any set speed; sparkless commutation at all speeds and at all loads, including 100 per cent. overload in either direction. The company was represented by Mr. F. L. Merrill, manager of the Chicago branch, and Mr. F. G. Bell of the home office.

The J. L. Schureman Company exhibited a complete line of elevator controllers. Much interest was also excited by the remote-control magnet switches on exhibition. This type of switch eliminates the necessity of running heavy mains to the point of operation.

The Lincoln variable-speed motor, made by the Lincoln Electric Manufacturing Company of Cleveland, Ohio, attracted much attention. This motor

is a recent invention of Mr. J. C. Lincoln and marks a decided advance in the building of this class of motors. The chief feature of the motor are that the speed ranges from 2 to 1 up to 10 to 1, or greater, constant horsepower at all speeds, for use on ordinary two wire direct current circuits. No controller is used, and the motor operates in either direction at full load at all speeds. Mr. H. Morley Hitchcock of Cleveland, Ohio, was in charge of the exhibit.

MISCELLANEOUS.

A model of a complete coal washer and also some fine photographs and property plans were to be seen at the exhibit of the Peabody Coal Company of Chicago.

One of the booths around which there was always a crowd, when demonstrations were going on, was that of W. Scheidel & Co. of Chicago. Some interesting experiments were performed here daily, and the people were never tired of examining the X-ray and other apparatus.

The Standard Electrical Manufacturing Company and the Star Electric Company of Niles, Ohio, in Section C-10,, were very much in evidence with a display of their lamps and other products, and Mr. James P. Gilbert, secretary and treasurer of both companies, T. H. Bullock of the Chicago office, R. W. Lease, Robert Miller and H. H. Albut were present in the interest of these concerns.

An exhibit of historical interest was that of Charles E. Gregory. It consisted of the first electric-light plant in Illinois, installed in a Chicago store. The dynamo and some of the lamps were shown, the latter charged with nitrogen, original voltage unknown.

Simple but original in design, the exhibit of the National Carbon Company of Cleveland attracted no little attention. Large cylinders of carbon, and also smaller pieces of the company's product were built up in a large cubical structure in the center of the booth. There were also ample facilities for those who wished to rest there.

The B. F. Sturtevant Company had a working exhibit at the Show.

An armature for an electrical generator was constructed in the booth of the Guarantee Electric Company, an interesting process to visitors who were unacquainted with the method. There was also a line of small power motors shown at this booth.

An interesting piece of apparatus was the small Curtis steam turbine exhibited by the General Electric Company in a space apart from its regular booth. This machine was of the horizontal type, driving an alternator at 3,600 revolutions per minute. The turbine was of 33.53 horsepower.

The Dearborn Paint Company was an exhibitor at the Show.

A unique and interesting exhibit at the show was that of the American Bank Protector Company. The system shown in operation is known as the automatic double electrical burglar-alarm system.

Engineers and others interested in power-plant equipment found much of interest in the exhibit of the Crane Company, Chicago, in which were shown this company's latest designs and improvements in valves and steam specialties.

A complete and interesting line of portable electric drills, "holders-on" and storage batteries was shown by the Chicago Pneumatic Tool Company. A line of magnetic "old men" or "holders-on," for use with the drills, was interesting. This piece of apparatus is used entirely without bolts, and will hold in any position, the magnetic force being sufficient to hold it to the work against the pressure of the feed screw of the drill.

A device which will not only appeal to building contractors and decorators, but also to central-station men, as a user of current, was the electrically operated floor polisher, exhibited by J. P. Sullivan & Co.

The Fair Store of Chicago had a very artistic display of electrical novelties and fixtures at the show.

W. H. Schott of Chicago entertained many friends at his handsome booth near the northeast corner of the hall. In this booth was also installed a small system of piping, arranged to show the working from boiler to consumer of the well-known Schott system of heating.

A device not electrical but of interest to engineers in general was the Niagara tachometer, which indicates the speed of a machine connected to it by the rise of a liquid in a tube, centrifugal force being the actuating means. It was exhibited by the Niagara Tachometer and Instrument Company of Niagara Falls, N. Y.

The Bryan-Marsh Company, although it did not make an extensive display of its lamp products, had one of the most luxuriously arranged booths in the Coliseum, which was much frequented by the many friends of the company.

Electrical headlights of various sizes dazzled the eyes of visitors at the booth of the Edwards Electric Headlight Company of Laporte, Ind.

The Sandwich Pole-changer Company of Sandwich, Ill., had on exhibition the Sandwich ohmmeter, pole-changer and duplexer at the exhibits of the Stromberg-Carlson Telephone Manufacturing Company and the Electrical Appliance Company.

Northwestern Electrical Association.

An excellent programme [illegible] for the convention of the Northwestern [illegible] Association, which [illegible] held [illegible] [illegible] 18th, and the [illegible] were discussed [illegible] determined to [illegible] from deriving the most good [illegible]

The opening [illegible] on Wednesday morning [illegible] reported in the Western Electrician last week [illegible] new officers elected on Thursday morning

NEW OFFICERS OF THE ASSOCIATION.

Harold Almert of Chicago, the new president of the association, is well known and liked by members of the association on account of the prominent part he has always taken in its affairs and from his genial nature as well, which makes him welcome at all the meetings. Mr. Almert for the last three years has been general manager of the Cicero Light, Heat and Power Company at Oak Park, Ill., also of the Constantine Hydraulic Company of Constantine and Three Rivers, Mich. He also has acted in a consulting capacity for several other electric light and power companies. Four years ago, for one year, he was engineer for the Chicago office of the Buckeye and Jandus Electric

E. B. Kirk, First Vice-president — Harold Almert, President — B. C. Adams, Secretary and Treasurer

NEW OFFICERS OF THE NORTHWESTERN ELECTRICAL ASSOCIATION.

Company of Cleveland. Previous to that he was for four years superintendent of water and light for the Lincoln Park commissioners of Chicago. Nine years ago he was instructor for a short time at the Chicago School of Applied Electricity. Previous to this, after finishing his schooling at the Chicago English High and Manual Training School and the Chicago Business Law School, Mr. Almert was for five years in the engineering department of the Chicago Telephone Company. Mr. Almert is only 30 years old; and for one of that age his experience has been remarkably broad and varied.

Edward B. Kirk of Oshkosh, Wis., first vice-president of the association, is vice-president and general manager of the Winnebago Traction Company of Oshkosh. Mr. Kirk graduated from Purdue University with the class of 1897 in electrical engineering. For one year he was electrician in charge of the lighting plant at the Illinois Central Hospital, Jacksonville, Ill. After this he was for six months shop foreman of the Jacksonville Railway Company at Jacksonville, Ill. Four years were spent as superintendent of the Jacksonville Railway Company at the same place. For six months Mr. Kirk was engineer of tests for the Milwaukee Electric Company, Milwaukee, Wis., and for one year electrical engineer and master mechanic for the Grand Rapids, Grand Haven and Muskegon Railway Company, a high-speed, third-rail electric line. Since December, 1904, he has been with the Winnebago Traction Company as general manager and vice-president.

Frank J. Baker, second vice-president, is the manager of the North Shore Electric Company, which furnishes current to towns in the vicinity of Chicago both along the north shore of Lake Michigan and in a belt surrounding Chicago. Mr. Baker is well-known to central-station men and his election was a well-deserved compliment to his ability.

B. C. Adams of Madison, Wis., superintendent of distribution of the gas and electric departments of the Madison Gas and Electric Company, was elected secretary-treasurer of the association. Mr. Adams is a young man well liked by members of the association, which he but recently joined. In 1903 he graduated from the electrical engineering department of the University of Wisconsin and for a time was employed by the Colorado Telephone Company at Denver. The remainder of his experience has been with the Madison Gas and Electric Company, where he was successively connected with the operation of the steam plant, gas-engine plant, coal-gas works and water-gas plant, until finally he was appointed to the responsible position of superintendent of distribution.

The new officers were installed on Thursday [illegible] Williams [illegible] [illegible] mitted.

PAPERS AND DISCUSSIONS.

The first paper read [illegible] Proper Handling of [illegible] George H. [illegible] the paper was read by Irving P. Lord of Waupaca and was well discussed.

Wednesday afternoon there were three papers read. The first was by P. H. Korst of Janesville upon "Suggestions for Increasing the Power Output of Central Stations." The next was by W. D. Buford of La Cross upon "Modern Underground Construction." Following suggestions made last year, written discussions were called for from a number of the members. One of these written reports was from G. B. Springer of Chicago on Mr. Buford's paper. The paper was discussed generally also by the members present. The last paper on Wednesday was by George Williams on the "Organization and Development of New-business Departments," a written report on this paper being contributed by Mr. Almert.

The remaining papers on the programme were read on Thursday and were as follows: "Government Test on Fuels," by C. J. Davisson (report by A. W. Richter); "Successful Applications of New Business Methods," by John S. Allen; "The Economics of Combined Railway and Power Plants," by Ernest Gonzenbach; "The Effect of Load Factor on Station Costs," by R. N. Kimball.

Seven new members were elected to the association at the close of the session Thursday. The executive committee held a meeting on Friday morning, which closed the proceedings of the convention.

National Electric-light Convention to Be Held at Atlantic City.

Official announcement is made that the twenty-ninth convention of the National Electric Light Association will be held at Atlantic City, N. J., on June 5, 6, 7 and 8, 1906. Owing to the many additions to the membership of the association now being made, as well as other evidences of increased interest in the association work, it is confidently believed that all previous records of attendance will be broken. It is the intention to provide a suitable hall for such exhibits as may be made by the manufacturers and supply dealers who are members of the association.

The Iron Trade Review of Cleveland believes the electrification of most of the steam railroads of the United States is as certain as any future great event can be. It believes that many hundreds of millions of dollars will be spent in this way during the next quarter century. The change will naturally follow much the same lines as did the introduction of the present high-power locomotive, the great trunk lines taking the lead and being more or less closely followed by the smaller roads

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

Steam-turbine Power Station in the Clyde Valley Near Glasgow. By Frank C. Perkins. Illustrated....71, 72
The Chicago Electrical Show. Illustrated....72, 73, 74, 75, 76, 77, 78. 79
Northwestern Electrical Association. With portraits....79
National Electric-light Convention to be Held in Atlantic City 79
Editorial....80
The Franklin Bicentenary. Illustrated....81, 82
Proposed Power Development from the Glaciers on Mount Hood....82
Municipal Ownership Measures of Mayor Dunne Passed by Chicago City Council....82
Sleet Hampers Transportation and Communication Facilities in Chicago....82
Electrical Salesmen's Association. Illustrated....83
Proposed Power Transmission in Western New York....83
Indiana Engineering Association....83
Selling Electricity....84, 85
The Sale of Electric Light and Power. By S. Morgan Bushnell....84
Co-operation in Stimulating the Use of Current-consuming Devices. By J. Robert Crouse. (Communication.)....84, 85
Central-station Advertising. Illustrated....85
Suggestions for Increasing the Power Output of Central Stations. By P. H. Korst....85
Allis-Chalmers Railway Motor. Illustrated....86
New Fuseless Rosettes. Illustrated....86
New Holophane Reflector. Illustrated....86
Municipal Street Railway in British Columbia Loses Money.. 86
Electrically Operated Pulp Mill at Sauk Rapids, Minnesota... 86
Independent Telephone Interests Win in Important Patent Litigation....87
New Officers for Indianapolis Telephone Companies....87
Indiana Telephone Items....87
Telephone News from the Northwest....87
Ohio Telephone Notes....87
Michigan Telephone Matters....87, 88
New Companies....88
Extensions and Improvements....88
General Telephone News....88
Chicago Telephone Company's Report....88
Bell Telephone Output for 1905....88

DEPARTMENTS.

Correspondence....88, 89, 90
Great Britain....88, 89
Dominion of Canada....89
New York....89
Ohio....89
Michigan....89
Indiana....90
Pacific Slope....90
Northwestern States....90
Personal....90
Electric Lighting....90
Electric Railways....90
Publications....90, 91
Societies and Schools....91
Miscellaneous....91
Trade News....91
Business....91
Illustrated Electrical Patent Record....91, 92

DATES AHEAD.

Chicago Electrical Show (first annual exhibition of Electrical Trades Exposition Company), Coliseum, Chicago, January 15th to 27th.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

THE success of the Chicago Electrical Show is a credit to the electrical industry. The show is honestly electrical, managed by electrical men, and containing genuine electrical exhibits, which are up-to-date, varied and instructive. It has excited the interest of the press and public of Chicago, who have liberally supported it, and it has drawn a large out-of-town attendance of electrical men. The result has entirely justified the expectations of the Chicago electrical men who organized the show and worked so hard for its success. No doubt the show will hereafter be an annual event, as it should be.

HELPFULNESS in the matter of securing new business for the central station is one of the functions of the electrical journals, and the fact is gracefully recognized by Mr. John S. Allen in his paper on "The Proper Handling of the New Business Department," read before the Northwestern Electrical Association last week. The electric-light company, he truthfully says, should subscribe, for the benefit of the new-business department, for at least six magazines. Mr. Allen suggests two lists of helpful journals, the second given as supplementary. The Western Electrician, it is pleasing to observe, is on the first list.

AUTOMOBILE trucks of the electric variety have one certain advantage over their gasoline competitors; they are safe. An illustration is afforded by the following news item from the Chicago Daily News of January 11th: "An auto-truck, valued at $5,000, and owned by Lyon & Healy, caught fire at One-hundred-and-sixth Street and Avenue L today from an explosion of gasoline. Three men who were on the truck at the time escaped unhurt and, assisted by firemen, saved a piano which was in the truck." The incident discloses a practical objection to the gasoline truck. Nobody ever heard of an electric vehicle catching fire from any internal cause.

TELEGRAPHY, in mimic representation, has for many years had a place on the stage, and playgoers can easily recall not a few dramatic climaxes in which the ticker or the operator's room or the cross-country construction played a conspicuous part. Some of these plays, like the well-known "Secret Service," with its readily remembered telegraph scene, were meritorious productions and received the applause of theater frequenters of the better grade. But the newer "wireless," which has of late made its appearance on the stage, appears to be restricted to melodrama as yet. Billboards bear gaudy pictures of alleged space-telegraph stations with aerials shaped like a pantograph spitting fire into the atmosphere in the most terrifying and absurd fashion. This is, we are told, "the famous wireless telegraphy scene—the first production on any stage." It is conceivable that "wireless" episodes could be deftly woven into legitimate drama. Indeed, a story built around the war correspondents' use of space telegraphy from their dispatch boats during the Russo-Japanese war might be thrilling and true to the fact. But the melodramatic "wireless" of the forked-lightning variety is merely tiresome. The "first production" of such trash might well be the last.

HOLDING an electrical convention during an exposition has its drawbacks as well as its advantages, as was demonstrated during the World's Fairs of Chicago and St. Louis. The great outside attraction may serve as a magnet to draw a greater attendance than would be otherwise the case, but yet the convention has in a measure to compete with the big show, with the result that those who attend are strongly tempted to "play hookey" instead of discussing problems of management in the convention hall. Nevertheless, the Northwestern Electrical Association held a creditable convention in Chicago last week during the period of the Electrical Show. A good programme had been arranged, and it was carried out faithfully. The papers were up-to-date, including two on the "new-business" propaganda which is now attracting so much attention. One of these papers is given in this issue of the Western Electrician, and others, with discussion, will be given later. The association has chosen an entire new administration, after giving a unanimous vote of thanks to Mr. Mercein, who has been secretary and treasurer of the association for so many years. Mr. Almert, the new president, is a resident of Chicago, although his central-station interests in Michigan make him more particularly eligible for the office he now holds. He is well known and well liked by the electrical fraternity, and his clear-headed progressiveness and popularity should do much for the success of the association during the coming year.

IN RELATION to the electrification of the Simplon Tunnel the Western Electrician is now advised that the negotiations which have been in progress for some time between the Swiss and Italian governments relative to the subject have recently been concluded. The system to be adopted is that at present in use on the Valtellina railway in Northern Italy. We understand that various non-technical reasons have conduced to the choice of the three-phase system in this case, and we are furthermore informed that the merits of the single-phase system of traction have not been overlooked, for its adoption in the future has been provided for in the contract recently awarded the Brown-Boveri concern by the Swiss authorities.

Both the Swiss and Italian governments were very desirous that the electric trains should be running at the inauguration of the tunnel early in June next, and the Italian government has agreed to lend the necessary locomotives from the Valtellina line in case the contractors are unable to deliver the three-phase locomotives in time for this date. This solution has been accepted by the Swiss government. Two sub-stations will be established, one at each end of the tunnel, and current will be supplied gratis by the Swiss government up to these points of conversion. This current will be generated at one of the numerous hydraulic stations in the district. The estimates have been based upon an assumed train weight of 300 tons for passenger trains and about 400 tons for freight trains, with approximate speeds of 89 and 35 kilometers an hour, respectively.

The prices in the contract include that for the train haulage, which averages 60 centimes per train kilometer. The contract further provides for the substitution of single-phase traction for the three-phase to be provisionally installed. Apparently the Swiss government authorities took a large view of the question in this particular and were firm in their desire to have the contract modelled to include the eventuality of the adoption of single-phase traction.

BY A complete and curious reversal in its policy the Chicago City Council has abandoned its support of the principle of private ownership, as expressed in the ordinances extending the franchises of the street-railway companies, and has given its adherence to the mayor's policy, or rather to one of his policies—and not the one he favored most, which was his "contract plan"—looking toward municipal ownership of Chicago street-railway lines. In other words, the council, on January 18th, by a vote of 37 to 28, adopted a resolution providing for the issue and sale of $75,000,000 worth of "Mueller-law certificates," the proceeds to be used for the purchase, construction and equipment of street railways "in and upon and along the streets upon which street-railway tracks are already located." This action, by an express provision of the Mueller law, is subject to ratification by vote of the people at the municipal election of next April. It is not certain at this writing whether the proposed extension ordinances will be submitted at that time. But it is to be hoped that they may be, so that a clear-cut issue may be presented to the voters, who should decide between two concrete policies. After the election the final solution of the almost interminable traction imbroglio should be appreciably nearer. That result, at least, will be some alleviation of a dismal situation.

In the Chicago City Council there is one group of aldermen conscientiously favoring immediate municipal ownership. Another group, just as honest, considers municipal ownership at the present time inexpedient. But there is a third group which does not appear to be governed very much, in considering this question, by principles of settled convictions of any kind. The aldermen constituting this remnant of other days have now, for reasons best known to themselves, swayed the balance in favor of municipal ownership. The victory is one of which the honest municipal-ownership aldermen are not particularly proud.

The Franklin Bicentenary.

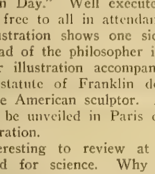
The two-hundredth anniversary of the birth of Benjamin Franklin was celebrated very generally on January 17th in Boston, Philadelphia, New York, Chicago and other large cities. In Philadelphia, where Franklin spent the greater part of his long and useful life, all the public schools, many churches, societies and institutions united in observances, and at night there was a beautiful illumination of the great municipal building. The exercises, however, were only preliminary to the celebration, which will be held Easter week in Philadelphia and in France. In Boston the state of Massachusetts and the city of Boston united in celebrating the two-hundredth anniversary of the birth of Benjamin Franklin. Public exercises were held in Symphony Hall in the presence of a large company. The programme included the singing of historical and patriotic selections by a chorus of pupils from the Boston public schools and addresses by prominent men. There were also public meetings, banquets and lectures in New York, Chicago and elsewhere, printers and publishers being especially conspicuous in paying these honors.

An interesting feature in Chicago was the designation of January 17th at the Electrical Show as "Franklin Day." Well executed bronze medals were given free to all in attendance. The accompanying illustration shows one side of the medal, with the head of the philosopher in bas-relief.

The other illustration accompanying this article shows the statute of Franklin designed by John J. Boyle, the American sculptor. A replica of this statue is to be unveiled in Paris during the bicentenary celebration.

It is interesting to review at this time what Franklin did for science. Why should scientific and electrical men pay tribute to his memory? The Western Electrician can perhaps best answer this question by quoting from an article written by the late John B. O'Hara, at that time managing editor of this journal, on the occasion of the dedication of the Franklin statue in Lincoln Park in 1896. What follows, therefore, is from Mr. O'Hara's pen.

Every schoolboy is familiar with the experiment that made Franklin's name immortal, but how few educated men are fully acquainted with the studies and experiments, the labor and trials, the disappointments and failures experienced by this eminent philosopher in solving the great problem of the age? There were many considerations that entered into the subject and they must now be recognized if proper credit is to be given for the successful accomplishment of Franklin's great undertaking. One has only to consider the prejudices and superstitions of the people, the awe with which they regarded the "celestial fire" in those days, to realize the strength of mind and steadfastness of purpose which Franklin possessed. "From lightning and tempest, from plague, pestilence and



FRANKLINS MEDAL DISTRIBUTED AT CHICAGO ELECTRICAL SHOW (ACTUAL SIZE).

famine," the Christian world prayed for delivery, and the full meaning and significance of this invocation of divine protection or interposition can best be understood after an examination of the literature of early days. It abounds in reference to this fire from heaven—the scourge which the human family most dreaded. Christian nations looked to the Almighty for protection from this terrible visitation of the wrath of Jehovah, and they refused to entertain the idea that divine will might be exercised through the instrumentality of man's devices. This sentiment prevailed long after the announcement of Franklin's discovery, and it may be said to have many supporters at the present time.

Abbé Nollet voiced the belief of the age when he declared it "was as impious to ward off God's lightnings as for a child to resist the chastening rod of the father." And yet the man who spoke thus was one of the foremost scientists of his day and generation. He had followed Franklin's experimental work in its development with no little interest, and he had himself devoted much thought to the identity of electricity and lightning. His treatise on physics, which appeared in 1748, contained an article which formed a valuable contribution to the literature of this subject. In this he says: "If anyone should take upon him to prove from well connected comparison of phenomena that thunder is in the hand of nature [illegible] our pleasure are [illegible] that frighten us, and [illegible] the same mechanism, [illegible] that a cloud prepared [illegible] by heat, by a mixture of [illegible] to a terrestrial object, [illegible] tized body and at a certain [illegible] which is not, I avow that [illegible] supported, would give me a [illegible] and in support of it how [illegible] present themselves to a man who [illegible] with electricity."

Thus wrote the great French [illegible] discovery of his American contemporary, [illegible] announcement of the latter [illegible]

THE BOYLE STATUE OF FRANKLIN.

ments reached Europe and the means to which the discovery was to be applied, Abbé Nollet did not hesitate to condemn the plan as "an impious defiance of the power of the Almighty." He had many supporters, too, among the learned men of Europe and this country.

Still Franklin determined to utilize his discovery for the benefit of mankind in spite of adverse criticism and condemnation of many who had formerly admired and supported him. It was for this purpose that he had labored so unceasingly, that he had endured privations and hardship and had braved death itself in the pursuit of his investigations.

Franklin was eminently practical; all of his work was directed toward the amelioration of the condition of his fellows. When he engaged in the study of electricity in 1746 he at once sought a way to secure some practical benefit from this scientific toy. It was in the experiments conducted at Philadelphia that it was first demonstrated that the electric motor could be utilized for imparting motion to other apparatus and doing useful mechanical work. It is true that the motor with which Franklin and his associates performed the experiment of ringing chimes was a very crude affair and not at all like the finished product of the present day; yet this early utilization of electrical energy is abundantly attested and is accepted by the authorities.

That Franklin was actuated by philanthropic motives in conducting these experiments and not by a desire for distinction or fortune is clearly shown by his personal correspondence with Peter Collinson, the English merchant and trader, who was greatly interested in the work of the American colonist and through whom Franklin communicated his discoveries and conclusions to the Royal Society.

Franklin frequently expressed regret in the early days that his experiments had not as yet developed anything of practical value. "We have been hitherto able to produce nothing in this way of use to mankind," he says in one of his letters to Collinson, and this sentiment often finds expression in his correspondence, but he continues hopeful of great results, and in another of his letters he outlines his plans for a meeting of his friends at the conclusion of his experiments, when "turkey is to be killed by the electrical shock and roasted by the electrical jack before a fire kindled by the electrical bottle; when the healths of all the famous electricians in England, Holland, France and Germany are to be drank in electrified bumpers under the discharge of guns from the electrical battery." This fanciful description gave many the impression that the New World possessed a master in fiction, a dreamer, and the great philosopher was ridiculed for his boldness.

The history of his preliminary work, if such it [illegible] advantage [illegible]

It is not necessary [illegible] to dwell upon the [illegible] the many [illegible] to the [illegible] through his [illegible] affairs, the [illegible] colonies that had [illegible] England [illegible] bestowed upon the [illegible] who had overturned [illegible] will explain the condition [illegible] the Royal Society considered [illegible] tributions. Collinson, to whom [illegible] intrusted for transmission to the [illegible] at once their importance, but he [illegible] the organization to accept his [illegible].

The rejected papers comprised the [illegible] Franklin's scientific labors, his final [illegible] reached after years of application, and a careful explanation of the reasons that led him to believe that electricity and lightning were identical. He had departed from approved methods, he had put aside his "electrical bottles" and his glass tubes, and he had looked in the face of nature for an explanation of the phenomena. He had utilized the knowledge gained in his preliminary work in making his deductions.

Following this line of reasoning to its logical conclusion the idea was forced upon him that lightning could be drawn from the clouds by means of pointed steel rods the same as a charge of electricity could be drawn from one body by a pointed conductor. "May not the knowledge of this power of points be of use to mankind in preserving houses, churches, ships, etc."? is the query propounded by Franklin. He believes it may, and proceeds to tell how the experiment may be made. There were no buildings in Philadelphia sufficiently tall to afford facilities for this test, and therefore his conclusions were given to the world untried by actual experiment. How positive must have been the faith of the great philosopher in the accuracy of his conclusions. He accompanied his suggestions by detailed instructions of the manner in which the experiment should be carried out. He had reached the conclusion by a purely mental process, but so exact was he in all the details that one can scarcely believe that the system proposed was not developed by years of experience.

This document is most convincing proof of the high order of the intellectual gifts of the great American. But the English society did not regard it in this light; they looked upon it as the freak of a madman, and neither Collinson nor Dr. Fothergill could persuade their associates that it should be given a trial upon its merits. It was pronounced too absurd to be seriously considered by a society of English scientists. Franklin's friends persisted in getting his contribution before the world, and when the leading scientific journal of the English-speaking world refused to admit it to its columns they secured its publication in pamphlet form. Only a limited number of copies were printed, but they proved a drug on the market. A year passed and still there was no evidence that this wonderful discovery had made any impression on the public mind. Then a copy found its way into the hands of a Frenchman; it appealed to him, and he gained the interest of others. It was translated into the French language, placed on sale in Paris, and soon the French capital was in a fever of excitement over the quaint work. The experiments described by Franklin were performed before the scientific societies and repeated in the presence of the king.

One experiment was reserved for future consideration. It was agreed that this was by far the most important revelation of the entire work, the experiment with the pointed rods, which had been pronounced by the Royal Society of England too visionary for the serious consideration of English scientists. Elaborate preparations were made for this test at Marly la Ville, near Paris, and also in the gay French capital. It is unnecessary here to repeat the story of the successful experiment or to dwell upon the sensation produced throughout the entire civilized world by the announcement. The Royal Society was incredulous, but when the facts were communicated to the French Academy by eminent scientists that body placed its official sanction upon the so-called "fairy tale."

When the news reached Philadelphia there was great commotion. Franklin was dissatisfied, how-

ever. In the French experiments the pointed rods were only 40 feet high in the first case and did not extend above 90 feet in the second test. This did not prove conclusively that the electrical charge from the clouds had been dissipated by the pointed rods. But how was he to conduct experiments upon a more extensive scale? There was no tall building in Philadelphia upon the top of which he could erect a rod that would pierce the clouds. Then came the idea of the kite—an idea that would have made the Frenchmen love Franklin even had his grand experiment failed. But it was one that would scarcely find favor in the eyes of his fellow citizens, and therefore Franklin did not communicate his plans to his associates.

The details of this trial need not be enumerated here; all are familiar with the circumstances and the tale has been told to every generation and in every clime. The fame of America's first and greatest philosopher spread rapidly to all lands. He had braved death, he had invited destruction, and had he perished the world would have pronounced him a madman. But he lived; he triumphed; his theory was established beyond dispute; science was enriched; mankind was benefited, and that was the ultimate aim of the great philosopher's life.

Proposed Power Development from the Glaciers on Mount Hood.

The Mount Hood Electric Company, incorporated by G. W. Waterbury and C. W. Miller of Portland, Ore., and Edwin D. Whitney of Chicago, proposes to develop the waterpowers from the Big Sandy and Zigzag glaciers near the summit of Mount Hood and hopes to generate 80,000 horsepower to be carried on three independent transmission lines to Portland for power and lighting in competition with the Portland General Electric Company, which at the present time controls the production and distribution of electricity in the Willamette Valley by possession of the waterrights at the Oregon City falls of the Willamette River.

Bids are being invited for equipment of the first of three plants to be constructed by the Mount Hood company on the Sandy River, which has its source in the Mount Hood glaciers, and drains a watershed embracing 500 square miles. Within these limits the annual precipitation, according to government records, is 84 inches, or double the precipitation at the city of Portland, 50 miles distant from the glaciers. The aggregate effective head at the three plants is 850 feet and is secured by using the water at different points for 14 miles along the upper reaches of the stream.

Work is being pushed on construction of a five-mile canal for plant No. 1, located 30 miles from Portland. The available water supply at this point is about 600 second-feet, and a head of 300 feet will be obtained by taking it in a canal to a reservoir about 100 acres in extent and dropping it into the wheels. A minimum of 17,000 horsepower, it is said, will be secured.

After the water is discharged from the wheels of plant No. 1 it is carried in a canal six miles to a 200-acre basin near the town of Bull Run, 320 feet above the original Sandy River, for plant No. 2.

At this point the waters of the Little Sandy River also are discharged into the basin through a flume three miles in length. The available water supply is 800 second-feet, having a generating capacity continuously of 24,000 horsepower. This plant is located 22 miles from Portland. The equipment now being purchased for its construction will consist of six hydraulic units having a development of 5,000 horsepower each, with a speed of 450 revolutions per minute, direct connected, the alternators generating three-phase 60-cycle current at 2,200 volts, each having a normal capacity of 2,500 kilowatts. The transformers will be in banks of three, having a normal capacity of 5,000 kilowatts per bank; each bank thus providing for two generators. Bids have been asked for six 5,000-horsepower 43-inch high-pressure Victor turbines, 450 revolutions per minute, Francis type, constructed to operate in a spiral cast-iron flume discharging through a cast-iron quarter turn through the draft tube into the tail race.

About one mile below the No. 2 plant the water is taken from the stream by canal and woodstave pipe and carried five miles along the mountain side to the site of plant No. 3. Here the available water supply is 1,000 second-feet, and the mean effective head under which it is to be discharged into the wheels is 220 feet, giving about 20,000 horsepower at the generators. The development will consist of four 5,000-horsepower units. This plant's location is 16 miles from Portland.

The company has been organized with a directory including S. B. Cobb, Samuel Connell, C. W. Nottingham and eight other prominent Portland business men. The project has been financed by a $1,000,000 bond issue to the Bank of America of San Francisco.

It is pointed out that peculiarly favorable conditions are proved by government records to exist on the mountain. The elevations along the stream within the limits of the development vary from 2,000 feet at the lower plant to 6,000 feet at the site of the uppermost plant near the timber line. The glaciers, lying at an elevation of 9,000 feet, will furnish the bulk of the water supply from July 15th to October 15th, when the Oregon rains begin. Government Camp at Bull Run, at an elevation of 9,000 feet, records an annual precipitation of 90 inches, while the precipitation at Portland is only 43 inches. At Government Camp the average maximum temperature is 84 and the minimum 33. When the rains on the lower levels of the mountain cease in the late spring the melting snows in the timber belt on the higher elevations continue to furnish a steady supply of water until late in July, and after the snow below timber line disappears the water comes from the glaciers. Mount Hood is 11,500 feet above sea level. H.

Municipal Ownership Measures of Mayor Dunne Passed by Chicago City Council.

By a complete reversal in its attitude the Chicago City Council last week rejected the franchise-extension ordinances drawn by the local transportation committee when the aldermen met in committee of the whole. Instead the council adopted, by a vote of 37 to 28, the mayor's $75,000,000 Mueller-certificate ordinance, allowing the city to purchase, build and maintain street-railway lines, the action being subject to a referendum vote of the people at the April election. Following this, the council, by the same vote, passed the mayor's ordinance providing for municipal operation of the lines, also subject to a vote of the people.

As the traction situation now stands, the voters will have to decide clearly whether they want to place $75,000,000 in the hands of the aldermen to go into the street-railway business. Of course should the people ratify the council's action, it would then have to be determined in court whether the provisions of the Mueller law are valid, and then, if declared valid, it would be necessary to find people willing to put their money into the Mueller certificates.

The action of the council came as a great surprise. All along a good majority voted against the mayor's municipal-ownership ideas and stood with the local transportation committee, which was by a safe majority in favor of renewing the companies' franchises under proper restrictions. This committee worked for months with the representatives of the traction companies and finally completed what it considered a fair agreement with the companies. The ordinance so drawn provided compensation to the city, required reconstruction into first-class systems with ample service, and contained a clause under which the city could buy the lines at certain defined periods during the 20-year term.

This ordinance, the principal features of which have appeared in the Western Electrician, was declared by the committee to be the best available solution of the tangled situation which is responsible for the city's inadequate transportation facilities. The companies, also, declared that in agreeing to the terms of the ordinance they had made many concessions and would not accept it if essentially changed by the council.

This ordinance was reported to the council by the committee, to be considered in committee of the whole. So many amendments were in sight that the ordinance was at once referred back to the committee, which undertook to pass upon them and later report back to the council. It at once became apparent to the committee that the amendments offered were considered so burdensome by the companies that the traction officials would reject the ordinances if so amended.

When the council met last week to consider the committee's report about a dozen aldermen who have always been against the municipal ownership ordinances concluded from speeches which had been made that it would be useless to try to pass the extension ordinance, and when someone made the motion to substitute the mayor's $75,000,000 ordinance for the extension ordinance, these aldermen, following the lead of Alderman Cullerton, voted with the mayor's supporters with the result stated. The franchise-extension advocates then refused to have their ordinance placed on the ballot for the spring election with the mayor's proposition.

The Mueller certificate ordinance is entitled: "An ordinance authorizing the city of Chicago to construct, acquire, purchase, own and maintain street railways within its corporate limits and providing the means therefore," and the two important sections read:

Be it ordained by the city council of the city of Chicago:

Section 1. That for the purpose of acquiring street railways either by purchase, construction, condemnation, or otherwise as provided by law, and for the equipment of such street railways in and upon the streets of the city of Chicago hereinafter described, so as to provide for a first-class street-railway system, the city of Chicago may issue and dispose of its interest-bearing "street-railway certificates" in the manner provided by law, not to exceed the sum of $75,000,000.

Sec. 2. That said street-railway certificates or the proceeds arising from the issuance and sale thereof shall be used by the city of Chicago for the purpose of acquiring either by purchase, construction, condemnation, or otherwise, street railways, together with the equipment thereof, in and upon and along the streets upon which street-railway tracks are already located.

There are a number of following sections which are drawn to comply with the intent of the Mueller law. They provide for the form of the certificate to be issued and the formation of a sinking fund to care for their retirement, this fund to be invested at compound interest, if the city treasurer does not object. They provide further that the street-railway properties to be acquired be mortgaged to secure the payment of these certificates, and none of the money received from their operation, except interest on these certificates and cost of operation and expenses, be used for any other purpose than a sinking fund until the certificates are wiped out.

If, however, there is a surplus after the sinking fund has been provided for them it can be spent on extensions, which, however, shall not in any one year exceed five per cent. of the total mileage of the city's roads.

Provision is made for a trustee or trustees to whom the certificates shall be issued under the mortgage which is to secure them.

The second ordinance—the one which puts up to the people the question whether they want to authorize the city to operate street cars, as well as to borrow money to buy them with—quotes the section of the Mueller law which reads: "But no city shall proceed to operate street railways unless the proposition to operate shall first have been submitted to the electors of such city as a separate proposition and approved by three-fifths of those voting thereon."

Sleet Hampers Transportation and Communication Facilities in Chicago.

Chicago and the territory for 200 miles west, northwest and southwest was almost cut off from telegraphic and telephonic communication with other parts of the country by an unusually heavy blanket of sleet which fell late Sunday night. Steam trains and electric interurban cars entering the city were delayed on Monday morning. In the city, service on the elevated roads was badly delayed, and the interruption continued throughout the day and following night, during which time an alternating storm of rain, sleet and snow kept up. The sleet on the third rail was the worst since the elevated roads were constructed.

Telegraph lines and poles became strained beyond endurance by the load of ice which formed, and broke down. The city was cut off from the east practically all day on Monday, but hundreds of linemen from Chicago and other cities were able to repair the damage sufficiently so that by night messages were coming in slowly.

Communication by telephone from the east and south was even more difficult. The long-distance company made this statement of conditions: "Extraordinary roundabout methods of electrical communication were attempted on a scale seldom if ever before known. New York endeavored to reach Chicago by way of the Canadian Pacific to Duluth, and thence south. This proved unsuccessful, but a trunk line finally was established on a long-distance telephone wire from Minneapolis to Cleveland, via St. Louis. Before this was accomplished, the only possible route from the east was through St. Louis and Kansas City to Salt Lake, Utah and Helena, Mont. From Helena there was a loophole back east to St. Paul, but of such an uncertain character as to be available for only the most important brief news bulletins."

Sunday evening the lines of the Postal Telegraph-cable Company to St. Louis began to break. From then on the progress of the storm could be traced as it came from the southwest by the successive breaks that occurred. Monday evening messages to and from Chicago either were mailed to some point from where they could be sent or they were carried there by the operators who took them on the trains to and from South Bend and other cities where the wires were in working order.

The Western Union company suffered no less severely, and the few lines that remained intact gave but poor service. Its difficulty also lay toward the east, principally.

Many of the wires of the municipal light plant in Chicago were down Sunday night. After midnight the current failed in many West Side streets. In Madison Street the lights were out at two o'clock. At Forty-third Street several telegraph and telephone poles fell down, carrying the heavy cables with them, on the elevated tracks of the Rock Island and Wabash roads.

A bill has been introduced at Albany, N. Y., empowering the governor to appoint an examining board of three members in each county to license master electricians. The boards shall be composed of employing or master electricians. A fee of $25 is provided for all applicants who have been for five years previous to the passage of the act master electricians, and an annual registration fee of $2 may be charged.

Electrical Salesmen's Association.

The American Electrical Salesmen's Association, organized by the salesmen present at the meeting of the Illinois State Electric Association in Peoria last October, held its first annual meeting at the Grand Pacific Hotel in Chicago on January 20th. The meeting was well attended and the members were enthusiastic over the prospects of the new association, whose influence has already been felt for mutual benefit and for the general advancement of electrical interests. Electrical salesmen, the president ventured, are the best on the road. He pointed out that while the object of the association is primarily for the general betterment of its own members, it will, nevertheless, stimulate the business of those making or dealing in electrical devices, and must also benefit those in that branch of the industry interested in the broad subject of selling electricity.

The meeting was called to order in the forenoon by President Vincent Gray of St. Louis. The forenoon meeting was a business session for members only. The association already has a membership of 250, with excellent prospects for a large increase during the present year. At the meeting the name was changed to simply "Electrical Salesmen's Association," dropping the word American. Emblems bearing the new initials will soon be distributed to take the place of the old ones.

The permanent headquarters of the association will be in the city of Chicago. One of the purposes of the organization is to educate its members along the line of distributing circulars and written addresses from such speakers as appear before the association in the various cities at various times during the year. This will give each and every member of the association an opportunity to read the address and become familiar with the general line of work intended to be carried out by the association. Members and prospective members are invited to call upon the secretary for any information they may desire, or when in the city of Chicago they are at liberty to make their headquarters at the association rooms—Room 51, 88 Washington Street.

The new by-laws will be distributed within the course of the next two weeks, so that members may study them to become familiar with the object and purpose of the association. A clause has been inserted in the revised by-laws stipulating annual dues, which will be $2. In addition to this, $1 initiation fee will be charged.

At the afternoon session guests were admitted. President Gray opened the meeting and introduced Mr. Howard S. Taylor, city prosecuting attorney, who, as the personal representative of Mayor Dunne, heartily welcomed the salesmen to the city. Mr. Gray then made a short and pleasing address.

Mr. J. Robert Crouse of Cleveland gave an illustrated address in which he outlined a proposed co-operative new-business-getting campaign for stimulating the use of current-consuming devices. His plan proposes co-operation among manufacturers, publishers, jobbers, dealers, contractors, societies, associations, salesmen, central stations, etc. Among these, Mr. Crouse said, there exists a community of interests for the promotion of the increased use of electrical appliances and devices by the public for light, heat and power. The details of Mr. Crouse's proposed business-getting campaign are given in another column of this issue. He has been interested in the incandescent-lamp business for some time, as well as in the manufacture of carbons and electrical glassware.

"Modern American Meter Practice" was the subject of a carefully prepared paper read at the meeting. The author, Mr. F. C. [illegible], gave a description of the meters produced by the various manufacturers, and [illegible]. Frank L. P[illegible] Electrician addressed the [illegible] and there was a short discussion of general [illegible] before adjournment.

The accompanying group picture was taken after the adjournment of the open session. As many of the members had become scattered about the hotel the picture does not do justice to the association in numbers, but otherwise it is a representative group. Reading from left to right, President Gray and Secretary Erick appear [illegible] respectively, in the bottom row.

While the association is still young, the enthusiasm shown by those who have joined [illegible] will no doubt stimulate a large growth throughout the country. All who have to do with the sale of electrical machinery, devices or supplies of whatever nature, and those who are directly connected with the advertising departments of electrical journals are eligible to membership.

SOME OF THOSE IN ATTENDANCE AT ELECTRICAL SALESMEN'S CONVENTION.

The officers and committees of the association are as follows:

President, Vincent Gray, 2119 Locust Street, St. Louis; vice-president, Cecil R. Wood, Moline, Ill.; secretary-treasurer, George H. Erick, 88 Washington Street, Chicago.

Executive committee, Vincent Gray, Cecil R. Wood, George H. Erick.

Finance committee, Arthur Jones, Thomas G. Grier, Vincent Gray.

Membership committee, J. B. McCarthy, A. A. Morton, E. P. Magoon.

General advancement committee, Frank L. Perry, J. T. McNaier, James R. Cravath, W. W. Moore, C. A. S. Howlett.

Co-operative committee, J. S. Corby, Francis Raymond, James S. Campbell.

Auditing committee, E. W. Kearns, H. N. Remington, Darwin Ukle.

Proposed Power Transmission in Western New York.

The New York State Gas and Electricity Commission has given a hearing on the application of the Niagara Electrical Transmission Company to increase its capital stock from $100,000 to $5,000,000, and also for permission to purchase the obligations of the Albion Power Company and the stock and obligations of the Niagara Falls Gas and Electric Light Company. The Niagara Falls Transmission Company is an international company, and it was organized to act as the transmitting agent for the Electrical Development Company of Ontario, Limited, which company is developing power in Victoria Park on the Canadian side at Niagara Falls. It expects to begin work very soon on the construction of its transmission line from the Niagara Falls to Rochester and other points. While the line will not parallel that of the Niagara, Lockport and Ontario Power Company, the Niagara Electrical Transmission Company will be the greatest competitor of this company, especially eastward from Niagara Falls toward Rochester. The president of the Niagara Electrical Transmission Company is Frederic Nichols of Toronto. Hon. Frank A. Dudley of Niagara Falls is vice-president.

Indiana Engineering Association.

[illegible] transmi[illegible]. The current may be used for transmission for almost any length. [illegible] and the [illegible] to 30,000 volts. The [illegible] has been of immense benefit to the development of long lines. Up to 1903 the three-phase alternating current had been the only form of [illegible] alternating current used on traction work. Although engineers have been working on the single-phase method for several years, it is probably safe to say that the first commercial [illegible] this line was the installation of the Indianapolis and Cincinnati traction line between Indianapolis and Rushville, a distance of 40 miles, which was opened in July, 1905. Thirty-seven miles in 40 minutes have been made on this road."

Prof. J. D. Hoffman of Purdue University in a committee report said that in the production of electric power from waterpower two projects are reported in Indiana—one at West Muncie and the other near Monticello on the Tippecanoe River. In the latter it is proposed, by the construction of a short dam, to form a reservoir into which will flow the rainfall from the surrounding territory. A waterpower plant is then to be installed with the necessary water turbines and generators to form a complete electric generating plant. This plant is now in the process of designing. Throughout the state a number of power plants for electric lighting are being built. Some of these are municipal and some private; some are in connection with water-supply service and some are in connection with central heating plants. It is interesting to note, he said, where such plants are installed, that economy of operation is taken into account. This is exhibited by the fact that first-class machinery, such as engines, boilers, coal-conveying systems, mechanical stokers and the like are being demanded. Central-station heating and lighting plants are being talked of for Fort Wayne, Auburn and Oakdale. The new plant of the Indianapolis Light and Heat Company has just opened up for service, with 1,500-kilowatt Curtis turbines and boilers equipped with superheaters.

The increased activity in interurban engineering work, said Mr. Hoffman, is more pronounced than in any other line. The experience of the past few years has shown that there is a big demand for the electric road for local service. The single-phase alternating-current system is giving good satisfaction, and he did not doubt would lead to a more extended use of this system within the state in the near future. Of the existing power stations in the state those of especial interest are the Anderson station and the Rushville station. These represent the two classes of electric power generators and are considered first-class in the quality of the equipment. The steam turbine is being installed instead of the steam engine in some of the large electrical plants. Economy of operation and economy of floor space are both controlling factors in their selection. High-pressure steam for engines and turbine work is responsible for better grades of material and workmanship in boiler construction.

Other papers were presented by Hugo Diemer of Indianapolis on "Graft in Large Industrial Establishments" and on a "Combined Water Supply and Electric-light Plant for Towns," by Prof. R. L. Sackett of Earlham College, Richmond. Mr. Diemer said that the greatest difficulty that confronts factory owners is the scarcity of capable men to fill the head and staff positions. "America needs experts in distribution as well as experts in production if she expects to assume her natural leadership in trade. The all-round machinist is almost extinct. Machine-shop foremen who have advanced from the ranks are men who are proficient as a rule on but one tool, and are not competent judges of the best way to do work on all the different machines."

The meeting concluded with a trip to Rushville over the single-phase traction line and a banquet at night. Robert P. Woods was re-elected president, E. E. Walls vice-president and Charles C. Brown secretary.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

The Sale of Electric Light and Power.

By S. Morgan Bushnell.

The two most important elements in the art of selling are price and personality. Both are equally important, as no salesman, however pleasing his personality, can hold his customers very long if his prices are very far out of line. On the other hand, a poor salesman with a disagreeable manner will repel the prospective purchaser, even if he is presenting a good proposition.

While the above two elements are needed in every form of business, they are especially required in the exploitation and sale of electric light and power.

Someone has said that the time to commence training a child is 100 years before it is born. In like manner, in order to have a successful central station, it will be necessary to start right with the first investment and have a station so designed as to be capable of producing a kilowatt-hour of electricity at a minimum of cost.

Combination, co-operation, consolidation, the development of large enterprises—such are the characteristics of the business evolution of the twentieth century. The reason why the large department store is supplanting the smaller store and supply house lies in the fact that it can supply a better assortment of goods and at more attractive prices than the small retail dealer. The essential economic reason why the central-station company should be a success is the fact that it can produce electric power and light and sell it with profit at a lower price than the cost of producing power and light from the small isolated plant. The central station that sells current at a high price may appear to be successful for a short time, but any enduring success must be based upon economic conditions.

A few years ago one of the large electric-light and power companies had a net income of over 20 per cent. on its capital stock in one year. From one viewpoint the year was very successful, but the fact remained that during that year smaller competitive plants were springing up all over the city. A new management took hold of the property; prices were reduced, large sums of money were spent in improving the character of the service, and profits dropped from 20 per cent. to scarcely eight per cent. A superficial observer might expect that the value of the company's stock would be cut in two. As a matter of fact, the market value of the stock, after a slight dip, began to improve instead of decline. The reason for this lay in the fact that the investing public approved of the far-sighted policy of the new management in putting the company in a position successfully to meet competition and also cover the territory which naturally belonged to it. A great many central-station companies and a great many other enterprises fail on account of lack of judgment in the matter of price.

A new street railway started up in a western town. The fare was 10 cents for a single ride; the road did not pay expenses. The fare was then raised to 15 cents, and the road went into the hands of a receiver. The receiver was a wise man in his day; he reduced the fare to five cents, and the road became a paying proposition.

The company that makes a success of selling electricity will make its price as attractive as possible, will place as few restrictions as possible around the use of the current, and thereby give to its agents a proposition which will naturally invite business in and of itself. In establishing a scale of prices, there is always a golden mean. If prices are too high, the business of the company is curtailed, and, on the other hand, if prices are too low, a large increase of business may mean only disaster to the enterprise. It is therefore necessary that every central station maintain a strict record and analysis of its costs, so that it may have a clear idea of where to draw the dividing line between the loss of business and the loss of money through unprofitable business.

The second requisite—personality—is the combination of qualities hard to define, yet easily recognized by the experienced business man, which go to make up a good salesman. A good salesman is not a chance combination. There are certain characteristics which apply to a good salesman, and which have long been recognized. For this reason, during recent years, schools have been established for the training of salesmen. The training is based on the scientific arrangement and study of the various positive qualities which are required for salesmanship, and the basis of the whole system is the cultivation of character.

It is an old proverb that "honesty is the best policy;" yet many men, especially young men, are inclined to laugh at the idea of character as a business asset. The commonly received notion of a good salesman is that of a hale-fellow, well-met, ready at any time for a drink, a smoke, or a story; in short, a man who can associate himself with a customer in the way of having a good time and thus secure his business. In former times there may have been a measure of truth in this assumption, and so far as this assumption includes the idea of a cheerful, pleasing manner, it is true today; but the above type of salesman, if these are his only qualifications, is sure to fail. This is an age of keen, close, calculating competition. The man who has a proposition submitted to him must have a reason why before he acts, and the successful salesman must not only have a sound, convincing argument, but must have the character to back it.

Many of us have heard the story of Daniel Webster in that great meeting in Faneuil Hall in Boston, when, in the midst of his speech, he reached a momentary climax and exclaimed, "Destroy the Whig party and where am I to go?" The story states that everyone held his breath, wondering where he would go. If Daniel Webster had been five feet six inches in height and of ordinary personality, every man in the audience would have thought to himself, "Who in the world cares where you go."

It is character that commands sympathy, confidence and respect, and an argument, no matter how ingenious or plausible, without character to back it, is likely to fall short of its object.

A great many central-station companies are inclined to consider the sale of current as a merely mechanical operation. They figure that the attractive qualities of electricity for light and power must be apparent to everybody, and that therefore the securing of business is merely the work of filling out contracts and securing signatures wherever people are found who need this commodity. As a result they are inclined to employ a cheap class of men for this work, relying on the supposition that the customer must necessarily use the current, rather than on any attractive presentation of the merits of electricity as compared with other methods of securing illumination and power. As a result a great deal of business is lost, and the fact that this business is lost may never be realized by the central-station company. On the other hand, salesmen themselves very often underestimate the importance of their position. You will sometimes hear a salesman complain of his lack of opportunity, saying he is merely a salesman, an "electric-light peddler." As a matter of fact, the opportunities for a good salesman are fully equal to those offered in any line of effort.

Some time ago the writer was talking with a department manager of one of the largest electrical concerns in the country, and the latter referred to a certain man with the remark, "That man draws one of the biggest salaries that is paid by our company." When asked what department this man had charge of, he answered, "He has no department, and no one reports to him, but he is the best salesman employed by this company." This instance is cited simply to show that large commercial institutions recognize the value of a good salesman.

It is not easy to find a man of executive ability—a man who is capable of handling men and controlling large enterprises. It is still harder to find a first-class salesman, namely, a man who can influence the actions of others, not by virtue of any position or authority, but simply by the winning power of his argument and attractive personality.

A few years ago many companies were inclined to doubt the wisdom of advertising. They would say, "Why, everybody in town knows that we are furnishing electricity. What is the use of advertising?" At the present time, however, the more progressive companies are paying great attention to this method of securing business, recognizing the natural inertia which tends to make people leave things as they are rather than to adopt any new improvement. Judicious advertising, by keeping the subject constantly before the people, together with its merits and advantages, soon sets them to thinking, and the result is that the salesman has a much easier task when he in turn presents his proposition.

In the installation of electrical machinery the best engineers have adopted the motto that "The best is none too good." In like manner, in the development of central-station properties, it is necessary to follow a large and progressive policy. The best investment that a central-station company can make is to secure first-class talent for its light and power solicitors. The results may not be fully apparent the first year, but as time goes on the company that surrounds itself with a force of strong and efficient salesmen and provides these salesmen with a just and equitable scale of prices will year by year secure a most satisfactory increase in the number of customers and at the same time will have a business which is established on a sound and substantial basis.

COMMUNICATION.

Co-operation in Stimulating the Use of Current-consuming Devices.

To the Editor of the Western Electrician:

A few introductory remarks, with your indulgence, possibly at the expense of platitude, as to the basis and theory of this proposed co-operation.

Association and co-operation are increasingly the watchwords of modern commercialism. "Competition is the life of trade" crystallizes the sentiment of a period in business development which is merging into a new regime, characterized by the sentiment, "Co-operation is the life of trade."

Not co-operation of manufacturers or others to set prices or conditions of sale to the buyer, but broad-gauged co-operation among all the different interests, through associations, societies or otherwise, working for general progress and improvement on the basis of the square deal. Through such co-operation furthermore developing the strength to attain an approximation to it.

The governors of the western states believed the American people should see the wonders of the West before spending their money to visit Europe. They met and devised co-operative plans for bringing this about. This was modern co-operation.

The governors of 13 southern states appreciated that the South needed more people to develop her great natural resources. They recently met and made plans for co-operating in the expenditure of both time and money to accomplish this result. This was modern co-operation.

These two instances might be otherwise characterized as associated or co-operative self-interest.

While experience amply proves that self-interest is the great "prime mover" in the affairs of men, the more widely it can be made co-operative or associated (necessitating the recognition of the rights of others) the more nearly it exercises its most proper and efficient function in the line of progress.

May it not be well to consider whether there does not exist likewise in this great electrical field a common ground on the basis of which co-operation of this kind, in some degree at least, may be broadly undertaken to the advantage of all?

At first blush, it may seem that our interests are too diversified and conflicting as manufacturers, publishers, jobbers, dealers, contractors, societies, associations, salesmen, central stations, etc., but when we have reviewed all the interests, conflicting or harmonious, the fact remains that they form a continuous chain (kinks and all) from the manufacturer to the consumer.

This great body of 86,000,000 consumers, spending $12,000,000,000 annually, or putting it into the bank for future expenditure, controls the exchequer from which we are all, directly or indirectly, endeavoring to secure an honest livelihood in turn for the making, selling, installing or distributing of electrical apparatus, supplies and current.

If this be true, it suggests that there does exist a community of interest among us all for the promotion of the increased use of electrical appliances and devices by the public for light, heat and power, as against all competitive means and methods for the same purposes.

Any increased success in accomplishing this through co-operation obviously predicates greater demand for "Everything Electrical," from the coal pile to the final appliances through which the public is electrically served.

The question, then, is: Can any scheme of practical co-operation be devised which will bring about the result desired by all, and will such results probably be large enough to justify the expenditure of both time and money in their accomplishment?

This is a subject which has interested the incandescent-lamp manufacturers for a year past. We believe such co-operation is not only possible, but profitably so. As "faith without works" is profitless, these manufacturers have backed their faith with an appropriation of $10,000, to which has been added another $10,000 from other sources, for the initiation of the plans.

It has been determined to undertake practical work along co-operative lines through the medium of the Co-operative Electrical Development Association.

While this association will look to the manufacturers generally for the revenue with which to prosecute the plans, equal importance is attached to

securing the moral co-operation of all other electrical interests, societies and associations.

It would at this time be premature to go into the detailed plans of the new association, until its activities had both aroused and justified sufficient interest in them. It may be said, however, by way of passing, that they have been fully and freely laid before many men in the various electrical interests, whose counsel and criticism has been sought and secured. Whatever degree of merit they may now possess is attributable to their hearty co-operation and encouragement.

As initial progress in this work has been possible along these lines in the past, so, for the future, it points for continued and permanent success, to systematic cultivation of the same sources of strength.

Your attention is respectfully called to certain campaigns of commercial business-getting literature which either are, or are about to be, issued by all the central lighting stations of the country, in direct line with the purpose of the new association, through the medium of co-operating advertising agencies.

The objects of the new association are one in common with the electrical technical press along all lines looking to increased commercial activity, directly or indirectly, in the sale of current, and it will both seek their co-operation, and endeavor in turn to co-operate with them, along any practicable lines.

Finally, coincident with the recent and prospective great advances made by the mechanical and electrical engineers in increasing the efficiency of prime movers, the means of transmission, and the final appliances through which the public is served, this new association stands for a vigorous attempt to match, and, if possible, to exceed, these accomplishments in the commercial field, through a general appeal to the selling ingenuity of the fraternity for effort along co-operative lines.

To you, if sufficiently interested in the detailed plans of the new association, as they have thus far been developed, the writer would be pleased, upon request, to submit the preliminary prospectus for criticism and comment.

In the spirit of "Co-operation," and to the sentiment, "All together, all the time, for everything electrical," I am most respectfully yours,

J. Robert Crouse,
Cleveland, Ohio (1814 Forty-fifth Street, N. E.),
January 20, 1906.

Central-station Advertising.

That advertising in the local newspapers of towns and cities helps central-station managers to sell their current is conceded. The Portland General Electric Company of Portland, Ore., one of the large and successful central-station companies,

A NEW YEAR'S GIFT TO ALL PORTLAND

THE 25% CUT IN RATES FOR ELECTRIC LIGHT GOES INTO EFFECT TODAY!

THE REDUCTION IS FROM 20 CENTS TO 15 CENTS A KILOWATT HOUR

It Means Electric Light for EVERY HOME—In EVERY STORE!

Electric Sigma Sell Goods They Burn the Name Into the Brain

ELECTRICITY FOR YOUR EVERY-DAY NEEDS

Portland General Electric Company

SEVENTH AND ALDER STREETS

Telephone Exchange 13

A RECENT EXAMPLE OF CENTRAL STATION ADVERTISING.

is a believer in this method of publicity. Its ads are, of course, well written and attractive—an essential feature in getting busy people to spend time in reading what the ad has to offer. The accompanying illustration is a reproduction of a full-page ad of the Portland company in a daily newspaper. It is a good illustration of the kind of advertising which has been found profitable to a company which has had experience. The Portland company has for its advertising agent Mr. Bury I. Dasent.

An electric railway from Shawnee, Okla., to Tecumseh, Okla., is said to be contemplated by the Shawnee Lighting Company.

Suggestions for Increasing the Power Output of Central Stations.[1]

By P. H. Kerst.

[illegible]

Methods of Charging.

There is a large divergence of views and practice in rates and methods of charging for power service. It is generally conceded that by some method a minimum charge must be made, based upon the size of the motor or maximum demand. This is to guarantee a proper return from large motor which are seldom used and to prevent the installation of motors for breakdown service without proper compensation where other power is used, such as steam, gas or gasoline engines. The usual practice is to charge a minimum of $1 per month per horse-power or fraction thereof installed. Some obtain the maximum demand by an instrument such as the Wright demand meter, and charge for the first 30, 60 or 90 hours of use per month at the maximum demand; a high rate and a low rate for all over that. The Doherty method is to make a fixed monthly charge for the readiness to serve, based on the fixed charges of the central station and the size of the customers' installation, and then charge for the current used by meter at a low rate per kilowatt-hour.

Others use a modified rate similar to the Doherty or Wright demand methods. Many use the older methods of a minimum rate for the installation with a base price per kilowatt-hour and a sliding scale of discounts governed by the quantity used. There are still a few places that sell power at flat rates. All of these methods have their strong and weak points, and none has become so thoroughly in use as to be recommended as the proper method.

Rates.

Power rates vary from 20 cents to three cents per kilowatt-hour.

Local conditions and cost of fuel should largely determine the making of rate. A steam-driven non-condensing plant has a high fuel cost per kilowatt-hour, while a compound condensing engine or steam turbine has a much lower cost, and of course the ideal condition is a good reliable waterpower.

Intermittent and small users of power, such as residences, dentists, physicians, offices, etc., are usually connected to the lighting meter and pay lighting rates until their power demands warrant a separate meter.

Sometimes central stations, in their eagerness to obtain a large power load quickly, will make large users too low a rate, which afterward they find unprofitable. They are then in the dilemma of carrying these at a loss, or raising the rates with the possibility of losing them, with the accompanying bad moral effect on other customers. It is customary to offer special rate to such customers as use power 24 hours a day and also those whose business is such that it is possible to dispense with the use of power during the hours of peak lighting in winter. Sometimes water plants make special rates to customers which have steam plants and who use electric power only during such portions of the year that there is ample waterpower. This enables the central station to carry a smaller steam reserve for use during seasons of low water.

Soliciting.

Power business differs from lighting, inasmuch as everybody needs and uses light, and it is only a question of what kind.

While with some power users it is a question of electric or antiquated methods, yet many non-users can be made consumers, and it is the duty of the solicitors to create this demand to show the various applications that would be useful to any given prospective customer and to convince him that he needs it. Good solicitors employing all or part of their time, according to the field for canvassing, are invariably a good investment, and to those that now use canvassers they are an absolute necessity for the proper growth of power business. Especially

[illegible]

Advertising.

Judicious advertising always pays. A live newspaper is always a good medium, but make your story concise and catchy. Do not try to tell too much at once, but leave something for tomorrow. Well-selected cuts help very much to the attractiveness of an ad, and many manufacturers will be glad to loan suitable cuts illustrating their products. Circulars sent to a well-selected mailing list and carefully followed up by a solicitor always bring good results. Many manufacturers gladly send descriptive pamphlets and flyers for distribution, and these always bring in inquiries if properly sent out.

Since we also sell advertising through illuminated signs, we must be liberal advertisers to be consistent and show our faith in it.

Applications of Motors.

The more commonplace applications of motors are so well known that no special mention is needed beyond a list of stores, offices, factories, etc., showing the prospects for power in the various places.

Heretofore the use of electric power has been largely confined to the smaller factories and printing offices, but it is being rapidly extended to stores and residences.

Automatic refrigerators are being successfully employed now in restaurants, meat markets, etc., but there is a large unexplored field for it in domestic use, and it behooves us to watch this development closely and endeavor to get in a sample installation. There is no reason why electric plants cannot obtain as large returns from residences for current at power rates, for heating and power use, and battery charging for automobiles as gas companies now get for fuel gas. Power, in addition to refrigerators, can be used to operate pumps, laundry machines, dishwashers, ice-cream freezers, ventilating fans, and it is a safe prediction that this will soon become one of the most profitable fields for the sale of current for these purposes and also help largely to solve the vexatious servant-girl problem.

Another advantage is that residence customers will employ considerable current during the day, on Sundays and holidays when the station load is usually low.

The use of small motor-driven air compressors should also be vigorously pushed among barbers and physicians for their special needs; among saloons for charging beer in place of carbonic-acid gas and for other purposes, such as housecleaning outfits, drilling and chipping metal or marble.

Fans are successfully employed in winter to keep frost off the show windows, to blow through steam or hot-water radiators, thereby increasing their heating capacity, and to place over hot-air registers to start a circulation of hot air when the wind is in a direction that will not let them operate properly.

In many cities the power circuits on the outskirts reach some farmers who can be induced to use power for pumping water, shredding corn, sawing wood, cutting feed, separating cream and other uses.

In closing I will quote from a letter received from a friend very much interested in electric power development: He writes:

"The key to the success of gaining power customers seems to be in popularizing the use of electric current on a just basis, keeping yourself before the public, systematically planning and following your campaign, getting after the many 'little fellows' instead of forgetting them for the 'big ones'; changing your 'ads' frequently, and keeping everlastingly at it in an intelligent, comprehensive manner."

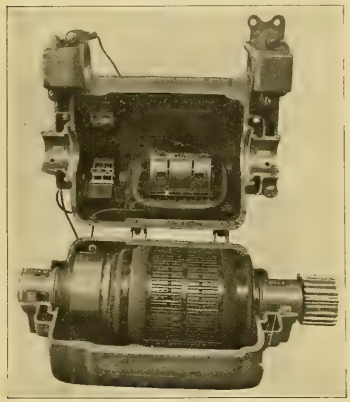
[1] Abstract of paper read before the Northwestern Electrical Association, January 17, 18. Mr. Kerst is manager of the Janesville (Wis.) Electric Company.

Allis-Chalmers Railway Motor.

Electric interurban service of a much better character than is now to be had will be begun this year between Toledo and Marblehead, Ohio, through the improvements which have been put through by the Toledo, Port Clinton and Lakeside Railway Company. A fine new power house of 1,600 kilowatts capacity has been built, and new equipment in all departments has been put in.

One of the features of interest in the car equipment is the use of the Allis-Chalmers R-50 motors made by the Bullock works of this company, and designed for a minimum gauge of four feet eight inches. They are of liberal design, with ample bearings, and particularly adapted to interurban service.

This motor is rated at 50 horsepower, though it is capable of delivering a greater output without overheating. It has a continuous capacity of 45 amperes at 500 volts, showing no more than 75° C. rise in shop test. The field frame is of steel casting, divided horizontally through armature and axle bearings. A liberal center distance is allowed between these bearings, so that a maximum axle of six-inch diameter may be used. The pole-pieces are of laminated iron secured to the frame by through bolts. There are four poles, each provided with a coil, which is securely held in place by the projecting tips of the pole-pieces. The pole-



ALLIS-CHALMERS RAILWAY MOTOR.

pieces are provided with ventilating ducts, which register with the ducts in the armature, allowing air to circulate through the pole-piece and around the coil.

Soft steel laminations, annealed after punching, are used for the armature core. The coils are machine-wound and thoroughly insulated; they fit accurately in the slots and are held down by band wires, which are well below the surface of the core. The commutator is 11½ inches in diameter with 4¼-inch face. It is built up of hard-drawn copper bars, and insulated with the best mica. The commutator has a wearing depth of about seven-eighths inch.

Brush holders are of cast brass secured to a specially treated wood block. This block is in turn bolted to the end of the upper field frame, fitting in an accurately babbitted seat. Each holder is secured to its block independently of the other and carries two carbon brushes, an independent pressure finger is provided for each brush. The bearings are of cast-iron with babbitt lining. The pinion-end armature bearing is 5½ inches in diameter and 9½ inches long, and the commutator bearing three inches in diameter and 7¼ inches long. The axle bearings are 5½ inches in diameter and 9½ inches long.

Cast-steel cut gears of split pattern are used. The pinions are of forged steel, fit the armature shaft on a taper seat, and are securely keyed to it. The gear ratio is 24 to 65. Lugs are provided on the top field frame for bolting to the suspension bar.

The controller used is of the series-parallel type. The main drum makes the rheostatic and motor combination for the four motors. The reverse drum is provided with contacts for each motor and is interlocked with the main drum. A cut-out switch is provided for cutting the motors out of circuit, and can be thrown without removing the controller cover by using the reverse lever.

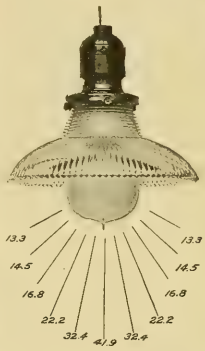
The Federal Mining Company, owner of extensive mining properties in the Cœur d'Alene district of Idaho, is planning to erect a large waterpower plant at Thompson Falls, Mont. It is understood that the power is to be utilized not only in the mines, but for the operating of an extensive system of electric railways, connecting the mines of the Cœur d'Alene district with the steam roads.

New Line of Fuseless Rosettes.

"The Little Twister," a new line of fuseless rosettes, has been designed by the Peru Electric Manufacturing Company of Peru, Ind., and will be placed on the market within a very short time. These rosettes are made in three styles for cleat, concealed and molding work, and they have a number of special features of merit that recommend them to all practical wiremen.

Although small in size, the rosette is a substantial and practical article, and is designed to meet all requirements as to safety and utility. It is neat in appearance and of safe construction. It is made in two pieces, secured together by a half turn connection. The base can be installed when the wires are being stretched, and the cap, with lampcord and socket attached, inserted by a half turn, thus saving considerable time in wiring.

Fig. 1 shows the "Little Twister" for cleat work, Fig. 2 for concealed work, and Fig. 3 for molding. The inside construction is shown in Fig. 4. A large cavity in the cap takes a knot in the cord and relieves the connections from all strain. It will be noted that the terminals, both cord and main wire, are easily accessible for wiring, which is one of the marked features. A special feature in the rosette is a spring lock under the connection



NEW HOLOPHANE REFLECTOR.

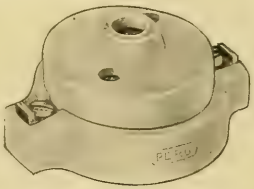


Fig. 1. Rosette for Cleat Work.

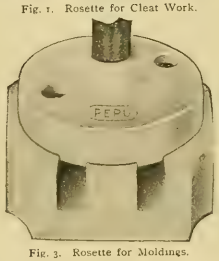


Fig. 3. Rosette for Moldings.

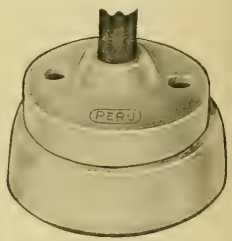


Fig. 2. Rosette for Concealed Work.

Fig. 4. Internal Parts of Rosette.

NEW FUSELESS ROSETTES.

to the base, which prevents the cap from working loose, which guarantees a good contact between the parts.

This line of rosettes will be ready for delivery the latter part of February, and the Peru company will gladly furnish descriptive literature and prices to all interested.

New Holophane Reflector.

The Holophane Glass Company's sales department of New York has just placed upon the market special reflectors for eight, 10, 16 and 32-candle-power clear and frosted lamps. Much time and effort have been spent in the past in producing efficient combinations, consisting of scientific prismatic reflectors and high-efficiency lamps. The sales department of the Holophane Glass Company has gone a step farther and taken hold of the smaller units and designed some very effective shades to be used for this purpose. It is making six styles, three of which are used for concentrating the light, and three of which are used for distributing the light. In one instance the downward light is increased almost 800 per cent., it is said, over that of the bare lamp. All of these reflectors are made to fit standard 2¼-inch holders, and are graceful in design, presenting a pretty appearance when used as shown in the illustration. The Holophane company has issued a circular which describes the shade and shows how the light is distributed.

Municipal Street Railway in British Columbia Loses Money.

A correspondent of the Western Electrician at Winnipeg, Man., writes that, according to figures given out by the city officials of Nelson, B. C., on January 5th, the first year of the municipal control of the street railway in that city resulted in a loss of $5,663.70. The city took over the railway at the beginning of 1905 from the company on a lease for three years, the company to pay 60 per cent. of any deficit up to $2,500. The cost of operating the system was $9,000 alone, and the total income under $5,000. The cost of power was $2,400, and as some time during the current year the city hopes to be in a position to supply this power from the mains of its own electric-light plant, at a nominal cost, the experiment will still be carried on, and the net loss reduced, if possible, to a minimum by the end of the year 1907.

Electrically Operated Pulp Mill at Sauk Rapids, Minn.

The latest example of Mississippi River power application will be found in the establishment of a mammoth pulp and paper mill at Sauk Rapids, Minn., by the Watab Pulp and Paper Company of Sauk Rapids. This company is owned and will be operated by practically the same capital which owns and operates the Watab Rapids Power Company, from whose power rights it is proposed to operate the new pulp mills. The site selected for the new mill is in every way suitable for the best production of the paper product, the principal advantage being the abundant and cheap power derived from the Mississippi River, seconded by the proximity of the mill to the supply of pulpwood and the excellent transportation facilities afforded by the river and railroad connections.

The Mississippi River affords a more than ample supply of water at all seasons of the year. The power to be derived is placed in the lowest estimate at 9,000 to 10,000 horsepower, with a capacity capable of developing 20,000 without difficulty. The river has a width at this point of 600 feet, and over most of its width a depth of from 12 to 15 feet. The new dam, which will be of the type known as a crib, will have an effective working head of 16 feet. The power house, which will be constructed of reinforced concrete throughout, will be located in the center of the river, with the grinding room extending from it to the river bank and the beater room and machine room adjoining the grinding room but extending 400 feet along the bank.

Power-house equipment will consist of three 560-kilowatt three-phase 60-cycle Allis-Chalmers waterwheel-type generators, 440 volts, and a speed of 200 revolutions per minute. They are to run direct-connected to a shaft operated by three pairs of 32-inch horizontal waterwheels, only two of the generators being installed at the present time. The exciters are to be two in number, each of 75 kilowatts capacity, one direct-connected to a waterwheel running at a speed of 300 revolutions per minute, while the other is to be direct-coupled to an induction motor operated at a speed of 720 revolutions per minute. These generators will supply current for the operation of all machinery throughout the entire mill, with the exception of the grinders, which will run directly from the waterwheel shafts. There will be nine grinders installed, for each of which two pairs of 32 one-half-inch waterwheels will be required, making a total of over 5,000 horsepower in the grinding room alone.

Induction motors are to be used in driving the apparatus throughout the mill, with the exception of the motor-driven variable-speed shaft of the paper machine and one or two others. This shaft is to be driven by a 250-horsepower direct-current motor placed in the center of the shaft and direct-coupled to it. The motor will have a normal speed of 270 revolutions per minute and will be required to develop 150 horsepower at that speed. By means of shunt-field resistance the speed may be raised from 270 to 540 revolutions per minute, and at maximum speed the motor will be required to develop full horsepower or 250.

Independent Telephone Interests Win in Important Patent Litigation.

In the case of the Western Electric Company (complainant and appellant) against the Rochester (N. Y.) Telephone Company and others (defendants and appellees) the United States Circuit Court of Appeals for the Second Circuit (Judges Wallace, Lacombe and Townsend) has affirmed the decision of the court below in favor of the defendants. The Scribner and McBerty patent, on which suit was brought, was considered one of the most valuable owned by the Bell interests, and the Independents are correspondingly elated. While the defendant was the Rochester Telephone Company, it was well known that the Stromberg-Carlson Telephone Manufacturing Company maintained the defense.

Following is the full text of the opinion of the Court of Appeals:

This cause comes here upon appeal from a decree of the Circuit Court, Western District of New York, dismissing a bill of complaint in a suit in equity for alleged infringement of United States patent 559,411, granted May 5, 1896, to complainant as assignee of Charles E. Scribner and Frank R. McBerty for "Improvements in Apparatus for Telephone Switchboard." The opinion of the Circuit Court is reported in 132 F. R., 814.

Per Curiam.—We find it unnecessary to add anything to the very full and careful discussion of the issues and testimony which is contained in the opinion of Judge Hazel, who heard the cause at circuit. While we do not find in any single prior patent a distinct anticipation, we fully concur in his conclusion that the device of the patent "was a mere improvement without involving the exercise of inventive faculty."

There is a wide difference and an extended controversy between the experts for the respective sides as to opinions, theories and deductions, but as to the facts which establish the prior art there is really no conflict, nor indeed any ground for conflict, since they are set forth in written documents—the earlier patents which have been put in evidence. Moreover, these patents, or at least the four or five most important of them, are both in specifications and drawings very clearly expressed. When once familiarity with the nomenclature and the elementary features of the art (about which there is no dispute) is acquired the character and functions of the respective structures are found to be clearly displayed therein. Indeed they are far more illuminative than are some of the so-called "simplified diagrammatic drawings" which have been put in evidence. If the expert who is called to testify in such causes would only appreciate that he is not addressing electrical engineers, but laymen; and if, when undertaking to describe what some particular patent showed to a man skilled in the art, he would take the specifications and drawings of the patent as his text instead of some conventional paraphrase of his own devising with its lettering entirely changed, he would materially lighten the labor of the court.

At the close of a very long record one of the patentees finally stated the improvement of the patent to be the devising of a "system of supervisory signals in which the interruption of the talking current in the line circuit is caused to apply the current or power for displaying the positive supervisory signal, which current or power is later withdrawn when the plug is withdrawn from the jack, permitting the signal to disappear." This "system" is brought about by a rearrangement of old parts, and in the literature of the art these parts had already been brought together in such a variety of ways, and there had been so many substitutions of one device for another, so many methods shown of controlling one current by another and of displaying and obscuring signals, such a transposition of parts and shifting of currents, that it seems to us entirely clear that the rearrangement of the patentees, clever though it may have been and in its details perhaps novel, was nevertheless one of those minor improvements which was easily within the ordinary skill of the telephone engineer. The case seems to come within the views expressed in Atlantic Works v. Brady, 107 U. S., pp. 199, 200; and peculiarly within those expressed in Thomson-Houston Electric Company vs. the Western Electric Company, 65 F. R., 619.

The decree is affirmed with costs.

New Officers for Indianapolis Telephone Companies.

With the view of carrying out original intentions to keep the affairs of the Indianapolis Telephone Company and the New Long-distance Telephone Company under local control, both companies have made changes in officers. The lists are now as follows: Indianapolis Telephone Company—President, Harry S. New; vice-president, secretary and treasurer, George C. Hitt; general manager, A. L. Tetu; directors, Harry S. New, John H. Holliday, Cortlandt Van Camp, Jesse Fletcher, A. L. Tetu, Herman C. Stifel, James S. Brailey, Jr., A. H. Bauer and Ben Altheimer. The officers and directors of the New Long-distance Telephone Company are: President, Herman C. Stifel; first vice-president, Harry S. New; [illegible] secretary and treasurer, George C. [illegible] secretary, Charles S. Norton; [illegible] L. Tetu; directors, Harry S. New, [illegible] B. Wilson, A. L. Tetu, Herman C. Stifel, James S. Brailey, Jr., C. M. Porter, Breckenridge [illegible] and A. F. Ramsey.

Indiana Telephone Items.

A new telephone service between Plainfield, Clayton and Brownsburg is being established by the Central Union Telephone Company, and exchanges are being installed at all three places, at a cost of about $20,000. The Central Union hopes to secure a franchise from Danville, where it has been for two years trying to enter, the delay being due to the excellent service given by the Consolidated Telephone Company, an Independent company in that field, with about 1,200 subscribers.

The Tocsin Telephone Company has been incorporated to take over the business and property of a plant which already has a large number of telephones in the northern part of Wells County. The capital will be $10,000. Extensions will be made and some new appliances installed in the exchange at Tocsin.

Fred T. Loftin, formerly press agent for the Indianapolis and the New Long-distance Telephone companies, will go into the Southern States and give telephone lectures to induce people of the village and farm communities to build and install telephone plants. In these southern neighborhoods he thinks hundreds of telephone lines may be established on the initiative of local societies organized for the purpose, if properly directed by a few trained telephone experts. Mr. Loftin says that local development of the telephone has often been brought about entirely by the enterprise of a single individual.

The Mugg Telephone Company of Spencer, Ind., has changed hands, the new owners announcing that it has taken over the business of the Central Union Telephone Company at Spencer.

The Cumberland Telephone Company, operating in Evansville, wants a franchise for 45 years, and as long as no other telephone company is permitted to enter the field, the company agrees to pay to the city two per cent. of its gross earnings. In no event shall the city receive less than $2,500 a year from the company. The company also agrees to lay conduits within two years, for the purpose of carrying its wires underground. The company proposes to make the following charges for telephones: For a direct business line, $5.50; two-party business line, $4.50; four-party business line, $3.50; for a direct residence line, $2.50; two-party residence line, $2; four-party residence line, $1.50. The Cumberland has been operating without a franchise since July 18, 1902. When the franchise expired, the company made application for a new franchise, but it was refused, as the city did not think it liberal enough. The city then began suit to oust the company, and a recent decision by the United States District Court held it to be without a franchise. Mayor Boehne is not inclined to grant the Cumberland company a franchise unless it pays to the city $15,500 for the time it has operated without a franchise and an additional $6,500 that the city paid out in its fight against the company in the courts.

C. B. Imel of New Ross has been appointed a telegraph operator on the Isthmus of Panama.

S.

Telephone News from the Northwest.

The Hughes Telephone Company contemplates installing a local exchange for Garrison, N. D.

Thomas H. Bunn has been granted a franchise for a local exchange for Pine Island, Minn.

The State Municipal and Commercial League of Minnesota has passed a resolution favoring placing telephone companies under the control of the state railroad commission.

The New York Center Telephone Company of Loyal, Wis., has filed articles of incorporation with $10,000 capital.

The Northwestern Telephone Exchange Company is installing an additional switchboard in its exchange in Stillwater, Minn., to accommodate the growing business.

The Northwestern Telephone Exchange Company has severed its connection with the local exchange of H. Fant at Thief River Falls, Minn., and now has a toll booth there. It is understood the Northwestern will seek a franchise to put in a local exchange in competition.

The Mesaba Telephone Company will build a toll line to Deer River, Minn., and will establish a local exchange there.

The Lilly Local Telephone Company of Lilly, S. D., has been incorporated with $3,750 capital stock.

The Pioneer Rural Telephone Company of Hitchcock, S. D., has been incorporated with $5,000 capital.

The Casselton (N. D.) Telephone Company has been incorporated with $20,000 capital stock.

The Fairmont Telephone Company has sold the North Star toll line to the Armstrong Telephone Company of Truman, Minn.

The Tri-state Telephone Company has applied for a 20-year franchise at Breckenridge, Minn. The [illegible] Minn.

[illegible]

[illegible] $10,000.

C.

Ohio Telephone Notes.

Should the [illegible] bill become a law, [illegible] will have the right to regulate the rates of telephone companies [illegible] companies accepting franchises [illegible] state legislation. The bill also provides [illegible] panies shall furnish conduits [illegible] tions for fire and police [illegible] place free for the municipality [illegible] telephone.

Last Friday the committee of the Cincinnati council on telegraphs, telephones and [illegible] took up the application of the Queen City Home Telephone Company for a franchise to operate in the city. The session was short, and a set of questions was submitted to the company. Another meeting will be held on February 2d. Attorney C. B. [illegible] stated that the officers of the company are: President, C. W. Beers of Fort Wayne, Ind.; vice-president, C. B. Wing of Cincinnati; secretary and treasurer, Harry B. Gates of Indianapolis. These officers, with Senator Max Silbergerg and Mr. Mathews, constitute the board of directors. The applications of the Cincinnati Telephone Company and the Interstate Telephone Company will be considered within a few days. Senator Silbergerg is credited with the statement that the rates of the Queen City Home Telephone Company will be at least 40 per cent. lower than the Bell rates and that the company is willing to be bound by a rate agreement with the council if it can be legally done.

The Thompson Telephone Company of Thompson has joined the Geauga County Telephone Association, and the toll rate has been done away with, so far as communication between that place and Chardon is concerned.

Both the Home and the Bell telephone offices were destroyed by fire, which swept the business portion of Convoy a few days ago.

Bell telephone officers have been in Lorain lately arranging to build a local system. The franchise was granted almost a year ago, after a hard fight, but up to the present time nothing has been done toward installing a plant.

The Salem Ridge Telephone Company of Rising Sun has been incorporated with a capital stock of $2,500, to build and operate a system. Charles Rice, William Rockafellow and others are interested.

Articles of incorporation have been filed by the Meigs County Home Telephone Company of Pomeroy. A. B. Kratz, C. E. Peoples, O. A. Rowley, W. E. Stansberry and others are the incorporators. The capital stock has been placed at $50,000.

The capital stock of the Gilbert Telephone Company of Zanesville has been increased from $2,000 to $7,000.

The Haskins Bell Telephone Company of Haskins has been incorporated with a capital stock of $10,000 by H. A. Fanning, H. J. Johnston and others.

Notice has been filed of the increase in the capital stock of the Credersville Telephone Company from $5,000 to $25,000.

C.

Michigan Telephone Matters.

The Citizens' Telephone Company of Allegan is running a copper metallic toll line from there to Hamilton, to connect with a line from that place to Holland, doing away with the relay service through Grand Rapids.

At a meeting of the North Marshall Telephone Company in Marshall the following officers were elected: President, Frank Bell; vice-president, Fred Huggett; secretary, Frank Lovejoy; treasurer, John Sackett; lineman, M. Farnum.

The third farmers' telephone company, with headquarters at Ceresco, to be known as the South Emmet Telephone Company, has filed articles of incorporation. The other two companies are the North Marshall Telephone Company and the Ceresco Telephone Company. The capital stock of the new company is $1,000. John Ulrich, E. T. Eyre, R. M. Gubbins, Jacob Paul and M. Gitchell are the stockholders.

The Reading Central Telephone Company of Reading has closed a contract with the Steuben County Electric Telephone Company, by which rates to Indiana points are materially lowered. The Steuben company owns 18,000 telephones in the county, with 26 toll stations, and has trunk-line connections with 145,000 telephones in Indiana.

The committee of the council of Sandusky to which was referred the application of the Sandusky Telephone Company for a franchise, recommended

that a clause be inserted in the franchise whereby the rental would remain at $8 a year for 20 years. The company refused to accept such a condition.

A representative of the Automatic Telephone Company of Chicago has been in Marquette in consultation with business men regarding the installation in Marquette of the automatic system. The city now has the Bell and a county system. B.

NEW COMPANIES.

J. Getchel and others have organized the Osceola Farmers' Mutual Telephone Company of Osceola, Wis., with a capital of $25,000, to build rural lines.

The Charlotte Telephone Company in Charlotte, Ark., has been incorporated with a capital stock of $1,500, by W. P. Jones, J. C. McGill and C. H. Hogan.

The Hardin County Telephone Company of Elizabethtown, Ill., has been incorporated by L. O. Whitnell, D. W. Whittenberg and Robert Thacker.

Among the recently incorporated telephone companies are the following: New Home Telephone Company, Beatrice, Neb.; Ettrick Telephone Company, Ettrick, Wis.; Lincoln County Telephone Company, Lake Benton, Minn.

EXTENSIONS AND IMPROVEMENTS.

A new office building is being erected in Payette, Idaho, by the Independent Telephone Company.

A new telephone exchange and office building is being erected by the Water, Light and Telephone Company of Lafayette, Tenn.

The Pittsburg and Allegheny Telephone Company has obtained a franchise in Washington, Pa. An exchange will be constructed at once.

The Delaware and Atlantic Telegraph and Telephone Company will erect an addition to its present exchange building in Wilmington, Del.

The Southern Bell Telephone Company proposes to enter Swainsboro, Ga., where it has maintained a long-distance line for some time. A franchise has been secured for a local system with 100 subscribers.

The Independent telephone company has begun construction work in Port Townsend, Wash. The company already has a rural line throughout the adjoining country with direct connections to Port Angeles and Dungeness.

GENERAL TELEPHONE NEWS.

Wyatt & Meadows have purchased the telephone business of J. B. Wilkinson at Comanche, Texas.

Richard Inglis has been granted a franchise to construct and operate a telephone system in Longbeach, Miss.

The Home Telephone Company of Kansas City has purchased the local telephone exchange at Richmond, Mo.

The Cottonwood Valley Telephone Company has succeeded to the business of the Canton Telephone Company at Canton, Kan.

The Bell Telephone Company has purchased the plant of the Sabetha Telephone Company, including rural lines at Sabetha, Kan.

G. M. Hardy, W. E. Henkel and associates have secured a franchise for the construction of a telephone system in Ruston, La. It is proposed to organize a stock company.

The Citizens' Telephone Company of Grand Rapids, Mich., is installing a gas engine, with a view to operating its own electric power plant. The electricity will be used for lighting purposes and for charging the batteries.

The Chicago Telephone Company proposes, as soon as an equitable agreement is reached with the city, to construct a new building to cost close to $1,000,000. The new structure will adjoin the present building at Washington and Franklin streets and will care for the companys increasing business.

The National-Interstate Telephone Association calls the attention of the various state associations to the necessity of electing delegates to the Nation-Interstate convention to be held some time in June. Independent interests in states at present having no association are urged to organize as soon as possible, so that they may affiliate with the National-Interstate, and be represented at the convention.

The Independent Telephone Clearing House Company, which was organized in Iowa some time ago to check up toll-line-message business, and apportion the earnings of interchanged toll business, has secured a suite of rooms at 410 Locust Street, Boone, Iowa, and has engaged George T. Hewes as manager, and is now starting in with its work. Arrangements have been made with a large number of Iowa companies to have their business checked up. Charles C. Deering is president of the company.

Chicago Telephone Company's Report.

The directors of the Chicago Telephone Company made their annual report for the year ended December 31, 1905, to the stockholders at the annual meeting on January 17th. The gross revenue of the company for the year was $7,131,342, an increase of $758,226 over 1904. Gross expenses, which include operation, taxes, maintenance and reserve for deferred maintenance, amounted to $5,504,531. Dividends consumed $1,400,000. The resources at the close of the year are placed at $16,572,589. The following table shows the growth of the company's plant for the last three years:

	1903.	1904.	1905.
No. exchanges	114	111	156
Toll stations	81	80	57
No. of exchange telephones	101,187	117,893	143,223
Underground conduits, miles	235	254	335
Underground duct, miles	1,372	1,468	1,755
Miles of wire, underground	149,234	161,202	187,231
Miles of wire, aerial cables	40,480	46,697	51,711
Miles of wire on poles	41,484	45,189	52,213
Total miles of wire	231,198	253,088	291,155
Capital stock	$14,000,000	$14,000,000	$14,000,000

The following extracts are taken from President Albert G. Wheeler's report:

The Chicago exchange system boundaries, for service within which in 1889 there were neither toll nor mileage charges, have been enlarged from time to time from the 16.3 square miles in 1889 to 82 square miles in 1905. We are not aware of any similar telephone area with corresponding density of population and telephone development elsewhere in the world. Payments to employes for services amounted to $2,635,568. The activity and expansion in industrial and commercial affairs in 1905 resulted in demands upon our company unprecedented in its history. This is true both as to the net increase in telephone stations in service and to the labor and detail involved in effecting this increase. At the close of 1905, 143,223 subscribers' stations were in service, 25,330 more than at the end of 1904. The energy of our suburban department and the appreciation of our telephone service in the farming sections of our territory are evidenced by the fact that telephones are installed in seldom less than 80 per cent. and in many districts over 90 per cent. of the farmhouses.

Of the telephones now installed 84,215 are for receiving service upon a message (or measure) rate basis, showing that its equity and elasticity commend it to subscribers. The supreme importance of rendering efficient service with every telephone station is fully realized by the operating department. The real estate operations of the company during the year have included the purchase of land for an exchange building at Irving Park and of premises for construction division headquarters for barns and storage on the North and South sides of Chicago. The fireproof four-story building for use as an extension of the quarters of Central Exchange in Chicago has been practically completed. Buildings of the high type and peculiarities of construction suitable for telephone purposes have been erected in Wilmette, La Grange and Blue Island and on Western Avenue, near North Avenue, known as Humboldt Exchange in the Chicago exchange system.

We believe it to be the function of the company to provide such varying classes of telephone facilities as to make available for all members of the public the service required by their differing business, social and other relations. This is a great task, involving investment in increasing amounts and requiring constant foresight in planning in anticipation.

Mr. Wheeler refers to the large amount of money spent in bringing the plant to its present state of development. He says that the company is now at a point where further enlargements and improvements must be made. This makes it necessary, in view of the fact that the company's franchise expires in 1909, to ascertain the attitude of the city in regard to future relations. A committee of the council, as previously stated in the Western Electrician, has the matter under advisement, and the passage of an equitable ordinance will be followed by calls upon stockholders for further investment.

Bell Telephone Output for 1905.

The American Telephone and Telegraph Company reports for 1905 a total net output of 1,217,694 instruments. The report for the month of December shows a heavy net gain over the two previous Decembers in the comparative table. October was the big month of the year in gross output, but November surpassed it in net output, with an aggregate net of 134,395. Following are comparative figures for December and the calendar year:

December.	1905.	1904.	1903.
Shipments	163,828	122,285	88,947
Returned	57,381	49,898	39,678
Net	106,447	72,387	49,269
Year December 31.			
Shipments	1,841,628	1,216,576	1,109,888
Returned	623,934	515,529	480,691
Net	1,217,694	701,047	629,197
Total December 31	5,698,258	4,480,564	3,770,517

The Saline and Hamilton County Mutual Telephone Company of Cornerville, Ill., has been incorporated by O. A. Tate, J. L. Harris and W. H. Johnson.

CORRESPONDENCE.

Great Britain.

London, January 10.—It has leaked out in a very unobtrusive way that the Post Office is most seriously considering the advisability of acquiring the few municipal telephone systems that exist in Great Britain. Of course, the question of terms has yet to be settled, but the government has the whip hand here. So far the engineers of the Post Office have been paying visits of inspection to the five municipal undertakings in Glasgow, Brighton, Hull, Swansea and Portsmouth, and there can be no reasonable doubt as to the ultimate future of these telephone systems. It may be well to recall the offer of the late postmaster-general that he was willing to deal with municipal exchanges on the terms accorded to the National Telephone Company, but whether the Liberal postmaster-general is prepared to take any other course, has not yet been made public.

An interesting trial has just been brought to a successful conclusion on the Great Western railway. Continual experiments are being made with various systems of train lighting on the different railway lines of the country, and every electrical engineer is familiar with the difficulties to be overcome in adapting electricity to this purpose, when the energy has to be produced by the motion of the train. The main difficulty, of course, has been to avoid the fluctuations in the pressure, due to the stoppage of the train. One of the newer systems of electric train lighting—the Leitner-Lucas—was installed upon a Great Western train and sealed up for 12 months. During this period the train traveled over 25,000 miles, and no attention was paid to the machinery, which, when unsealed, was found to be capable of sustaining further hard wear before repairs would have been necessary. In addition, careful watch was kept upon the steadiness of the light. The equipment on this system is capable of working in either direction of the motion of the train without any operation by an attendant, and, in view of the recent recommendation of the railway inspecting officers of the Board of Trade that the adoption of electric lighting of trains was advisable to prevent a fire following a collision, this test will doubtless attract the attention it deserves.

The appointment of Edgar Speyer to be chairman of the Underground Electric Railway Company of London, in succession to the late Mr. Yerkes, in view of his past co-operation with Mr. Yerkes and his generous benevolent contributions, is a popular one. Equally so is the appointment of Sir George Gibb, general manager of the Northeastern Railway Company, as vice-chairman and managing director. The Northeastern Railway Company was the pioneer of electric traction on main-line railways in this country, and Sir George Gibb will have plenty of opportunity for exercising his well-known ability in his new sphere, as the following, for an example, will indicate:

Since the electric trains were introduced on the Inner Circle there has been an ever-increasing overcrowding at certain hours of the day, which, from personal experience, I can say is so acute that I doubt whether it would be tolerated anywhere else in the world; absolute danger was imminent at times. An association was formed and legal opinion taken, with the result that an appeal was to have been made to the railway commissioners, who have jurisdiction in these matters. When this came to the knowledge of the company it was immediately stated that in a few weeks' time a two-minute headway would be run, owing to the completion of the automatic block signaling system. The association has therefore stayed its hand temporarily.

An interesting development in the various schemes for providing electric power on the Rand, in South Africa, has been the registration of a syndicate in London having for its object the promotion of a company in the English Parliament to erect a generating station some 40 miles from Johannesburg. From here energy would be transmitted to various mines, etc.

The question of municipalities undertaking the wiring of consumers premises for electric light, in competition with private contractors, has for a long time been an acute one in Great Britain, but in the past there has not been sufficient combination among the contractors to bring the law into action. It has been judicially given out that without special powers from Parliament, such work on the part of a local authority is illegal; yet several have continued. Of late there have been signs that the Electrical Contractors' Association is awakening to the seriousness of its responsibilities, and an application has been made for an injunction to restrain one very large municipality from carrying on such work without authority.

It is reported in various quarters that experiments are being carried out by the Midland Railway Company in establising connection by wireless telegraphy with moving trains. These reports have not been denied, although no official account of what is being done has been published.

Some tests with the tantalum lamp, for street lighting, have been carried out at Ealing, near London, with such satisfactory results that it has been decided to install quite a large number of

this type, superseding ordinary incandescent lamps. It has been estimated from these tests that more light at less cost would be obtained than at present.

The underground telegraph line between London and Glasgow has now been completed, after several years of difficulties and complaints. [illegible]

Dominion of Canada.

Ottawa, January 20. In view of the great cost of gas in the city of St. John, New Brunswick, and the refusal of the gas company to reduce prices, the City Council has decided to make arrangements for the expropriation of the street railway company's electric plant for lighting and power purposes.

It is stated that the Ontario government is considering the question of controlling the operation of telephones in the province. In this connection it is said that the Bell Telephone Company will be compelled to exchange traffic with farmers' lines. The question of rates will also be considered.

The commissioners of the Temiskaming railway have informed the Ontario government of their intention to electrify the railway from North Bay to the Blanch River, 38 miles north of New Liskeard. This will mean the electrification of the first 151 miles of the road. The power will be obtained from the waterpowers along the route.

Arrangements are being made for transmitting electric power from Hannawa Falls, N. Y., to Brockville, Ont., via Ogdensburg and Prescott. The line will come to Ogdensburg, N. Y., without fail, it is stated, and if sufficient inducements are held out, a cable will be laid across the river between Ogdensburg and Prescott, Ont., and continued to Brockville. It is estimated that the electricity can be generated at Brockville at a cost of about $35 per horsepower.

The Canadian General Electric Company has sold the remaining 11,000 shares of its authorized capital to English bankers at 120. The price, $1,320,000, has been paid over. Under the agreement, the stock is to be listed in London, and not a share of this block will be offered in the Canadian market for a term of years.

The annual report of the Montreal Telegraph Company shows the gross assets to be $2,288,000. The company's property is operated and maintained by the Great Northwestern Telegraph Company of Canada, and is also guaranteed by the Western Union Telegraph Company of New York, under an agreement for 97 years from July 1, 1881.

W.

New York.

New York city, January 20.—At the meeting of the Board of Aldermen on Tuesday the Tammany representatives, who are in a minority this year, attempted to put through a resolution in favor of municipal ownership, but without success. On Thursday, in the state Legislature at Albany, Assemblyman Oliver introduced a number of bills designed to give New York city owning and operative powers in regard to traction, gas and electric companies.

Ex-Controller Edward M. Grout has stated that there will certainly be competition against the Ryan-Belmont traction interests in the matter of seeking franchises for new subways. As to the Third Avenue route, the representatives of the Portchester Railroad are said to be looking toward it.

The New York Times says that the Ryan-Belmont merger was in reality brought about by the attempt of the Rapid Transit commissioners to force the traction companies into bidding for "all or none" of the new subway routes. The Times has ever been able to see the necessity of a subway on the Crowded East Side, and renews its criticism of this portion of the scheme.

A bill is about to be introduced at Albany to provide for the awarding of separate contracts for the construction, operation and maintenance of all future tunnels in Greater New York. The real object of this bill is not clear, but a similar measure failed to pass last year.

At noon, on Friday, a Brooklyn elevated train struck a half-open switch, and one of the cars fell from the structure into a vacant lot, with its passengers, killing one and injuring 14 others. Preliminary investigation shows that the switch had been unspiked for a special train to be run over a track not generally used in winter.

The McAdoo Tunnel Company is planning to put up an immense building at the Manhattan end of its New York-New Jersey trolley tunnel. The building will probably be designed for a department store, and the tunnel station would be in the basement.

Borough President Coler of Brooklyn, following complaints of others, and his own personal experience, is taking steps to compel the Brooklyn Rapid Transit Company to maintain its cars in a clean condition. Mr. Coler is also opposed to granting a franchise for a subway under Livingston Street, and prefers that if any such line is made, it should be constructed by the city and leased for short periods.

The directorate of the Long Island Electric Railway has been reorganized and is now practically in the control of Belmont interests, in place of the Elkins-Widener Philadelphia syndicate. Among the new directors [illegible] Long Island Railroad [illegible] improvements and the [illegible]

H. H. Vreeland, president of the [illegible] Street Railway, addressed the [illegible] on Monday evening on [illegible] transportation on [illegible] marked that [illegible] and that [illegible] the public [illegible] companies [illegible]

[illegible] secretary of the [illegible] meeting Society. [illegible] Glass Company, treasurer.

At a dinner of the Telephone Society [illegible] U. N. Bethell, general manager of the [illegible] Telephone Company, announced that a [illegible] station rate would go into effect on [illegible] March 1st. Mr. Bethell [illegible] New York and the New York and New Jersey telephone companies will come under one [illegible] management, though retaining separate legal entities.

The chief engineer of the Borough of Brooklyn is at work on plans for the construction of a city-owned wire conduit, and, pending the authorization of the scheme, the telephone company is forbidden to erect poles in certain streets.

D. W. W.

Ohio.

Cleveland, January 20.—It is stated that the Pittsburg Railway Company will build a line between Monaca and Coraopolis, Pa., which will give through service from Pittsburg to Vanport, Pa. The East Liverpool Traction Company is ready to build from Vanport to Smith's Ferry, Pa., and from Wellsville to Empire, Ohio, where connection will be made with the lines of the Steubenville and Toronto Electric Railway Company. A line is already in operation between Steubenville and Wheeling, W. Va. With a short stretch built between Bellaire and Zanesville the route would be complete to Columbus and Dayton and Cincinnati. The connecting up of these cities will form an important chain of roads for the eastern part of the state.

An ordinance limiting the number of persons that may ride on a car will go into effect in Cleveland Monday. It states that only as many persons as may be seated and half as many again shall ride on a car. President Horace E. Andrews of the Cleveland Electric says that extra cars will be put on during the rush hours up to the point of congestion, but even then, he says, people will have to be left standing on the streets for a long time.

The increase of $4,000,000 of stock for the Andrews-Vanderbilt syndicate has all been taken by the original subscribers. The money thus obtained will be used in taking over the Rochester Railway and Light Company in February. It is said that the Vanderbilts are to furnish 60 per cent. of the money and Mr. Andrews and the local syndicate is to furnish 40 per cent. Many business men of Cleveland are associated with Mr. Andrews in this syndicate.

Directors of the Cincinnati Gas and Electric Company have voted to increase the capital stock of the company from $31,000,000 to $36,000,000, in order to secure funds for carrying out the contract to furnish natural gas for the city. A company has been incorporated to take care of the pipe line, and the local company will have the distributing system to build, or alter the artificial system in such a manner as to put it in condition for the change.

The Massillon Light, Heat and Power Company shut off the street lights in Massillon last week because the City Council refused to make a contract of any kind. The company has been furnishing an all-night service for $62.50 per lamp, and on a new contract asked $69.50, which the council has refused to give. The contract expired last October, and since then the company has been furnishing lights, expecting that some arrangements would be made by the council.

According to a statement credited to W. Kelsey Schoepf, the capital stock of the company that will operate the Ohio roads of his syndicate will not exceed $10,000,000. He says, however, that not much attention has been given this matter, as an actual merger is still far in the future. The plan is to have the company lease the roads from the syndicate. Randall Morgan is now in the East arranging for the finances of the syndicate.

Representative Lehman has introduced a bill in the house changing the manner of fixing the taxes on interurban railways in such a manner as to permit the town or county where the power plant is located to secure its share of the valuation. These properties are now placed in the same class as steam roads, and valuations are placed on the lines by the county auditors, and prorated to the counties through which the lines pass. This includes power houses, and gives all the counties a show at it.

The Oliver Electric Vehicle Company of Cleveland has been incorporated with a capital stock of $10,000 by E. C. Mullen, Sherman Arter and others.

The right of the Cleveland Electric Railway Com- [illegible]

Michigan

[illegible] Grand Rapids [illegible] Spring [illegible] July 4th.

[illegible] the Grand [illegible] that the road [illegible]

Manager [illegible] of the Detroit, Monroe and Toledo Short Line [illegible] that on and after May [illegible] the multiple [illegible] to be in charge [illegible] double-tracked [illegible] the exception [illegible]

Surveyors have started [illegible] mural of the Owosso and [illegible] are surveying the grade for the [illegible] line to Durand. The proposed [illegible] parallel the Ann Arbor railroad.

Floyd Stoddard, representing a Saginaw [illegible] has asked for a franchise for an electric light plant at Bancroft, and for a contract to light the village. He offers to light the village [illegible] all night for $50 per arc lamp per year, and furnish incandescent lighting at 12 cents a kilowatt hour. His company purposes to utilize the power of the Shiawassee River, and light Morrice and Perry as well as Bancroft.

The erection of a gas plant has brought competition into Ludington for the Sterns Lighting and Power Company, which company announces that during the year 1905 it added 150 customers. In view of this fact it offers two months' lighting free to all persons wiring up between now and March 1st.

It is reported that several well-known men of Iron Mountain are planning to organize a stock company for the purpose of building and operating an interurban electric-railway system to connect Iron Mountain, Quinnesec, Norway, Vulcan, Loretto, Waucedah, Niagara, Spread Eagle Lakes, Commonwealth, Florence and other towns in the region. It is said that possibly the new line will be extended so as to connect the electric road projected from Menominee to Escanaba. The reports say it is proposed to generate power at Twin Falls, near the city. A franchise was obtained from the city of Iron Mountain some time ago.

With the beginning of 1906 the Jackson and Battle Creek Traction Company began running through freight cars from Kalamazoo to Jackson. Heretofore all merchandise had to be transferred at Battle Creek. The cars of the Michigan Traction Company, which is a part of the system, have been equipped with third-rail attachment to be able to make the trip East from Battle Creek.

Engineers for the South Bend Power Company, which controls the interests of the Hen Island dam and the Buchanan dams, have completed a survey for a proposed dam in the St. Joseph River on the line between Michigan and Indiana. The dam will cost in the neighborhood of $500,000, and will add about 2,500 horsepower to the system of the corporation. The advisability of building on the state line or at Berrien Springs, Mich., will be considered at a meeting of the board of directors which will be held in about 30 days. It will cost in the neighborhood of $1,250,000 and will furnish about 10,000 horsepower. Both dams, it is said, will eventually be built.

A proposition is on foot to extend an electric road to Hesperia from points to the south with terminus at Grand Rapids. Power for this purpose is to be obtained from White River. Hesperia will give an exceptionally good bonus as an inducement to secure the road. A permanent organization of business men will be effected on January 24th for the purpose of furthering the project. A proposition is to be laid before interested persons in February.

B.

Indiana.

Indianapolis, January 20.—Articles of incorporation of the Crawfordsville and Northwestern Railway Company state that the proposed electric railway is to start at Crawfordsville and pass through Wesley, Waynetown, New Richmond, Wingate, Attica, Hillsboro, Mellott, Aylesworth, Stone Bluff, Newton, Williamsport, Kramer, Carbondale, Judyville and Pence. The capital stock of the corporation is $100,000, and the directorate consists of Spencer J. Hunt, A. L. Mason and John F. McFarland.

Chicago and Indianapolis men planning to build an electric railway between Indianapolis and Louisville have filed articles of incorporation as the Indianapolis and Louisville Traction Company, Samuel D. Miller of Indianapolis, John E. Greeley of Jeffersonville and Robert Candee of Chicago are among the directors. The company is capitalized at $3,000,000. According to the incorporation papers, the line is to touch Franklin, Edinburg, Columbus, Seymour, Crothersville, Sellersburg and Jeffersonville. Indianapolis and Louisville will be the terminals of the road.

Seven months ago Charles L. Henry, president of the Indianapolis and Cincinnati Traction Company, made a prediction in a prospectus that the earnings of the Shelbyville line for 1905 would aggregate $104,440.42. Data now compiled show that the earnings for the year were $104,448.46, or just $8.04 more than the amount named by Mr. Henry. Mr. Henry's report says that the limited cars of the Shelbyville line make an average speed of 34.46 miles an hour, while those of the Rushville line make an average speed of 42.13 miles an hour. The Rushville line is operated by the single-phase alternating-current system.

Directors of the Columbus, Greensburg and Richmond Traction Company predict that their cars will be running between Columbus and Greensburg during the present year. The company expects to build on to Connersville in the spring of 1907, and then to push on to Richmond.

A corporation which has for its object the operation of an electric plant to furnish heat, light and power to the three towns of Jasonville, Coalmont and Hymera has been organized. The name of the corporation is the Indiana Electric Transmission Company, incorporated with a capital stock of $250,000 and with the following directors: Howard L. Hyatt, William H. H. Hornberger and Thomas Duncan. Lafayette is given as the home of the company, although its operations are to be in Greene and Sullivan counties.

The Kerr-Murray Manufacturing Company of Fort Wayne is preparing to erect a new power plant.

A. A. Wallace is reported to have secured a franchise for an electric-light plant in Monon.

The Indianapolis Cold Storage Company is seeking a franchise to permit the company to dispose of its surplus light and heat within a limited territory tributary to the plant. The Indianapolis Light and Heat Company and the Merchants' Heat and Light Company object on technical grounds.

A franchise to operate a combined waterworks and electric-light system in Lawrenceburg is being sought by a company of local capitalists headed by W. H. O'Brien.

Mayor Bidaman's scheme for building a municipal electric-light plant in Terre Haute has received a set-back by threatened injunction proceedings.

S. S.

Pacific Slope.

San Francisco, January 19.—The San Francisco, Vallejo and Vaca Valley Railway and Steamship Company filed articles of incorporation in Solano County this week. This company is organized to build an electric railway connecting the principal towns of Solano, Napa and Yolo counties. Altogether, 80 miles of road are to be built. The new company has already applied for franchises in various towns and counties through which its line will pass. Engineer Soule of San Francisco will have charge of the engineering work. The principal owner of the road is Wilfred H. Hodgkin of Fresno, Cal.

The Town Council of San Jose, Cal., has granted a franchise to the San Jose and Santa Clara Railroad Company, extending the present franchise 32 years, with the privilege of broad-gauging and standardizing the present narrow-gauge lines.

John Martin and Eugene de Sabla have purchased a controlling interest in the co-operative electric-light company of Santa Cruz, which company furnishes electric light to the principal parts of the town of Santa Cruz. Several weeks ago the same men purchased the Santa Cruz Electric Light and Power Company of the same city. The latter company furnishes a part of the city lighting of Santa Cruz, and also furnishes current for the operating of street railways.

The Merchants' Association of San Francisco is promoting a movement to secure cluster lights along Market Street, the principal thoroughfare of San Francisco, for a distance of between two and three miles. It is proposed to raise $20,000 by subscription to defray the expense of constructing and installing the lights.

The Central California Traction Company has authorized an issue of bonds to the amount of $1,500,000, the proceeds of which will be used in building the company's proposed electric-railway system in Stockton, Cal. Eight miles of track have already been laid by the company, which owns franchises for extensions to the towns of Lodi and Woodbridge.

A franchise has been granted by the town authorities of Klamath Falls, Ore., to C. N. Hawkins for a street-railway system in that town, the work of construction to be begun on or before July 1st.

The Ygnacio Valley Railway Company has been incorporated in San Francisco for the purpose of constructing an electric railway from Oakland to Antioch, a distance of 40 miles, and also branches to Mt. Diablo and Martinez. The company has an authorized capital stock of $2,000,000, of which amount $75,000 has been subscribed. The principal stockholders are A. Bishop, L. F. Winchell and W. H. Murphy.

The Town Council of Seaside, Ore., has granted to W. L. Dudley of Seattle, Wash., a franchise to build and operate an electric railway within the corporate limits of Seaside.

J. A. Foster of Oroville, Cal., has applied to the city authorities of that place for a franchise to construct and operate, during a period of 50 years, an electric power and lighting plant. The franchise will be offered for sale on February 10th.

The Electrical Construction Company has been incorporated at Los Angeles, Cal., by L. R. Saunders, M. R. Bennaugh and Edmond Locke, with a capital stock of $30,000.

Northwestern States.

Minneapolis, January 20.—The Butte (Mont.) Electric and Supply Company has been incorporated with a capitalization of $50,000. H. K. Scheiber heads the list of stockholders.

A trust deed in favor of the Wisconsin Trust Company for $150,000 has been filed by the Manitowoc (Wis.) and Northern Traction Company. The issue is to pay an indebtedness of $118,000, and the remainder will be used in making numerous extensions.

The Des Moines, Winterset and Creston Electric Railway Company has applied for a franchise at Winterset, Iowa.

A. T. LeVesconte has decided not to renew his lease of the electric-light plant at Glencoe, Minn., and a new manager will have to be secured.

E. L. Healy of Red Lake Falls, Minn., and A. H. Savage of Minneapolis propose to establish a new electric-light system at East Grand Forks, Minn., and to transmit power and light from Red Lake Falls, where they will construct a power plant. Franchises at both Red Lake Falls and East Grand Forks will be asked for in February.

There is talk of putting in an electric-light system at Herreid, S. D.

William H. Young and associates at Oconto, Wis., have filed articles of incorporation for the Oconto Electric Company with a capital of $5,000.

R.

PERSONAL

Edwin L. Huntley has been appointed manager of the Postal Telegraph-Cable Company office at Omaha, Neb.

Frederick O. Nourse was recently appointed general inspector of the southern district of the Western Union Telegraph Company, with headquarters at Atlanta, Ga.

E. S. Loomis, superintendent of the Jackson and Battle Creek (Mich.) electric line, will, on February 1st, assume the superintendency of the Michigan Traction Company, which operates cars between Battle Creek and Kalamazoo. This will place Mr. Loomis in charge of both lines.

The Ferris brothers, well-known figures in the electrical activities of the West, were conspicuous visitors at the Electrical Show. There are four of them—W. J., Thomas, Robert and James W.—and they manage with modern enterprise a string of central stations in small cities in Illinois, Iowa and South Dakota.

E. W. Moore has been elected president of the Lake Shore Electric Railway Company of Cleveland to succeed Warren Bicknell. Mr. Bicknell resigned to become president of the Cleveland Construction Company. The board of directors passed a resolution approving the management of the road by President Bicknell.

A. J. Mellen, district superintendent of the Central Union Telephone Company for Northwestern Ohio, has been appointed manager of the Bell system in Toledo, where he has been making his headquarters. Mr. Mellen will look after this business and still discharge the duties of his former position. He succeeds John W. Cherry, who will, however, remain with the Central Union.

J. J. Stanley has been chosen vice-president and general manager of the Cleveland Electric Railway Company and will take over many of the duties heretofore performed by President Horace E. Andrews. This change was made at the suggestion of Mr. Andrews, in order that he might have more time to devote to the business of the Andrews-Vanderbilt syndicate. It will also be the means of having an executive officer present in the city at all times.

ELECTRIC LIGHTING.

W. H. Reber has applied for an electric-light franchise for Butte, Mont., to run 40 years.

Williston, N. D., is about to vote to issue $12,000 in bonds for an electric-light and water system.

I. N. Smith and C. E. Wood have been granted a franchise for an electric-light and water system in Kennewick, Wash.

This is Mark Twain's description of the electric searchlight: "Plenty of daylight in a box, and ready to be turned on whenever needed."

Chillicothe, Mo., is to hold an election on January 29th, to decide whether to issue bonds for $100,000 for an electric-light plant and waterworks.

Notice comes from New York that the American Light and Traction Company has purchased the properties of the Lacombe Electric Company of Denver, Colo., and the Muskegon Traction and Light Company of Muskegon, Mich. The latter property includes a street-railway system as well as gas and electric-light plants. Since this notice a report from Denver stated that the Lacombe plant, which cost about $350,000, and supplies the arc lights of Denver, had been damaged by fire to the extent of $100,000.

ELECTRIC RAILWAYS

A stock company is said to have been organized in Hutchinson, Kan., to build an electric street railway in that city.

The contract for the construction of the new trolley road between Seymour and Naugatuck, through the Naugatuck Valley, has been let by the Connecticut Railway and Lighting Company to the firm of D. W. Blakeslees' Sons of New Haven. Some hard problems in construction will be met along the tortuous course of the Naugatuck River, which it will follow. When this road is completed the trolley route through the Naugatuck Valley from Waterbury to New Haven will have been practically completed. The new road will run through High Rock and Beacon Falls, and parallel the Naugatuck division of the New York, New Haven and Hartford Railroad. It will be 10 miles long.

The board of directors of the Long Island Electric Railway Company has been reorganized by the election of Interborough representatives in the place of the Philadelphia interests, which formerly controlled the property. The company operates 26 miles of trolley lines, extending from the terminus of the Kings County elevated road to Queens, L. I., and to Far Rockaway. It is capitalized at $600,000, and has outstanding in addition $600,000 of five per cent. bonds. The directors elected are August Belmont, Ralph Peters, James Jourdan, E. P. Bryan, David C. Green, A. L. Langdon, C. L. Addison, Arthur Turnbull and Alfred Skitt. The officers elected are: Arthur Turnbull, president; F. L. Fuller, vice-president and general manager; Frank E. Haff, secretary, and J. J. Rollins, treasurer.

The Merchants' Association of Indianapolis, Ind., has for a year or more been working under the plan of refunding railroad fare to all purchasers of $25 worth of merchandise from any one or more of the members of the association. To such out-of-town purchasers the association refunds the fare on steam lines for a round-trip distance of 80 miles and for a round-trip distance of 150 miles on the interurban lines. Rebate books are issued to applicants, and when presented to Charles Z. Coffin, secretary and manager of the Merchants' Association, with the evidence of the purchase, he refunds to them the fare paid out. It is said that the association refunded upward of $20,000 worth of fares during the year 1905, three-fourths of the beneficiaries being interurban passengers.

The work of converting the existing mule-drawn street cars of the Compania Ferrocarriles Urbano in Lima, Peru, into an electric road and the building of several miles of new track has been undertaken by W. R. Grace & Co. of New York. United States material and equipment are to be used in the construction of the electric traction system. Forty-five cars will be used, of the open type. Power for the new lines will be generated at a hydro-electric plant, 30 miles from Lima, on the Rimac River. The Lima electric system will be the first to be built of American material on the west coast of South America, the British and Germans having hitherto secured such contracts in that part of the world. The new lines, about 30 miles long, will be in operation this year. The General Electric Company will furnish the electrical equipment.

PUBLICATIONS.

The latest report of the United States Geological Survey on Mineral Resources of the United States, being for the year 1904, has been issued by the Department of the Interior. It is a book of 1,264 pages, and the arrangement and scope are practically the same as in the 20 preceding reports on the subject of minerals. Each report records the

development of the mineral industries of the United States since the time covered by the preceding number of the series.

The Commercial Mica Company, Republic Building, Chicago, has published a standard price list of its Micavita insulation. It gives prices and information about a large variety of mica products, including cut and uncut mica.

The new 1906 catalogue of the Belden Manufacturing Company of Chicago is of convenient pocket size, well bound in cloth and a valuable little book for engineers to have. It describes the company's products in the line of electrical wire and cords and contains much valuable data.

A new edition of Webster's International Dictionary has 25,000 new words and phrases, a new gazeteer of the world and a new biographical dictionary. It has 2,380 quarto pages and 5,000 illustrations. The G. and C. Merriam Company of Springfield, Mass., is the publisher.

A handsome new catalogue from the C. W. Hunt Company of West New Brighton, N. Y., is an elaborate treatise on the narrow gauge "industrial" railway. The catalogue takes up both the track construction and the cars and equipment. There are 64 pages in the catalogue, which is plentifully illustrated.

"Roofing Rules" is the title of a handbook on sheet metals in building construction for architects, owners, engineers and builders, issued by the Merchant & Evans Company of Philadelphia. The book contains some handsome illustrations of buildings and also descriptions of the company's products in the line of roofing material.

The Star Expansion Bolt Company of 147-149 Cedar Street, New York city, has issued Catalogue No. 14, in which its products are illustrated and described. It says that its bolts, both lag-screw and machine-type, are standard. One interesting specialty is the Star cable dog, used to fasten electric cables or pipes to masonry walls, ceilings, etc. The employment of this device obviates the use of wooden plugs.

The J. L. Mott Iron Works of New York city is to be commended on the striking appearance and originality of its new catalogue "J" on "Electroliers, Lamps, Brackets and Posts." Numerous fine cuts illustrate the many beautiful designs of lamps and posts manufactured by this company. Prices and dimensions are also quoted for each piece. A blueprint supplement contains drawing of a number of designs for steel electric-light poles.

Sawyer-Man incandescent lamps, sold by the Westinghouse Electric and Manufacturing Company, are made the subject of a neat little book published by the Sawyer-Man Electric Company of New York. This company builds incandescent lamps in all candlepowers, voltages and efficiencies, and manufactures standard lamps of varied characteristics, about a dozen of which are illustrated and described in the book. The book will aid customers in selecting lamps with special reference to the conditions of operation.

"Under the Gates of Babylon" is the title of the latest advertising folder of the Buckeye Electric Company of Cleveland. The opening of the gates reveals an impressive night picture of the mighty walls of Babylon. The story of the centuries of impregnable security of Babylon, until the terrible night when the Persians ended the feasting and carousing, is told, ending with this paragraph: "And, in the impenetrable darkness, when the last light had gone out, slowly that weird, mysterious handwriting appeared on the walls—and there arose three words which have been echoed through time —'Better buy Buckeye.'"

The Ontario Power Company of Niagara Falls has embellished and published in convenient pamphlet form the Institute paper of Mr. P. N. Nunn, which gives an accurate description of the development of the Ontario Power Company at Niagara Falls and its works, which are now in operation. The pamphlet has some excellent halftones of machinery, buildings, etc., and drawings showing locations and the principal engineering features.

Accompanying the pamphlet [illegible] print [illegible] the [illegible] manufacturing [illegible] Power and the [illegible]

The [illegible] Company [illegible] Ohio, [illegible] of a book, entitled "The [illegible]" It not only explains the [illegible] for the [illegible] of the plant and [illegible] different styles of [illegible] The book is a credit to the company [illegible] up in novel form, and, [illegible] the company's product [illegible] mentary of the policy and method [illegible] the company. The plant includes three [illegible] adjacent warehouses, and [illegible] pieces of high-grade [illegible] made annually.

SOCIETIES AND SCHOOLS

The Proceedings of the Railway Signal Association for 1905 has been issued, being No. [illegible] It contains the proceedings of the [illegible] New York meeting on January 10th and [illegible] remarkable promptness on the part of Secretary H. S. Balliet in issuing it thus early. It contains a complete record of all the business transacted at the meeting, with the papers and discussion. In the back is a complete alphabetical index of members.

Announcement has just been made by the college of engineering, University of Wisconsin, of the complete list of non resident lecturers who are to address the students in engineering during the coming year. The lecturers selected include some of the most prominent authorities on special phases of engineering in the country. The lectures are not confined strictly to engineering topics, but include the consideration of various industrial and commercial problems with which the engineer is brought in contact. Among the subjects pertaining to electrical engineering, "High Speed in Modern Engineering" will be discussed by Mr. B. A. Behrend, chief electrical engineer of the Allis-Chalmers Company.

The annual inspection tour of the senior class in electrical engineering of the University of Illinois, under the direction of Professors Morgan Brooks and T. M. Gardner, was taken on January 22d to 25th inclusive. The Bloomington, Pontiac and Joliet single-phase railway was inspected, after which the party came to Chicago, stopping at the Grand Pacific Hotel. Various shops, factories and other institutions of electrical interest in Chicago were visited and considerable time was spent at the Electrical Show. A short trip was also taken to Waukegan to inspect the mills of the American Steel and Wire Company. There are 30 students in the senior class of electrical engineering this year, which is twice as large as last year.

MISCELLANEOUS

The backers of the Argentine Marconi Wireless Telegraph Company of the Rio de la Plata say that within a year they will be sending messages from Argentina to Italy and Ireland. It is expected that the cable rates between New York and the Argentine Republic will thus be considerably reduced. George H. Monroe of the firm of Monroe & Monroe, New York, has returned from Buenos Ayres, where he has been engaged for the last two months organizing and financing the scheme.

According to a jury, in Part II. of the Supreme Court, Brooklyn, a few days ago, a telegraph company is responsible for damages when in transmitting a message intrusted to it the company makes a mistake. The sum of $2,200, the full amount sued for, was awarded to E. S. Halstead & Co., bag manufacturers in Manhattan, against the Postal Telegraph Company. A message was sent by Armour & Co. of Chicago to Halstead & Co. inquiring the price on a contract for 25,000 bags. An error in figures in the telegraphic reply made a total difference of $2,200 in the contract.

TRADE NEWS

[illegible]

[illegible]

[illegible]

[illegible] Building [illegible]

[illegible] office in [illegible] 147 [illegible] Mr. L. [illegible]

BUSINESS

The [illegible] Nicholas, will be built by the F. Bi[illegible] of that city. It will be a board of [illegible] sign and large and [illegible]

What is said to be one of the largest [illegible] for machine tools ever given [illegible] company was recently placed by the Allis-Chalmers Company of Milwaukee to cover a portion of the equipment for the new extensions to its West Allis works, now under construction. Forty-two machine tools of extra heavy pattern designed especially for use with high-speed steels, and driven by Allis-Chalmers motors, were ordered from several of the most prominent builders of machine tools in the country. The combined weight of these machines, without motors, is about 4,282,000 pounds, or 2,141 tons. About 75 Allis-Chalmers motors of various sizes and aggregating a total of 1,200 horsepower, will be employed to drive these machines. In addition to the order for machine tools 34 electric traveling cranes were ordered at the same time for sizes and capacities ranging from 2-ton wall jib cranes up to 60-ton 78-foot span cranes with 10-ton auxiliary hoist for the new foundry. The combined weights of the cranes ordered is approximately 940 tons.

The Westinghouse Machine Company of East Pittsburg, Pa., has received during the last two months many orders for Westinghouse-Parsons steam turbines. The largest orders were received from the Transit Development Company, Brooklyn, N. Y., for a 7,500-kilowatt turbine; Edison Electric Company, Los Angeles, Cal., for a 7,500-kilowatt turbine; the Laclede Power Company, St. Louis, Mo., for two 2,000-kilowatt turbines, and the Chautauqua Traction Company, Jamestown, N. Y., for a 1,500-kilowatt turbine. Other important orders ranging from 1,000 kilowatts down to 300 kilowatts are also reported. The turbine to be installed by the Transit Development Company will be of the multiple-expansion parallel-flow type, direct connected to an alternating current generator running at 750 revolutions per minute, and will operate with dry saturated steam at 175 pounds boiler pressure and 28-inch vacuum. The generator will be of the rotating-field enclosed type and will deliver three-phase current at 6,600 or 11,000 volts. The Edison Electric Company turbine unit will be of the same general type. The turbines for the Laclede Power Company will operate at 1,200 revolutions per minute, with dry saturated steam at 165 pounds boiler pressure and 28-inch vacuum, and will deliver three-phase current at 2,300 volts.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 16, 1906.

809,929. Intercommunication Telephone System. Richard M. Beard, New York, N. Y. Application filed November 4, 1902.

The system consists of interwiring connecting three or more stations with one another, telephone apparatus at each station, signal-sending apparatus at each station, a separate group of wiring for the telephone and signal sending apparatus located at each station, signal-receiving apparatus and a separate group of wiring therefor at each station, and devices at the respective stations for electrically connecting the interwiring between any two stations, first to one group of wiring at one station, and then to the other group at the same station. The interwiring comprises independent wires for respectively connecting the apparatus at each one of the stations with the apparatus at each one of the remaining stations. (See cut on next page.)

809,966. Stopping and Starting Device for Motor-driven Apparatus. Walter B. Manny, New York, N. Y., assignor to the Pike Adding Machine Company, Orange, N. J. Application filed August 1, 1905.

A machine driven by an electric motor has a movable stool for the operator, upon which stool is arranged a starting and stopping device to be shifted by the presence of the operator.

809,978. Electric Safety Fuse. Elmer L. Ogle, Peru, Ind., assignor to the Peru Electric Manufacturing Company, Peru, Ind. Application filed May 25, 1904.

An inclosing case is provided with a main fuse connected with the terminals of the case. An auxiliary fuse is connected to the main fuse. A layer of paper saturated in a sensitive chemical material is adapted to be discolored upon blowing of the fuse, the auxiliary fuse being in contact therewith.

809,982. Electric Safety Fuse. Charles W. Rhoades, Peru, Ind., assignor to the Peru Electric Manufacturing Company, Peru, Ind. Application filed May 25, 1904.

The combination consists of a cylindrical shell or casing provided with similar terminal circuit contacts, an inclosed fuse of limited resistance connected with the terminal contacts, an outer spring device secured on the side of the main shell and a thread device attached to the end of the spring passing through an opening in the shell and looped around the fuse.

809,985. Incandescent Electric-lamp Remover, Replacer and Cleaner. Charles J. Rundberg, Kansas City, Mo. Application filed July 24, 1905.

A handle is provided at its upper portion with longitudinal grooves and openings, and resilient arms are arranged in the grooves and have their lower portions extending through the openings, the lower terminals of the arms being bent upwardly against the outer surface of the handle. Shoulders on the upper portions of the arms, a sleeve slidingly embracing the handle and the arms to regulate the tension of the latter, the movement

of the sleeve being limited by the lower terminals of the arms and shoulders, and resilient loops carried by the upper portions of the arms are the other features.

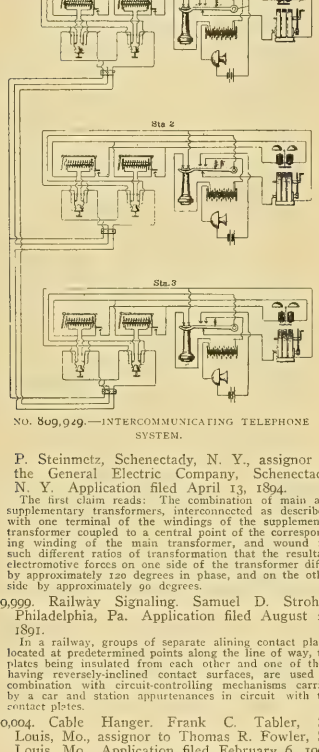
809,993. Cable Hanger. Frederick W. Sorg, Englewood, N. J. Application filed December 16, 1903.

A zinc strap is formed with grips and with keyhole slots adjacent the ends of the same. A headed zinc stud is rigidly riveted to the strap intermediate the slots, there being yieldable integral locking flanges adjacent the slots to co-operate therewith and to prevent the accidental displacement of the stud in the slots.

809,995. Electric Meter. William Stanley, Great Barrington, Mass. Application filed March 7, 1905.

The combination consists of a main series winding, an auxiliary winding at an angle thereto, a needle subject to the action of both windings and having its axis of rotation substantially at right angles to the axes of both of the windings, and means for periodically energizing the auxiliary winding so as to give the needle periodical impulses and maintain it in motion so long as current is passing through the series winding. (See cut.)

809,996. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 13, 1894.



NO. 809,929.—INTERCOMMUNICATING TELEPHONE SYSTEM.

The first claim reads: The combination of main and supplementary transformers, interconnected as described, with one terminal of the windings of the supplemental transformer coupled to a central point of the corresponding winding of the main transformer, and wound for such different ratios of transformation that the resultant electromotive forces on one side of the transformer differ by approximately 120 degrees in phase, and on the other side by approximately 90 degrees.

809,999. Railway Signaling. Samuel D. Strohm, Philadelphia, Pa. Application filed August 29, 1891.

In a railway, groups of separate alining contact plates located at predetermined points along the line of way, the plates being insulated from each other and one of them having reversely-inclined contact surfaces, are used in combination with circuit-controlling mechanisms carried by a car and station appurtenances in circuit with the contact plates.

810,004. Cable Hanger. Frank C. Tabler, St. Louis, Mo., assignor to Thomas R. Fowler, St. Louis, Mo. Application filed February 6, 1905.

The claims describe a convenient hanger for cables.

810,027. Electric Signal. Charles C. Blake, Brookline, Mass. Application filed August 19, 1905.

A selective signal system consists of a transmitting station having a series of pendulums adapted to send electric impulses of different periodicity over a line wire when connected thereto. A series of way stations are each provided with a pendulum device adapted to respond to the vibrating of one only of the transmitting pendulums and an electric-lamp signal and a semaphore arm become operative when the unison of vibrations is established between the transmitter and receiver.

810,069. Overhead Trolley Harp and Shoe for Electric Railways. John Miller, Jr., Amesbury, Mass., assignor to William E. Biddle, Amesbury, Mass. Application filed March 17, 1905. Renewed December 18, 1905.

An overhead device of the kind comprises a trolley pole, a harp mounted thereon, a shoe pivoted between the arms of the harp and having a hollowed-out contact surface along its upper edge, and means for normally maintaining the shoe with its contact surface tipped upwardly at its rear end approximately in line with the trolley pole.

810,150. Wireless Transmitting and Receiving Mechanism for Electric Waves. Christian Hülsmeyer, Düsseldorf, Germany. Application filed March 14, 1904.

An electric-wave transmitter and an electric-wave receiver each have synchronously rotating contact wheels and means for automatically freeing the contact wheels. Means are provided for actuating the receiver mechanism after a predetermined space of time, and there are means for preventing all other waves arriving at other moments actuating the receiver mechanism. Regulating the resistance of the coherer to a determined point can be accomplished by varying the angle of the coherer.

810,174. Oscillating Electric Fan. Gustav Sittmann, Brooklyn, N. Y., assignor to Herbert Stanley Brown, New York, N. Y. Application filed June 11, 1902.

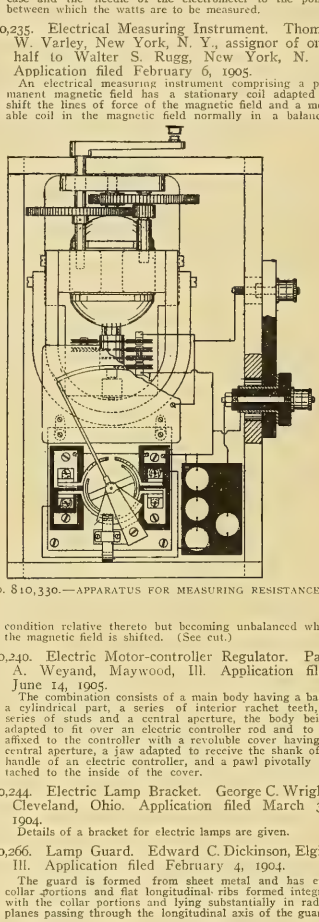
A device of the character described comprises a movable member, a fan and its motor pivotally connected therewith at one side of the axis of the member, and stops to cause the member and fan to oscillate.

810,179. Apparatus for Measuring Watts in Electrical Circuits. Ernest Wilson, London, England. Application filed December 17, 1904.

In combination with the primary conductors are a secondary electric system, means for producing between two points in the secondary system a potential which varies with the current in the work circuit and is always proportional thereto, an electrometer, means connecting the pairs of quadrants of the electrometer to the two points in the secondary system and means connecting the case and the needle of the electrometer to the points between which the watts are to be measured.

810,235. Electrical Measuring Instrument. Thomas W. Varley, New York, N. Y., assignor of one-half to Walter S. Rugg, New York, N. Y. Application filed February 6, 1905.

An electrical measuring instrument comprising a permanent magnetic field has a stationary coil adapted to shift the lines of force of the magnetic field and a movable coil in the magnetic field normally in a balanced condition relative thereto but becoming unbalanced when the magnetic field is shifted. (See cut.)



NO. 810,330.—APPARATUS FOR MEASURING RESISTANCE.

810,240. Electric Motor-controller Regulator. Paul A. Weyand, Maywood, Ill. Application filed June 14, 1905.

The combination consists of a main body having a base, a cylindrical part, a series of interior rachet teeth, a series of studs and a central aperture, the body being adapted to fit over an electric controller rod and to be affixed to the controller with a revoluble cover having a central aperture, a jaw adapted to receive the shank of a handle of an electric controller, and a pawl pivotally attached to the inside of the cover.

810,244. Electric Lamp Bracket. George C. Wright, Cleveland, Ohio. Application filed March 30, 1904.

Details of a bracket for electric lamps are given.

810,266. Lamp Guard. Edward C. Dickinson, Elgin, Ill. Application filed February 4, 1904.

The guard is formed from sheet metal and has end collar portions and flat longitudinal ribs formed integral with the collar portions and lying substantially in radial planes passing through the longitudinal axis of the guard.

810,269. Method of Operating Electric Motors. Arthur C. Eastwood, Cleveland, Ohio. Application filed July 24, 1903.

The method of utilizing electrical energy consists in first transforming electrical energy from a source of supply into mechanical energy, transforming the mechanical energy into electric energy, transforming a portion of the electrical energy into mechanical energy to drive a load, and employing another portion of the electrical energy to directly control the rate at which electrical energy from the source of supply is transformed into mechanical energy.

810,311. Electroresponsive Device. Elmer A. Terpening, Geneseo, Ill. Application filed December 17, 1904.

In a current-responsive device adapted for actuation by feeble currents two horseshoe magnets are arranged with opposite poles in proximity to leave therebetween two spaces constituting two strong magnetic fields. A coil has its two sides in the spaces and adapted for connection in a line, and there are means for suspending the coil for oscillation, means for retarding the oscillation of the coil, and working parts associated with the coil to derive their working power from the oscillation of the coil.

810,330. Apparatus for Measuring Electric Resistances. Sydney Evershed, Streatlev, England, assignor to himself and Evershed & Vignoles, Limited, Chiswick, England. Application filed February 27, 1904.

Claim 1 reads: In combination, a generator of electric current; an electrometer in close proximity to the generator having a rotatable index pointer and segmental piece thereon, in stable equilibrium throughout its range as regards gravitational or torsional forces; four metal quadrants connected electrically in two pairs, grouped about the spindle and segments of the rotatable index pointer; an electrical resistance in the connection between one pair of quadrants and an external terminal; an electrical resistance connecting the two pairs of quadrants, and adapted to cause a difference of potential between them and a portable box inclosing the whole apparatus. (See cut.)

810,335. Telephone Party-line System. Frank B. Hall and Arthur F. Poole, Wheeling, W. Va. Application filed September 23, 1901.

Of forty-five claims the first one reads: In a selective party-line system the combination with a battery, a continuous metallic line, normally open connections leading from said line to a series of stations, automatic switching mechanism at each station, and mechanism arranged to complete the circuit through the connection at any station and then cut out the battery from the continuous line.

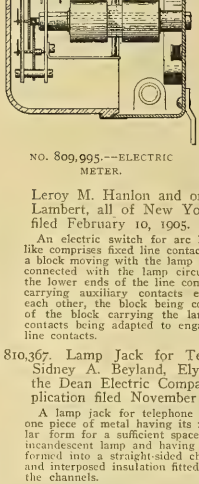
810,345. Telephone Party-line System. Arthur F. Poole and Frank B. Hall, Wheeling, W. Va. Application filed October 13, 1902.

Full details of a comprehensive party-line telephone system are given.

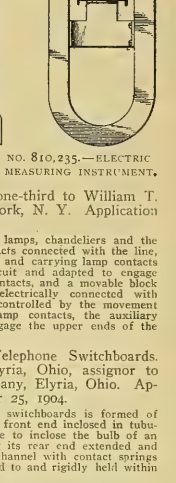
810,346. Party-line Signaling System. Arthur F. Poole and Frank B. Hall, Wheeling, W. Va. Application filed October 13, 1902.

In a selective party-line system the combination with the central station consists of lines running therefrom to a series of substations, signaling apparatus at each of the substations normally disconnected from the lines, means at each substation absolutely controlled from the central station and from the substation whereby the corresponding signaling apparatus may be connected with the lines, and means whereby an actuation of the first means controlled from the corresponding substation establishes a condition such that the substation control at the other substations of the first means is rendered ineffective.

810,357. Electric Switch for Street Arc Lamps, etc. Peter H. F. Spies, New York, N. Y., assignor of one-third to David E. Aarons, one-third to Leroy M. Hanlon and one-third to William T. Lambert, all of New York, N. Y. Application filed February 10, 1905.



NO. 809,995.—ELECTRIC METER.



NO. 810,235.—ELECTRIC MEASURING INSTRUMENT.

An electric switch for arc lamps, chandeliers and the like comprises fixed line contacts connected with the line, a block moving with the lamp and carrying lamp contacts connected with the lamp circuit and adapted to engage the lower ends of the line contacts, and a movable block carrying auxiliary contacts electrically connected with each other, the block being controlled by the movement of the block carrying the lamp contacts, the auxiliary contacts being adapted to engage the upper ends of the line contacts.

810,367. Lamp Jack for Telephone Switchboards. Sidney A. Beyland, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed November 25, 1904.

A lamp jack for telephone switchboards is formed of one piece of metal having its front end inclosed in tubular form for a sufficient space to inclose the bulb of an incandescent lamp and having its rear end extended and formed into a straight-sided channel with contact springs and interposed insulation fitted to and rigidly held within the channels.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on January 22, 1906:

396,403. Electric Meter. M. J. R. Jacquemier, Paris, France.
396,407. Electric-wire Conduit. J. Lynch, Washington, D. C.
396,422. Regulation of Alternate-current Generators. G. Pfannkuche, Cleveland, Ohio.
393,430. Electrical Switch. E. A. Sperry, Chicago, Ill.
396,450. Municipal Telegraph System. T. J. Zoeller, Louisville, Ky.
396,465. Sounder Attachment. G. H. Carey and W. McArthur, Dollarville, Mich.
396,543. Underground System of Electric Wires. H. B. Cobb, Wilmington, Del.
396,549. System of Electrical Distribution. E. N. Dickerson, Jr., New York, N. Y.
396,557. Dynamo for Telegraphic Purposes. B. Gmur, Schanis and O. Flatz, Niederurnen, Switzerland.
396,579. Wiring Block for Electrical Circuits. O. P. Loomis, Somerville, Mass.
396,580. Coupling Dynamos. O. P. Loomis, Somerville, Mass.
396,581. Coupling for Dynamos and Motors. O. P. Loomis, Somerville, Mass.
396,582. Automatic Sound Detector for Electric Circuits. O. P. Loomis, Somerville, Mass.
396,583. Incandescent Lamp Socket. O. P. Loomis, Somerville, Mass.
396,602. Combination of Electric Generators. E. W. Rice, Jr., Lynn, Mass.
396,603. System of Electrical Distribution. E. W. Rice, Jr., and A. L. Rohrer, Lynn, Mass.
396,618. Electric Railway Trolley and Support. S. H. Short, Columbus, Ohio.
396,633. Electric Railway System. D. G. Weems, Baltimore, Md.
396,645. Electric Time Meter. G. F. Card, Covington, Ky.
396,649. Turn Table for Cable or Electric Railways. W. Davidson, Oakland, Cal.
396,667. Burglar Alarm. A. C. Robbins, Brooklyn, N. Y.
396,681. Secondary Battery Charging. C. F. Brush, Cleveland, Ohio.

WESTERN ELECTRICIAN

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Electrically Operated Floating Fuel Depot for Coaling Warships.

By D. A. Willey.

One of the oddest types of marine craft ever designed is what Great Britain uses to supply its warships with coal in some of its harbors. The craft is called a floating coal depot, and well deserves the name, for it is a coal yard afloat, and when filled holds no less than 12,000 tons of fuel. It is in reality a great steel hulk, divided into compartments, all of which are utilized for coal storage, and is operated by a very elaborate mechanical system, the electric power used being generated on board. The floating coal depot here illustrated is located in the harbor at Portsmouth, which is one of the principal naval stations of Great Britain, and such is its size that it can fill the bunkers of three or four big battleships with fuel before its bins are empty. The odd appearance of this craft is well shown in Fig. 3. As the picture shows, a form of the plant commonly utilized in

Fig. 1. Unloading Coal in Bags.

Fig. 2. Electrically Operated Coal-Handling Apparatus.

Fig. 3. A Modern Successor of the Old Coal Hulk.

this country in transferring cargoes on the Great Lakes is employed.

The depot is equipped with four conveyors, each consisting of a steel tower mounted upon rails, so that it can be moved forward and back, and adjusted to the depot or the ship which it is to serve. Each tower supports a series of lateral tramways consisting of steel, which are so adjusted that they can be raised and lowered to a suitable angle. Upon each tramway travels the bucket, which can be raised and lowered at any point between its extremities by means of an automatic guide. Power is supplied by an electric motor, but to assist in overcoming the load of the mechanism, a chain holding the bucket is attached to a wire cable and sheave. The trolley system is utilized in hauling the buckets back and forth as well as in raising and lowering them, and as the tramways extend from both sides of each tower, two vessels can be coaled at once at the depot, which can also be filled from both sides.

In addition to the tramway conveyors, the hulk is also provided with a series of boom derricks, the arms of which are constructed of steel. These are auxiliary to the tramways, but are intended principally to serve the galleries. Frequently it is desirable for a warship to take on sorted fuel in bags. Nearly all of the manual labor required on board the depot is to fill the fuel bags with coal in the lump form. The lower portions of the bins open out into galleries, and as fast as the bags are filled they are wheeled into these, when the fuel is lifted out by the derricks, slung over the side and placed on board the receiving vessel. A half dozen or more bags can be transferred at once by means of the crane of hoist which are attached to the boom cable, the hoist being auto-matic gear fastened to the fuel bag. The process is represented in the animated scene pictured in Fig. 1.

As has been stated, the coaling depot is an individual power plant, and all the coal handling, with the exception of filling the bags, is performed by electric motor. The current is generated by steam power and transmitted to the series of motors installed on the tramway towers. The boom derricks are also motor driven. The length of the depot is such that the bunkers of a flotilla of gunboats can be filled at one time, while the reach of the tramway arms, which is plainly shown in Fig. 2, is such that the two small vessels can be abreast and be served by the mechanism.

In trials which have been made of the coal depot at Portsmouth, it has been hauled alongside a dock and a certain proportion of its cargo dumped on the dock in a given period of time. In another test the mechanism of the depot was employed to transfer its cargo to the dock, where the coal in bags was trundled on board the warship. As Fig. 1 shows, to keep pace with the charging capacity of the series of tramways, an entire ship's crew was required.

Perhaps the most valuable feature of the depot, however, is that it is not only movable, but is available for serving vessels on either side or on both sides. It can also be utilized, while loading, to fuel the battleship or cruiser alongside. While the bunkers of the war vessel are being filled on one side by the tramways and booms, the contents of the collier can be taken aboard by the mechanism on the opposite side. Indeed, the cargo of the collier can be transferred directly to the warship, the coal being taken across the deck of the depot by its conveying mechanism.

Ordinarily, the floating coal depot is moored in the harbor by means of heavy anchors attached to both ends. Consequently all of its apparatus can be employed, if desired, ships on both sides being served at one time. When it is necessary to fill up the depot, it can be towed to the dock and there loaded from railroads cars or coal piers.

ELECTRICALLY OPERATED FLOATING FUEL DEPOT FOR COALING WARSHIPS.

The Niagara Power Situation.

Senator [illegible] has introduced [illegible] the New York Legislature to [illegible] of four companies which were given the right to divert water from the Niagara River for power purposes. The companies affected are the Niagara Power and Drainage Company, granted in 1880; the Lewiston Water Supply Company, granted in 1888; the Lockport Water Supply Company, granted in 1889, and the Lewiston Water Works Company, granted in 1874. None of these companies has begun its proposed development, and it is probable that the charters have been automatically revoked, but it is thought best to wipe the charters out beyond question by passing the bills referred to.

Should these bills become law, there will be only four charters in existence for power development on the New York side of the river. These are the Niagara Falls Power Company, the Niagara Falls Hydraulic Power and Manufacturing Company and the Niagara, Lockport and Ontario Power Company, as well as the Niagara County Irrigation and Water Supply Company, the last named being better known as the Love scheme. Ground was broken for the Love development some years ago, but nothing of any account has ever been done. It is said about $600,000 was sunk in the project. While it is understood to be doubtful if a company could operate under the charter as it stands, it is reported that a project is on foot to revive the scheme.

The only two companies operating on the New York side are the Niagara Falls Power Company and the Niagara Falls Hydraulic Power and Manufacturing Company. The understood possibilities of the first-named company in the development are about 200,000 horsepower, while the last-mentioned company may develop 125,000 horsepower. The

three companies now at work on the Canadian side of the river have projected a total development of over 400,000 horsepower, which would appear to indicate that the Canadian side is likely to lead in the extent of the development, especially as it is contemplated to limit the development of the other two companies that have rights on the New York side. This condition of affairs is doubly important, because the demand for power is likely to be greater in the United States than in Canada. Under their agreements with the Ontario government, all the power companies developing power at Canadian Niagara may transmit one-half of their product to the United States, and each of the developing companies is preparing to send large amounts of power across the border, so much so that Canadians are beginning to realize that the development may not mean the upbuilding of their country.

Senator L'Hommedieu is quoted as stating that there are 11 franchises that permit of power developments on the Canadian side. This, however, does not mean there are that many franchises for development close to the falls. Plans have just been filed in York County showing the route of the Niagara-Welland Power Company through that county to Toronto. This company was chartered for utilizing a part of the waters of the Niagara and Welland rivers, the capital stock being $5,000,000, the plan being to tap the Welland River 4½ miles from Chippewa, and to construct a canal to the Niagara escarpment, six miles away, where a head of 225 feet would be obtainable. The project is very similar to Love's old project for the New York side.

Resolutions relating to the Falls of Niagara are being introduced in Albany and Washington. The latest in Washington is that offered by Senator Platt of New York. This resolution is intended to protect the waters of Niagara Falls, "to preserve their natural beauty," and to investigate the diversion of the waters of the Niagara River above the falls, and all other causes operating to diminish the flow of water over the falls. The president is authorized to appoint a commission of four, to meet a similar commission from Great Britain, to investigate and report on the matter. The sum of $20,000 is appropriated to meet expenses. D.

From the Canadian point of view the following from the Ottawa (Ont.) correspondent of the Western Electrician will be interesting: "The Canadian government will undoubtedly take steps to co-operate with the government of the United States in the movement for the preservation of the scenic grandeur of Niagara Falls from destruction at the hands of power companies. The Dominion government, however, must first ascertain from the courts whether it or the local government of Ontario is entitled to control of the waters of the Niagara River on the Canadian side of the boundary. In the event of the courts deciding in favor of the province, then the rights of the latter will probably be purchased by the Dominion. The Canadian authorities recognize the fact that there are two sides to the proposed preservation of Niagara Falls. They cannot ignore the fact that with the few waterpowers existing throughout Western Ontario the use of Niagara Falls for the development of electric energy will hereafter prove an inestimable boon to the traction and industrial interests of that region. The Canadian section of the International Waterways Commission has referred the question of policy in this matter to the federal cabinet for its determination and will await the government's decision before framing any recommendations as to how the power interests can best be held in check."

Telegraph Extension in Central America.

Belize, the capital of British Honduras, is now connected with the United States by telegraph. Formerly messages were sent to New Orleans, then carried every Thursday by mail to Belize, requiring three days, or 10 days if the weekly mail was missed at New Orleans. On December 15th the first telegram ever received direct at Belize was delivered at 10:30 a. m., having been dispatched at Louisville, Ky., at 3:30 p. m., December 14th. No tariff has yet been fixed, but the probable through rate from the United States will be $1 a word.

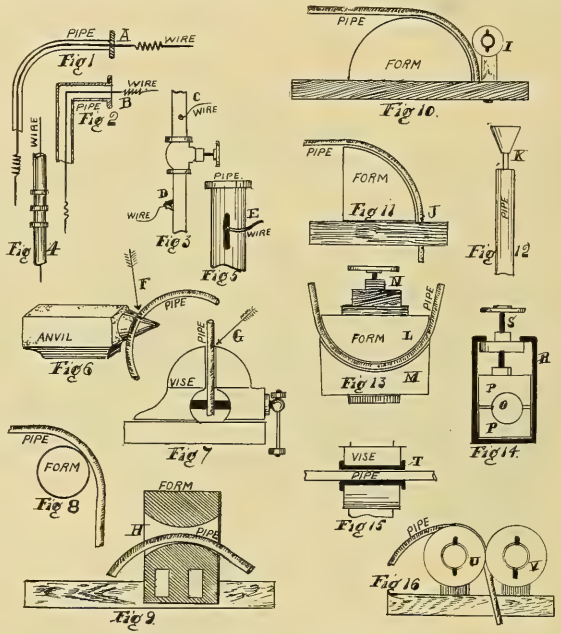
The new telegraph lines connect with the Mexican system. The Mexican Department of War erected the line from Payo Obispo, via Santa Cruz, to Peto, Yucatan—about 225 miles, in 1901—solely for official purposes. Last November it was transferred to the Department of Public Works, and its use granted to the general public. Payo Obispo, Mexico, is across the Rio Hondo, six miles from Consejo, British Honduras. This gap in the telegraph line requires a boat as yet to carry the messages, but as soon as Mexican authority is granted, a cable will be laid under the river. There will then be an unbroken line established from Belize to Galveston. The new line means much for American commercial interests in that region.

Cold Bending of Pipes for Electrical Wires.

By R. G. Grayne.

Installation of electrical wires for lighting or power purposes in modern building requires a certain amount of work and care to insure proper protection. Various types of metal, glass and other tubes are provided to protect the insulation. Serviceable casings of seasoned and selected hard wood are used in many places, and the wires are packed in asbestos in these casings. There are various other forms of protection for the lines of wires in buildings. But, after all, the common wrought-iron pipe is extensively used.

In nearly all of my work I have noticed ordinary inch metal pipe, painted black, utilized for carrying the wires from point to point. Not infrequently



COLD BENDING OF PIPES FOR ELECTRICAL WIRES.

these pipes must be bent. The electricians do not claim to be pipefitters, and oftentimes they seek the services of the nearest steam and water-pipe fitter to do the work required in connection with the pipe installation. Others prefer to work at the pipes themselves. I have observed curious undertakings in pipe-bending by electricians. I recollect one man whom I saw place the pipe in a vise, then play the jet of a Bunsen air-blast and house gas burner upon it. The pipe was heated and bent, but the pipe wall collapsed under the pressure and was ruined. Then I have seen electricians attempt to bend pipes over forms by means of repeatedly hammering them cold. Perhaps the desired curve is secured at last, but it will be at the expense of the evenness of the pipe wall.

In the accompanying illustrations are presented some methods of pipe-bending cold that may be used by electricians to advantage for wiring purposes. The usual form of turn made is illustrated by Fig. 1, showing the wire at (A). This curve is practically the only one possible to make in the completed pipe. There are instances, however, in which a sharp turn is needed, as in Fig. 2, in which case the best way for the insertion of the wire (B) is to cut off the pipe and thread the ends so as to use an elbow. Sometimes it is necessary to take the wire out from the side of the pipe, in which case it is found that there may be a bore, as at (C) (Fig. 3), for the wire, or a bore as at (D). In Fig. 4 is exhibited the common type of round pipe carrying the wire as shown. Occasionally it is necessary to have the wire enter a slot on the side of the pipe, in which case the slot is made after the plan of that from which the wire (E) protrudes in Fig. 5.

As to the bending of the piping cold, this may be done during the work of installing the wires, providing that a vise or anvil is at hand. If forms are made to order, and one or more taken along, the bending may be done on the ground. A careless way of bending a section of the metal pipe for wiring purposes is illustrated in Fig. 6, in which is shown how a friend of mine undertook to effect a certain curve in a pipe across the nose of an anvil. He failed to pack the interior of the pipe properly, and, lacking sufficient interior support, the wall of the pipe first collapsed and then fractured as at (F). Then in another instance the workman placed the pipe in the jaws of a vise, as in Fig. 7. As soon as he applied pressure to force the pipe over to the required curve the pipe wall broke at (G) and the pipe was rendered useless.

First of all the pipes must be properly packed for bending. This is done with a resin filler. The resin is melted and run into the pipe and permitted to harden. Then when bending the pipe wall is kept up full and it cannot be crushed in. Some use putty, clay or other material for the interior packing.

It is a good idea to have some forms made for bending purposes. The common round metal form is shown in Fig. 8. The pipe is properly filled and then bent about the form to the desired angle. Or a wood form may be made like that in Fig. 9. The base is a hardwood plank, with the hardwood block adjusted securely to the same. There is an hour-glass bore put through the center of the block. The odd shape of the bore makes it possible to effect various angles of bends in the pipe (H).

A very useful type of hardwood form is likewise exhibited in Fig. 10, consisting of the foundation plank for the support, and a half-circle cut out from a section of timber. The circle can be made of any size needed. This form is secured to the foundation with bolts and screws. Then an upright is adjusted to carry the grooved wheel of wood (I). To bend a pipe it is only necessary to place one end back of the wheel, next the form, and bend over.

The quarter-circle arc is shown in Fig. 11. Here the construction is practically the same. Instead of the grooved wheel there is simply a hole put through the foundation board so that the end of the pipe can be inserted as at (J). Then the pipe is bent over the wood form to the degree of curve needed. The easiest way to fill a pipe with molten material is shown in Fig. 12. Close the lower end with a pad of putty or clay and place the pipe

erect. Then place the nozzle of the tin tunnel (K) in the upper end pour the resin until the pipe is full to the top. The resin can be removed from the pipe after bending by heating the pipe.

Fig. 13 is a sketch of another form of home made pipe-bending contrivance for electricians. The bottom block (M) is cut from a piece of hardwood and shaped on top to a curve, as shown. Then the corresponding upper block (L) is made. The two blocks are arranged to be movable, up and down, inside the hardwood frame (N). The diagram shows the form cut through the center so as to exhibit the adjustment of the pipe. There is a support for the frame on both sides of the blocks and a spirally threaded screw of the copy press order, fixed to be operated in a threaded socket and flange in the frame, so that by turning the wheel of this screw the upper block (L) may be forced downward upon the pipe. Thus the block is run up, the pipe inserted and the block turned down until the pipe is forced into the curve required.

A handy clamping device for pipework is shown in Fig. 14. The heavy black part (R) is wrought iron. The forms (P P) are hardwood and are fitted over the pipe (O). By turning the wheel-shaft (S), pressure is brought upon the pipe and it is securely held for working purposes. When a vise is used it is a good plan to protect the pipe from the hard steel jaws with soft-metal (lead) protectors (T), as in Fig. 15. Fig. 16 is a diagram of a two-wheel form of pipe-bending device. The wheels (U) and (V) are grooved and are shaped from hardwood. There are two uprights mortised into the base, as shown, and the wheels are adjusted on these uprights by means of wood pins. This form is for bending light pipes. In order to get a curve in the pipe it is only necessary to pull the pipe through the wheels. Repeatedly doing this gradually makes the required bend.

Trolley Boat to Disperse Floating Ice at Niagara Falls Power House.

In order to create a surface current in the inlet canal so that the floating ice may be driven toward the overflow, the Niagara Falls Power Company has had built a boat 25 feet long, 10-foot beam and with a draft of 3½ feet. This is equipped with a Westinghouse 75-kilowatt single-phase railway motor, the normal speed of which is 1,000 revolutions per minute. In operating it a railway controller with rheostatic control is used. The current is supplied from the 2,200-volt mains to a 75-kilowatt oil-insulated transformer, the ratio of reduction being from 2,200 to 220 volts, at which voltage current is supplied to the motor on the boat.

The boat, which is shown with its trolley and the trolley wires in the accompanying picture, is operated on the same principle as a trolley car, the double-trolley construction being used, as it was deemed inadvisable to attempt a ground return. In the overhead work 350 feet of No. 0 hard-drawn copper wire is used, suspended at a height, approximately, of 40 feet above the water.

The radius of action of this novel craft is the entire width of the canal and 400 feet along its length. It is possible to get a speed of from 100 to 275 revolutions on the propeller, the gear ratio between the motor and the propeller shaft being 18 to 64.

In the illustration the boat is seen at work in the inlet canal at the [illegible] agitating the water [illegible] toward the overflow [illegible] can be seen the bridge [illegible] man is employed [illegible] paired with a [illegible] ball, shows quite [illegible] of the Niagara Falls power [illegible] troubled very much with [illegible] upper river has been removed, [illegible] ice and this has added very [illegible] operation of the power plant.

TROLLEY BOAT TO DISPERSE FLOATING ICE AT NIAGARA FALLS POWER PLANT.

Conversion of Three-phase to Quarter-phase Currents.

Among the patents issued on January 30th was one to Charles P. Steinmetz of Schenectady, N. Y., upon a system of electrical distribution embodying an arrangement for the conversion of three-phase to quarter-phase currents. Although the application for this patent was filed April 13, 1894, nearly 12 years ago, it is nevertheless of interest in connection with the problems of phase conversion.

The invention relates to a system of electrical distribution for polyphase currents of such nature that three-phase and quarter-phase currents are rendered convertible. In other words, a three-phase system, in which the currents are 120 degrees apart in phase, may be converted into a quarter-phase system, in which the currents differ by 90 degrees in phase, or, conversely, quarter-phase currents may be converted into three-phase currents.

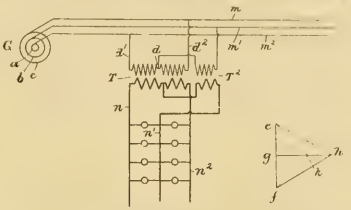


Fig. 1. Three-phase Converted into Quarter-phase.

Fig. 2. Victor Diagram.

In long-distance systems of distribution, as described in the patent, three-phase generators are employed, from which the energy is distributed to desired points, where it is converted into quarter-phase currents (that is, currents differing by 90 degrees in phase), which are utilized in the consumption devices. Such a system comprises certain advantages, because three-phase currents are well adapted for economical transmission over considerable areas, while in certain types of apparatus quarter-phase currents are preferable in the consumption devices.

Another advantage of this invention is the possibility of running three-phase and quarter-phase translating devices from a common power station and systems of distributing mains. For example, one station may have three-phase motors installed and another quarter-phase motors, yet all can be operated from a common generating plant.

Fig. 1 shows in diagram a three-phase generator, distributing circuits and means for converting the currents into quarter-phase currents. Fig. 3 shows in a similar manner a system of distribution in which the primary [illegible]

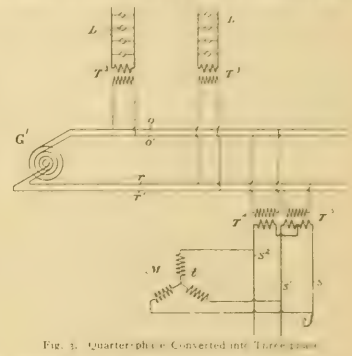


Fig. 3. Quarter-phase Converted into Three-phase.

THE CONVERSION OF POLYPHASE CURRENTS.

ings of the transformers are interconnected in a similar manner, the terminals of the main transformer leading to mains (n) (n²), while the terminals of the supplementary transformer are coupled to a third main (n′) and to a central point in the secondary winding of transformer (T). With this arrangement currents 90 degrees apart in phase or quarter-phase currents, as they are called, will flow between the mains (n) (n′) and (n′) (n²).

In order to explain the manner in which the change of phase is effected reference is made to Fig. 2. The electromotive forces maintained between the mains (m) (m′) (m²) are displaced in phase by 120 degrees and are equal. Let these electromotive forces be represented by the lines (eh), (ef) and (fh), which form an equilateral triangle. By dividing the base line (ef) at (g) into two equal parts and connecting point (g) with point (h), two equal right-angle triangles are formed whose bases and altitudes will represent component forces at right angles to one another, into which the forces represented by the lines (eh) and (fh) may be resolved. In other words, (eh) may in this way be resolved into (eg) and (gh), (fh) into (fg) and (gh), and the three forces (eh), (ef) and (fh) into (ef) and (gh). Comparing this diagram with the connections given the transformers (T) (T²), (ef) represents the electromotive force between the primary terminals of transformer (T), which are coupled directly to two of the mains; (hg) represents the electromotive force of transformer (T²), which is coupled between the third mains and the other two through halves of the main transformer. Hence the three electromotive forces existing between the primary mains and represented by (ef) (eh) (fh) will be resolved into two component electromotive forces 90 degrees apart in phase, with their relative values corresponding to (ef) (gh). These component electromotive forces may be separately transformed, if desired, and quarter-phase currents made to flow in independent circuits whose mains are connected in pairs with the secondary windings of the two transformers.

In order to change the phase relation as well as the potential, the transformers are wound for different ratios of transformation, so that the secondary electromotive forces will have relative values such as are represented by the lines (ef) and (gk) in Fig. 2. These two electromotive forces will then combine to form resultants, which may be represented by the lines (ek) and (fk) at an angle of 90 degrees from one another. Hence by resolving the electromotive forces on the three-phase side into components differing in phase by

90 degrees by properly proportioning the values giving these components on the secondary side of the transformers they recombine to give quarter-phase currents in an interconnected circuit requiring only three mains.

In Fig. 3 (G′) represents conventionally a quarter-phase generator of the ordinary type, with its terminals connected to independent circuits, comprising pairs of mains (o o′) and (r r′). Lights, as indicated at (L), may be supplied with current from these circuits through tension-reducing transformers (T^2). To convert the quarter-phase currents into three-phase currents, two transformers (T^1) (T^2) are used, whose terminals are respectively coupled with the mains (o o′) and (r r′). The secondaries of the transformers are interconnected in a manner similar to that already described. The terminals of the secondary winding of transformer (T^2) lead to mains (s s′), while one terminal of the secondary of transformer (T^1) leads to a third main (s^2), and its other terminal is coupled with the central point of the secondary winding of transformer (T^2). The electromotive forces on the primary side of the transformers are 90 degrees apart in phase; but on the secondary side the induced electromotive forces combine to form resultant electromotive forces 120 degrees apart in phase. In order that this may be the case the ratios of transformation in the two transformers is made such that the resultant electromotive force generated in the secondary transformer (T^1) and the respective halves of transformer (T^2) are substantially equal to the electromotive force between the terminals of the secondary of (T^2). These three electromotive forces then will be equal and 120 degrees apart in phase, as already explained in connection with the diagram in Fig. 2. The three-phase currents thus secured on the mains (s s′ s^2) may be utilized for operating translating devices of any desired sort and grouped in any well-known manner.

The Economy of Combined Railway and Lighting Plants.[1]

By Ernest Gonzenbach.

It is rather unfortunate that at the present time most of the combined railway and lighting plants which are in operation are the result of consolidations of two or more corporations which originally had independent existences. The natural result is unavoidable in many cases when the exigencies of business will not warrant the installation of new and uniform equipment. On the other hand, such plants are not getting the benefits of the best economy possible by the operation of the combined service. It is the writer's intention to here discuss a plant which is to be constructed in conformity with modern practice, and which shall be interchangeable as nearly as the nature of the two classes of service will permit.

It is particularly fortunate that the two classes of service have their maximum annual peaks at different times during the year, and the benefits of this condition are particularly appreciated in the production department, otherwise the power station. It is a well-known fact that so far nearly every lighting plant in existence has a tremendous peak lasting from one hour to two hours, and occurring near 5 p. m., during the winter months. This peak is particularly high during November and December. At such time the load factor of the lighting system is apt to be in the neighborhood of 30 per cent., even with a good motor load, and all this extra equipment to handle peaks must be installed and interest paid on it for the rest of the year. In other words, about 50 per cent. to 75 per cent. of the equipment of the lighting plant is earning money only for perhaps 150 to 200 hours during the entire year. The rest of the time it is not engaged in anything else except the absorption of interest and depreciation.

In a railway plant the peak loads occur during the summer season and particularly on Sundays and holidays. The amount of idle investment in the railway power station is not nearly as great as it is in the lighting plant, but nevertheless a considerable amount of equipment has to be held in reserve to take care of the excessive loads which occur on perhaps 15 Sundays and holidays during the warm months. It is customary for railway plants to operate with a smaller percentage of reserve apparatus than is usually found in lighting plants. On account of the very fine regulation demanded by the lighting system it is quite difficult to crowd that class of apparatus beyond a reasonable limit. The regulation of railway apparatus is ordinarily overlooked and the owners as well as the public close one eye to its defects. It is, therefore, possible to neglect the reserve capacity of the railway station, a fact which is taken too liberal advantage of by many existing properties. In any case it is advisable to have some reserve capacity, and it is one purpose of this paper to show that this reserve may be obtained in a combined plant without excessive idle investment.

Fig. 1 represents a series of typical local curves, the characteristics of which are taken from actual daily averages of a plant in a small city. The single-truck local cars and two double-truck suburban cars. The local cars are supplemented between five and six p. m. by two or more extra double-track cars to take care of traffic during the rush hours. The lighting load represented in the curve represents a total connected number of lights of about 40,000 equivalents of 16-candlepower lamps, and including a large number of stationary motors as well as city street lighting.

Considering now that the two plants, the railway and lighting, are separate and distinct corporations, and each has its own independent plant, it is interesting to calculate what the cost of equipping the power station will amount to. The lighting plant calls for a maximum of approximately 1,200 kilowatts, and it will be necessary to install that amount of machinery. Furthermore, prudent management demands that at least 25 per cent. reserve capacity be installed in order to meet emergencies.

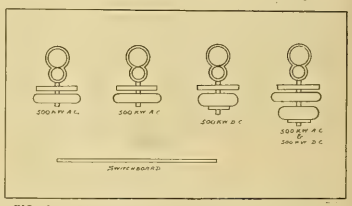


FIG. 2. ARRANGEMENT FOR COMBINED RAILWAY AND LIGHTING PLANT.

This will call for a total power installation of 1,500 kilowatts. Regardless of the matter in which this station may be subdivided into individual units, we may estimate a total cost of power station, including engine and boiler room and everything else complete at $125 per kilowatt. For the 1,500-kilowatt power station, therefore, we must make an appropriation of $187,500.

The railway company will also require a power station of its own in the case here assumed, and as the total maximum demand during the summer months is 950 kilowatts and 25 per cent. reserve capacity must again prudently be provided, we must assume a power station with a capacity of 1,200 kilowatts in railway generators. This at the same price per kilowatt will cost $150,000. The combined cost of both the railway power house and the lighting power house will, therefore, amount to $337,500.

If we combine the two plants and operate both the lighting and railway loads from one station, with one class of prime movers, we will have a maximum demand at peak loads during the winter months of 1,600 kilowatts. It is in this case also prudent to provide 25 per cent. reserve capacity, and this will call for a power station having 2,000 kilowatts in generators, engines and boilers. The same cost, $125 per kilowatt, will make this station cost $250,000, a saving of $87,500 in the first cost of the plants. Allowing 10 per cent. for interest and depreciation, the saving on this score alone amounts to $8,750 annually.

Besides this saving in first cost, the saving in cost of operation is very considerable. One chief engineer only instead of two is required. There are only half the shift engineers required which would be necessary under separate operation, and the same rule holds true down the line as far as the coal passers. It is safe to say that the cost of labor will be about 33⅓ to 50 per cent. less in a combined plant than it is under separate operation. In addition to the saving in labor the fuel economy is decidedly improved. In a lighting plant boilers and engine work under disadvantageous conditions, as a rule, during light loads. The engines may be only partly loaded, therefore not giving their maximum efficiency. The same holds true of boilers. In the combined plant above referred to, with a capacity of 2,000 kilowatts subdivided into, say four 500-kilowatt units, two of them alternating-current, one combination unit of the kind referred to below and one direct-current unit, it is possible to so operate the plant that there will always be a full load on one or more of the units. Fig. 2 shows such an arrangement. This gives the maximum efficiency. Data taken from a plant of this kind, now in operation, shows that the saving in labor and fuel economy amounts to about $6,000 per annum, over and above the operating cost of separate plants. Add to this the $8,750 saving in interest and depreciation and we get a total of nearly $15,000 per annum saving accomplished in a plant of the capacity and dimensions referred to. Fifteen thousand dollars will pay interest on $300,000 of bonds, or it will provide a neat little sinking fund or stock dividend. At any rate, it is an item which no prudent railway or central-station manager would care to overlook.

It may be urged against this plan that it is not practical to operate a railway and lighting load from the same generators and engines. The best reply to this criticism is that it is not a theory which we confront but an accomplished fact. There are today a number of well-designed power stations which supply lighting and power from one class of generators, and there seems to be no reason why the type of units in the power station of this class may not be identical at least within the

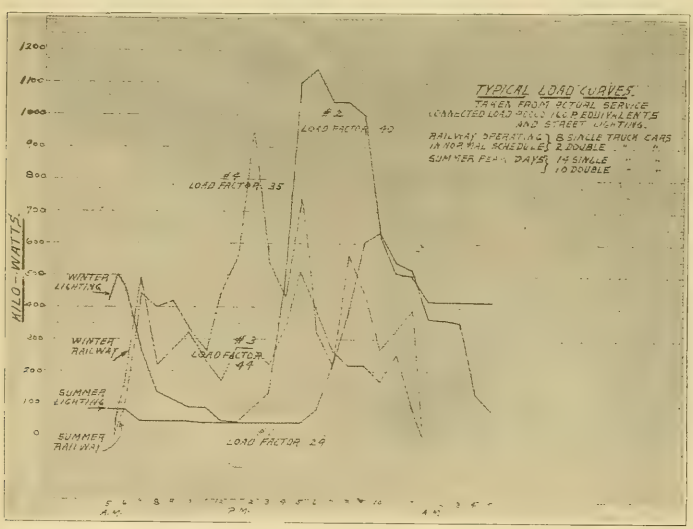


FIG. 1. TYPICAL CURVES OF RAILWAY AND LIGHTING LOAD.

a lack of uniformity in the producing plant which time and the natural wear and tear of apparatus only can eliminate. We still see in too many cases a power station equipped with separate generators and engines for lighting and another plant to handle the railway load. The two sides are generally combined in the boiler room, but some plants have gone so far even as to separate the steam generators. This is sometimes necessitated by the excessive fluctuations of the railway load, combined with insufficient steam piping and inefficient regulating devices. Such an arrangement of plant is

curves approximate very closely the true conditions found in any city between 30,000 to 50,000 population. The load factor of the combined summer curves is 53 per cent. and of the combined winter curves only 28 per cent.

In the case of railway plants operating a considerable suburban or interurban system in addition to the city system, the lighting load becomes a smaller fraction of the total load on the plant and the load factor will be very much improved. It is not the purpose of this paper, however, to consider such cases, but to take an abstract example from actual daily service. The railway load curve represented in Fig. 1 calls for the operation of eight

1. Abstract of a paper read before the Northwestern Electrical Association at Chicago, January 18, 1906.

limits outlined above. The writer has in mind for a plant of this sort direct-connected units operated at 60 cycles. The direct current for the railway operation may be supplied through either motor-generator sets or through one or more combination sets consisting of alternating-current and direct-current generators connected together, and connected with a clutch coupling to the engine. The latter is a much more economical plan, as during light loads the railway generators may be operated from the alternating-current machines working as synchronous motors, thus reducing the number of prime movers in operation and giving a very high demand factor. During peak loads the engines may be connected to these combination units through the clutch couplings, and both the alternating-current and direct-current machines may be used as generators, each doing its respective work. In waterpower stations such an arrangement is even more valuable than it is in a steam station.

Regarding the operation of direct-current railway units from synchronous motors taking their current from lighting generators, this is a feat which is being accomplished today and will be still more in the future than it is at present. It requires careful design of the generating units and requires close regulation in both generators and the engine governors. A Tyrrill regulator on the lighting lines will counterbalance any tendency to fluctuation caused by the railway load. A comparatively small storage battery will accomplish wonders in the way of regulating the fluctuating demand on the railway generators and will enable both classes of service to be furnished from one machine besides reducing the amount of railway apparatus which must be held in reserve.

Oscillograph for the Study of Alternating-current Wave Forms.

One of the interesting things exhibited at the Chicago Electrical Show was a new form of oscillograph of the d'Arsonval type. This device was shown at the booth of the University of Illinois

FIG. 1. APPARATUS FOR STUDY OF ALTERNATING-CURRENT WAVES.

and was made by two seniors in electrical engineering, Milton K. Akers and Edmund B. Wheeler, as the subject of their thesis. The device is of a practical nature and embodies many ingenious features in its construction. This oscillograph, of which a general view is shown in Fig. 1, is designed to be readily set up for operation at any place, and with parts strong enough mechanically to be easily handled and adjusted without the use of fine instruments, yet at the same time delicate

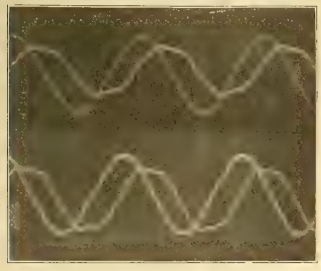


FIG. 2. PRESSURE AND CURRENT CURVES FOR CAPACITY LOAD.

enough to give accurate results under ordinary conditions.

The apparatus consists essentially of a modified d'Arsonval galvanometer, combined with a vibrating mirror and a falling plate apparatus. In a narrow gap between the poles of a powerful electromagnet are placed two parallel strips of phosphor-bronze ribbon, made into a loop, suitably supported to admit of oscillation about their common vertical axis. If the alternating current to be studied, suitably reduced in strength, is passed through the loop, one side of the loop will be deflected forward and the other backward at the same instant, upon reversal the sides of the loop will be deflected in opposite direction.

A very small mirror is cemented across the loop, oscillating with it. A ray of light is caused to reflect in a horizontal plane from the surface of the mirror upon it, the light being reflected from the mirror to the outside of the box by a system of prisms. If a photographic plate, therefore, be so placed in front of the mirror that it will receive the beam of light reflected from the mirror will trace upon the sensitized plate the curve of the alternating current.

This, in brief, is the principle upon which the vibrating system of the mechanism operates, without going into the details of the mechanical construction. By certain arrangements, however, the device is made applicable for observations of the curve direct, without taking photographs. This system is an ingenious one, in that the curves may be seen directly on a ground-glass screen, and any momentary fluctuations readily observed.

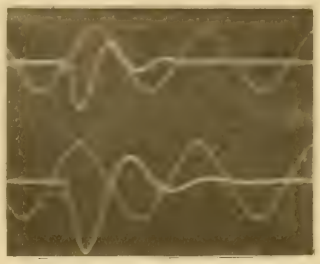


FIG. 3. CURVES OF 60-CYCLE PRESSURE AND CONDENSER DISCHARGE THROUGH INDUCTANCE.

In making the optical observations the path of light is as follows: The light from the arc passes through a hole in the side of the box to two small mirrors, from which it is reflected through two narrow slits to the vibrating mirrors. From here it is again reflected to a synchronous mirror through a cylindrical lens, passing from there to a ground-glass screen to be examined visually.

The synchronous mirror is used to draw the ray

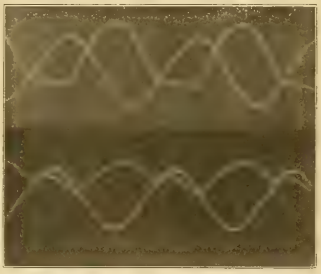


FIG. 4. CURVES OF RECTIFIED ELECTROMOTIVE FORCE AND CARBON-ALUMINUM CELLS.

of light out on the ground-glass screen in the form of a curve instead of having it appear as a single point. The synchronous mirror is only used in the case of optical observations, for in taking photographs the falling plate gives the necessary motion along the abscissa of the curve, to produce a curved pressure line. This mirror is operated by a cam mounted on the shaft of a synchronous motor.

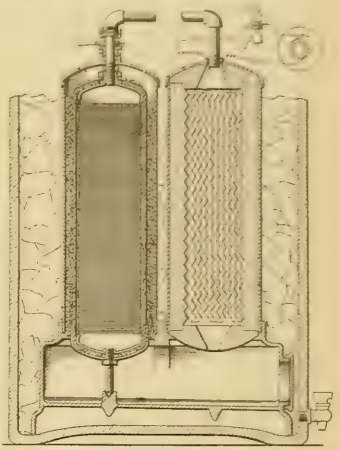
Briefly, the procedure is as follows: The arc is adjusted so that the light passes squarely through the hole in the box to the reflecting mirrors. These are adjusted so that the beams (for in this apparatus there may be more than one) are reflected to the vibrating mirrors. The vibrating systems are in turn adjusted until the beams of light reflected from them are in turn reflected from the synchronous mirrors to a common point on the ground glass. When the synchronous motor is started this point is stretched out in the form of a curve. When a photograph is to be taken the motor is stopped and the synchronous mirrors removed. The plate is arranged in grooves to fall in front of the ray of light from the vibrating mirror, and when it is released the photograph is taken.

With a free length of the vibrating system equal

[illegible] of the upper curves.

Electrical Water Purifier for Household Purposes.

[illegible] purifying effect. Electrical purification [illegible] A small water purifier, however, suitable for household purposes, possesses evident advantages, and a device of this nature was recently patented by Leon Dion of New York. The apparatus is shown in the accompanying illustration, which is a vertical sectional view.



ELECTRICAL WATER PURIFIER FOR HOUSEHOLD PURPOSES.

A cylindrical tank in a horizontal position at the bottom of the device carries two other vertical tanks, communicating with it. The water to be purified is supplied to the right-hand vertical tank through a pipe, beneath the opening of which are groups of electrodes having corrugated surfaces facing each other. These electrodes are divided into two groups, one positive and one negative. The electrodes are connected to the terminals of an electrical supply, and the water falling between them forms the connecting link in the circuit. The lining of this tank is of insulating material.

Water thus subjected to the action of current will have metals and other impurities deposited, and these will find their way to the horizontal tank at the bottom, from which they may be removed.

From the horizontal tank the water rises in the left-hand vertical tank, shown in the illustration, which acts as a settling tank and a filter container, the latter being of any approved construction. By means of the filter any particles of foreign matter held in suspension are removed as the water rises in the tank.

By means of an automatic arrangement connected with the discharge cock, current is only turned on during the withdrawal of water from the tank. The whole outfit is also enclosed in a casing which allows of its being packed around with ice, thus forming a refrigerator to keep the water cool.

Secretary Taft in response to a request from the House committee on inter-state and foreign commerce has sent a communication to that committee relative to the House bill for the construction of a cable connecting the mainland of the United States with the Canal Zone. The secretary encloses a resolution of the Board of National Defense, which he says shows a cable is indispensable for military purposes.

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CONTENTS OF THIS NUMBER.

Electrically Operated Floating Fuel Depot for Coaling Warships. By D. A. Willey. Illustrated 93
The Niagara Power Situation 93, 94
Telegraph Extension in Central America 94
Cold Bending of Pipes for Electrical Wires. By R. G. Grayne. Illustrated 94, 95
Trolley Boat to Disperse Floating Ice at Niagara Falls Power House. Illustrated 95
Conversion of Three-phase to Quarter-phase Currents. Illustrated 95, 96
The Economy of Combined Railway and Lighting Plants. By Ernest Gonzenbach. Illustrated 96, 97
Oscillograph for the Study of Alternating-current Wave Forms. Illustrated 97
Electrical Water Purifier for Household Purposes. Illustrated 97
Editorial 98
Conclusion of the Electrical Show 99
Institute Meeting in New York 99, 100
Central Electric Railway Association. (Convention at Dayton) 100
Electrical Section of the Western Society of Engineers 100
A Long Trolley Trip 100
Electrical Trades Association of Chicago 101
Frederic P. Vose. Portrait 101
Agree to 85-cent Gas in Chicago 101
Power Plant Economics. By Henry G. Stott. Part I. Illustrated 101, 102, 103
Shreffler Engine Indicator and Overload Alarm. Illustrated 103, 104
Cable Construction for Long Island Railroad. Illustrated 104
9,700-horsepower Hydraulic Turbine for California Gas and Electric Corporation 104
Convenient Tube for Soldering Flux. Illustrated 104
Chicago Street-railway Situation 104
Scribner Automatic Signaling Patent Not Infringed in Galesburg Case. Illustrated 105, 106
Nebraska Independent Telephone Association 106
Indiana District Telephone Meeting 106
Extension-telephone Litigation 106
Ohio Telephone Notes 106
Indiana Telephone Items 106
Telephone News from the Northwest 107
New England Telephone News 107
New Companies 107
General Telephone News 107
Types of Cars for City Service. Illustrated 107
Power-transmission Projects in Africa 108
Extensions to South Side Elevated 108
Books Received 108

DEPARTMENTS.

Correspondence 108, 109, 110
Great Britain 108
New York 108, 109
Dominion of Canada 109
New England 109
Southeastern States 109
Ohio 109, 110
Indiana 110
Michigan 110
Pacific Slope 110
Personal 110, 111
Electric Lighting 111
Electric Railways 111
Automobiles 111
Publications 111
Trade News 111
Business 111
Illustrated Electrical Patent Record 111, 112

DATE AHEAD.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

"CHICAGO, the Electrical City," is the title of an editorial in one of our esteemed electrical contemporaries published in New York city. Yes; Chicago is the electrical city all right; but isn't it rather late in the day to make the announcement? As Mr. Insull remarks, in an interview printed elsewhere, the attendance at the Electrical Show demonstrated that Chicago is the center of a very large electrical market. But while the exhibition made the fact prominent, the gratifying condition itself has been in existence for lo these many years.

THE educational function of an electrical show, such as the one just held in Chicago, is of prime importance. Many of the manufacturers, especially of the larger machinery, expect to derive little benefit directly, in the way of orders for their product, but they are more than willing to go to considerable expense in fitting up elaborate exhibitions and giving the time of high-class specialists in their various lines for the sake of the benefit that will be felt by the electrical trade in general through an increase of knowledge among the public concerning things electrical consequent to the holding of such a show.

Another educational feature which was more noticeable at the Chicago Electrical Show than at others held heretofore was the interest and co-operation on the part of the various universities and colleges of the Middle West that have engineering departments. Not a few of these institutions had interesting and instructive exhibits in "College Row," the booths being decorated in a pleasing manner with the college colors. The object of these exhibits was evidently not only to show by photographs and otherwise the local features of the institutions, but also to exhibit something in the line of original work which would be of interest from a scientific point of view.

For instance, the exhibit of the University of Wisconsin was devoted largely to the products of its excellent electrochemical department, showing specimens of electrolytic iron and an example of a perfected type of electric furnace, demonstrating some of the original and practical features of the work carried on in the electrochemical department under the direction of Professor Charles F. Burgess. At the exhibit of the University of Illinois there was also shown a very interesting piece of apparatus in the form of a practical wave indicator for the study of alternating current and pressure waves—a device designed and constructed by two seniors for their thesis work. Advantages offered by the Electrical Show to study the new developments in the electrical field drew a large number of students to Chicago and at least one of the institutions planned its annual engineering inspection tour so as to take in the exhibition.

THAT old but ever new subject, the efficiency and usefulness of central-station apparatus, was discussed at the recent convention of the Northwestern Electrical Association, and Mr. Harold Almert, who was later elected president of the association, expressed in vigorous terms the conviction that high-frequency alternating-current apparatus is practically obsolete, and, not only that, but that direct-current dynamos are really out of date also for purely central-station work. "You will find many central stations," he said, "that have attempted to go into the power business which still have the 500-volt, direct-current apparatus, with perhaps the single-phase alternating system, on 125 or 140 cycles, and from that up; and they will do lighting work with open or enclosed series arc lamps on series arc machines. I think it is very necessary for them first to reorganize their systems before they go out actively after new business. Many central-station managers still favor high-frequency apparatus. They say the stuff is good enough for them; they are doing a pretty comfortable business, and there is nothing in the day-circuit proposition. They are still contented to give a dusk-to-daylight service. But if they do not give in soon and get onto a 24-hour basis in some way they will have, sooner or later, to yield to the inevitable."

A gentleman asked the speaker if he really considered apparatus of 125 cycles or higher out of date. To this question Mr. Almert answered: "I do. I think a great many people who are still holding to the 125-cycle proposition do it simply because they dread to tackle the job of putting in an entirely new outfit. In the majority of small stations it is a very serious problem; but the change does not all have to be made at once. The high frequency of the transformers will work on 60 cycles with lower capacity and lower efficiency; so I think it is policy to weed the stuff out. The tendency of manufacturers is not to maintain the high-frequency apparatus in their improvements, and in the line of machinery for various industrial purposes the apparatus is built almost invariably on 60 cycles. You must get the lower frequency apparatus."

Later Mr. Almert admitted that there are cases, in towns where there is practically no manufacturing, or where the factories are so large that the central station cannot expect to get their power business, in which the high-frequency apparatus is justified. A suburban town near a large city might constitute such a case. But these conditions are exceptional. Another gentleman remarked that for lighting purposes alone the high-frequency efficiency is greater than the low-frequency efficiency, and this statement aroused no opposition. But all agreed that where there is a motor load to be cared for—and, of course, every central station should have a motor load—the lower frequency is the one that should be employed.

AS AN important result of the recent general election in the United Kingdom, free trade is extended an overwhelming vote of confidence as the cardinal principle of British economic policy. Protection or fair trade or fiscal reform, or by whatever name the policy proposed by Mr. Chamberlain may be called, has been rejected with emphasis by the electors. But the Birmingham statesman insists that after every tide there is an ebb and that he will continue to fight for empire and colonial preference by customs duties as long as he lives and that others will carry on the agitation after he has passed away. The discussion has excited an extraordinary flood of debate and has waged in the columns of the electrical press as well as elsewhere. Some of the arguments advanced are of interest to American electrical men. Thus, one free-trader says: "That there should be a great outcry when a British contract goes abroad is really foolish, save that such outcry may induce the home manufacturer to bestir himself. If it pays us better to manufacture cotton for export in payment for imports of, say, electrical machinery, then why on earth should we be such fools as to desire to make electrical machinery instead of cotton?" This comes, as might be expected, from Manchester. It contains no sentiment to which the American electrical manufacturer can take exception.

Another correspondent points out that the United States has an effective remedy if it is discriminated against in favor of British colonies. He thinks it surprising that there are men connected with the great electrical construction works in the United Kingdom who are followers of Mr. Chamberlain in his fiscal policy. Condensing somewhat, we quote further from this gentleman's letter in an electrical journal:

Mr. Chamberlain says that he will let in raw materials free, and for this we are duly grateful to him; but he proposed to put a tax on American wheat, with the object of stopping its importation in favor of colonial wheat. He takes it for granted that the Americans will quietly submit to this, and take it lying down.

America is the largest producer of copper in the world. Her output is over 400,000 tons per annum, and, as compared with her, the rest of the world is nowhere. In looking about her for a means of hitting back hard, is it not highly probable that she would give a thought to necessary articles, which she supplies to us and which we cannot get elsewhere. Mr. Chamberlain would do so, I am quie certain.

Our magnificent trade in electrical cables, etc., employing many thousands of workmen on the Thames, in Manchester, Liverpool, Glasgow, etc., and which, as you, sir, admitted to me the other day, is the greatest in the world, depends on American copper.

Suppose, therefore, the Americans said in reply to Mr. Chamberlain's action: "We will stop him getting his raw copper free by putting on a 10 per cent. export duty," how would that affect the electrical construction trade? It would in a very short time divert it to America. I ask your readers to calmly consider this view and put it to themselves whether there is not something in it.

I might follow the same argument in cotton, but need not do so, as in this we depend even more than we do in copper, if that is possible, on America.

We have never heard an export duty on copper, cotton or other raw material seriously discussed in this country. Probably such a policy would be unwise save in a very great emergency. But it is certainly a striking tribute to the favored position of the United States that the possession of this formidable weapon is conceded to it in the struggle for commercial supremacy. No matter what hostile tariff may be contrived by other nations, the unrivaled natural resources of the country will always give to the great American republic elements of strength which no other nation possesses.

Conclusion of the Electrical Show.

The Chicago Electrical Show came to end on January 27th, continuing its record of success to the last. Exhibitors were pleased with the interest which their products aroused and the sales they made, and visitors were greatly interested in the varied displays which they saw. The total attendance during the two weeks was not far from 125,000. Now that the show is over, all are looking forward to its repetition next year. At this writing over 30 exhibitors have signed for space at the 1907 show.

The manager of the Coliseum made the statement that the Electrical Show drew the largest crowds in the history of the building.

Friday, January 26th, was Thomas A. Edison Day at the show, and it is said the attendance on that day was at least 16,000. Handsome souvenir buttons bearing the head of Edison in bas relief were distributed.

The banquet on Friday night which was tendered to the Electrical Show exhibitors by the management and directorate of the Electrical Trades Exposition Company was a pleasant affair. Tables were set for 300, and as many as 258 partook of what was really a sumptuous repast. The banqueters assembled in the dining hall of the Coliseum Annex at 10:30 p. m., and music was furnished by the big exposition band. President Samuel Insull presided. Mr. Insull read this telegram from Thomas A. Edison, who had been invited to attend this dinner: "Regret inability to be present at dinner to-night. Please express to exposition people my best wishes for their success and prosperity."

Speeches were made by the following-named gentlemen: Samuel Insull, J. C. McQuiston, P. E. Odell, A. M. Ramsey, S. J. Gorman, Homer E. Niesz, E. B. Overshiner, Stewart Spaulding, B. B. Ayres, Charles E. Gregory, Frank L. Perry, Thomas R. Mercein and C. H. Gentry.

Weil's Band, the official organization of the St. Louis World's Fair, made such a big "hit" with the Chicago public during the show that the management of the Coliseum has engaged it for several weeks, beginning with the opening of the summer season.

The Sons of Jove held an initiation on Thursday night, at which about 100 new members, it is said, became better acquainted than ever before with the mysteries of certain electrical appliances. The initiation was held after the Coliseum had been closed for the night, and the fountain is believed to have played no inconsiderable part in the performance.

Thordarson's experiments and those of Prof. Clarke attracted thousands because of their spectacular features. The high-potential discharges which were one of the main attractions at the Thordarson booth were made possible by a potential of 300,000 volts. The experiments with inductive effects never failed, either, to elicit exclamations of surprise, for to see an incandescent lamp lighted without any circuit connections, or to see a loop of wire burned through with no visible connection to a source of current was surprising to those unfamiliar with the phenomena of induction.

New and interesting things were to be seen on all sides. One of these was an electric horn for use on automobiles. This unique device was exhibited by the Vesta Accumulator Company of Chicago. The horn is operated by a battery, the sound being produced by a vibrating body which is located in the base of the horn and actuated by the current from the battery. By merely pressing a button on the steering wheel the effect of a high-class reed horn is produced with but small consumption of current.

Those who had never seen rubber in its crude state were much interested in the rubber "biscuit" exhibited by the Central Electric Company of Chicago. The rubber was in the form of a hemisphere about 18 inches in diameter and was valued at $250. From the appearance of the mass it had evidently been rolled upon a stake in layers, the process going on until a ball weighing perhaps 150 pounds had been produced. This rubber "biscuit" was then cut in half to show the peculiar formation.

Next year the Chicago Electrical Show will be held during the two weeks beginning January 14th, undoubtedly at the Coliseum, and perhaps with an overflow.

Interviews on the Success of the Show.

Everybody who had anything to do with the show—managers, exhibitors and visitors alike—agreed that it was a great success. A few interviews on the subject were obtained by the Western Electrician, which are representative of a much larger number that could be [illegible] if space permitted.

Samuel Insull, president Chicago Edison Company: "The large attendance at the Chicago Electrical Show from the city [illegible] and from the surrounding territory [illegible] and the large amount of business transacted [illegible] clusively that Chicago is the center of [illegible] large electrical market. The experience of this year [illegible] courage the management of the exposition to go ahead and arrange for next year."

Angus S. Hibbard, general manager Chicago Telephone Company: "The show was [illegible] success. It was interesting and well managed and had a distinct educational value. Our company was well pleased with it. We expect to exhibit again next year, only on a larger scale. In fact, I may say that we were satisfied with the show in every way. I saw the New York electrical show, and the superiority of the Chicago exhibition was so marked that there was absolutely no comparison."

B. E. Sunny, western manager General Electric Company: "The genius of the inventor and the skill of the manufacturer of electrical appliances were both paid a very high compliment in the unprecedented attendance at the electrical exposition during the last two weeks. Some who thought that electrical manufactures had become commonplace, and without special interest to the public, were surprised to find that there was enough of novelty and attractiveness left, even after 20 years of rapid development, to keep the building crowded with lookers-on. If there ever was any doubt that electricity is a most popular agency wherever it is adopted for any service, the experience at the Coliseum has dispelled it."

G. H. Atkin, Chicago manager of the Electric Storage Battery Company of Philadelphia: "The two things about the electrical show which has just closed that impressed me were the large attendance of out-of-town electrical men and the deep interest evidenced by the American public in electrical and mechanical matters. At our booth, where we displayed the 'Chloride' and 'Exide' batteries, we were constantly being questioned by people who were not in any way connected with electrical industries, as to the functions of a storage battery, and I have no doubt that the educational work accomplished by this show is very widespread. We expect to exhibit next year, as we think the show is a good commercial idea and brings together a representative gathering of electrical people of all kinds."

J. C. McQuiston of Pittsburg, Westinghouse Electric and Manufacturing Company: "The success of the Electrical Trades Exposition by far exceeded our expectations. Much credit is due to the officials who so faithfully and courteously carried out the well-formed plans which made possible an electrical show lasting two weeks, and, which on the closing days and nights, attracted as many visitors as at the beginning. It is worthy of note that not a few who attended the exposition came quite a distance for the sole purpose of familiarizing themselves with the latest developments in electricity. On the other hand, the interest manifested by the people in general in the lectures given by Professor Clark in the side lecture room indicates that people in all walks of life have an open ear for anything connected with the uses of and developments in electricity."

E. F. Kirkpatrick, manager McRoy Clay Works: "Chicago's Electrical Show was a success. The exhibitors, stockholders and the general public so voted it. However, many of the thousands of people who paid 50 cents 'per' to see it wondered as they were pushed about and trampled upon in the great throngs that filled the mammoth building every evening whether it was worth the time and half dollar. Many were pleased and many were disappointed. Some expected to see 'aerograms' flying through the air, lightning flashing from every nook and corner, electricity being made,' Thomas Edison, Nikola Tesla and Marconi on exhibition. They, of course, were disappointed. From an educational standpoint, the show was all it was intended to be, and that was the sole purpose of the promoters. Such exhibitors as the General Electric Company, Westinghouse Electric and Manufacturing Company, Allis-Chalmers Company and the other manufacturers of large apparatus did not expect the show would increase their business. Their purpose in exhibiting was educational—for the benefit of the layman, the student and the general consumers and users of electricity. The railway, central-station and telephone-exchange managers and the [illegible] mingling [illegible] At the present show [illegible] on three or four sides of [illegible] off the general view [illegible] dismal failure [illegible] the management of the [illegible] the electrical trade generally [illegible] lated on the very splendid [illegible] point of the 'big show' just closed."

Institute Meeting in New York.

A regular meeting of the American Institute of Electrical Engineers was held [illegible] of the New York Edison Company [illegible] of January 26th, President Wheeler [illegible] chair. Secretary Pope announced [illegible] associate members had been elected [illegible] earlier in the day. Dr Wheeler [illegible] Mr T. C. Martin, chairman of the [illegible] committee, who made a plea for [illegible] building fund for the United Engineering Building toward the erection of which Andrew Carnegie had given $1,050,000. The three societies [illegible] expected to meet the cost of the land and equip their own quarters. The share of the electrical engineers is about $200,000. Of this, over [illegible] has been pledged, of which $55,000 [illegible]. Of the $100,000 remaining to be raised it is believed that a considerable proportion will be given by the great electrical corporations. Mr Martin continued: "In this vicinity we have 900 members of the Institute. Up to the present time about 220 of these have contributed to the fund. We have had 620 contributions, so that you can see 400 subscribers outside of New York territory have shown their interest in this grand and noble project, but barely 200 in this district, who will derive the greatest benefit from the project, have shown their interest in what we are doing." The speaker asked for a large number of $25 subscriptions, to be paid in five annual installments. But larger or smaller contributions will be gladly received. Mr Martin also made this interesting statement: "We have had several individual subscriptions of $5,000, but, as an indication of the interest which the electrical corporations of this country take in what we are doing, I would like to mention the fact that we have already secured from the General Electric Company a subscription of $25,000, and not only have we had the subscription, but the check has been banked."

Papers by H. G. Stott and E. F. Alexanderson were read.

The Institute has received from the Institution of Electrical Engineers of Great Britain a cordial invitation to the American Institute of Electrical Engineers to visit England during the latter part of June next. A similar invitation has been received from the Associazione Elettrotecnica Italiana to visit Italy during the season of the Industrial Exhibition at Milan, beginning May 1, 1906. Both of the proposed tours will embrace visits to important electrical plants, educational centers and scenic features of these countries. The Italian trip would necessarily either immediately precede or follow the visit to England, in all probability during the month of May. The time of year precludes the possibility of making special arrangements for transportation in advance, and it will probably be necessary to depend upon individual arrangements.

The proposed tour, if organized, will not take the place of the regular annual convention, which will be held as already proposed in a city of the Central West, June 26-29. The board of directors desires to obtain at the earliest possible moment an expression of opinion as to the participation of members either in one or both of the proposed visits.

In relation to the Edison medal, to be awarded for the best electrical thesis, it is announced that sufficient funds will be available from the net income of the trust fund, created in 1904 to establish the Edison medal, to provide for the award of the medal for the year 1906. The by-laws provide that not more than two students may compete in any one year from any one institution of learning qualified to present competitors; that each competing thesis or record of research must be the work of a single qualified student only; that no student may compete unless he has graduated when not more than 25 years of age and received a degree during the year for which the medal shall

be awarded in some course of study normally requiring not less than two years of continuous residence and work, which course of study shall include the branch of electrical engineering; and that each student shall be separately presented through the faculty of the particular institution at which he is a student by means of a presentation notice properly filled in.

Central Electric Railway Association.

Dayton, Ohio, January 26.—The second annual meeting of the Ohio Interurban Railway Association proved the occasion of the beginning of a broader and more important work in the way of organization than has ever been attempted in this part of the country before. Not only were the Ohio and Indiana associations merged, as had been outlined in the Western Electrician, but plans were made whereby Southern Michigan and Western Pennsylvania will be included in the working arrangement. The new organization will be known as the Central Electric Railway Association—a broader name than if the word "interurban" had been used.

A brief business session of the Ohio Interurban Railway Association was held in the forenoon, when all business matters were closed, in order that the merger with the Indiana association might be completed. General satisfaction was expressed that this action had been brought about, as it means not only a closer affiliation of the various lines, but makes it possible for more uniform operation and the extension of plans for long-distance business. Heretofore many difficulties have been experienced in perfecting plans for inter-line ticketing and the use of mileage coupons, but it is believed that the closer affiliation will make the accomplishment of these purposes a matter of little difficulty.

At the opening meeting of the new association the following-named officers were elected: President, E. C. Spring of the Dayton, Covington and Piqua, Dayton; vice-president, C. L. Henry, Indianapolis and Cincinnati Traction Company, Indianapolis; second vice-president, F. D. Carpenter, Western Ohio Railway Company, Lima; secretary, J. H. Merrill, Lima; treasurer, W. F. Mulholland, Indianapolis. The executive committee consists of F. J. J. Sloat, Hamilton; Theodore Stebbins, Columbus; Harrie P. Clegg, Dayton; J. W. Brown, Connellsville, Pa.; C. N. Wilcoxen, Cleveland; W. G. Irwin, Columbus, Ind.; C. D. Emmons, Fort Wayne, Ind.; Gardner Wells, Terre Haute, Ind.; C. C. Reynolds, Lafayette, Ind., and H. A. Nicholl, Anderson, Ind.

At the afternoon meeting J. V. E. Titus of the Garton-Daniels Company, Keokuk, Iowa, read a technical paper on "Lightning Arresters," which was interesting and instructive.

It seems that no decision was made regarding headquarters for the association, and, from present indications, that will be left to the secretary. At one time it was supposed that Columbus would be chosen, but this was not done.

While no permanent secretary was elected at this meeting, it was settled that J. H. Merrill of Lima, formerly with the Western Ohio, will be selected for the position. Mr. Merrill was the first secretary of the association and did a large part of the work toward permanent organization. He is also thoroughly acquainted with the coupon-book business and the interline ticket system, so that it will be no trouble for him to take up the work at once and formulate a system for operation.

After discussing matters of business to some extent and listening to brief papers and addresses on interesting topics, an early adjournment was taken in order to prepare for the banquet. President E. C. Spring opened the after-dinner talks with an address of welcome and congratulation. Among other things, he said: "The work which we have done in the various branches of the association seemed almost impossible to accomplish, but it has been found to have been comparatively easy. The close touch, whereby the various companies of the state have been brought together, has been very evident to every operative man of the state. The magnificent work done by the transportation committee, under the effective management of its able chairman, Mr. Merrill, stands pre-eminent in the work of the association. The universality of the sale of the interchangeable coupon book has gone way beyond the anticipation of any member of the association, until today it is recognized as a potent factor in the Middle West. I might reiterate the work of the association in the matters of operation, of passenger service, of freight, etc., matters which have been taken up and thrashed out during the year, and have brought effective service to the various properties, but time will not permit me to take this up in detail.

"And now, as we turn down the second page of the association's history and close the book of the Ohio Interurban Railway Association, let us open tonight and hail with a new determination the clean pages of the book of the Central Electric Railway Association. When we stop and think that this association tonight, represented by you gentlemen sitting at this board, represents an invested capital of $300,000,000, 4,500 miles of interurban track, gentlemen, this association is of no mean proportion.

"We have shown, up to the present time, that securities in electric railways are a far more profitable investment than steam roads. The average capitalization of steam roads in the United States, according to the report of the Interstate Commerce Commission, for the year 1905, was $61,490 per mile, while the average capitalization of electric interurban railways will not average over $35,000 per mile. The average earnings of steam roads in America from passenger traffic for the last year amounted to $1,674, while the average earnings of the interurban electric roads were nearly 2½ times that amount, being approximately $3,800 per mile. The earnings of many roads, however, run very much higher. This shows we have set an enviable standard of efficiency in construction and operation, and I believe that we can better serve these interests by joining hands and affiliating ourselves one with another."

President W. Caryl Ely of the American Street and Interurban Railway Association was next introduced. Mr. Ely said in part: "What you need in this state is legislation patterned after that which obtains in New York. In a spirit of fairness to the public and with its ultimate good as your object, all things can be won to you. But the work must be done openly. The day when things could be secured in the dark is past. All must be fair and open to the people, and the fairer your business, the safer it becomes, and the greater measure of success is enjoyed.

"Here in Ohio, the financial side of traction operation should be given much-needed legislation. Now, in financing a road there must be as much capital stock issued as there are mortgage bonds. This leads to overcapitalization, one of the greatest perils that confront the railway interests today. Another law that should be enacted is one calling for the establishment of a state board of railroad commissioners. We have them in New York, and while the bill calling for the establishment of such a commission met with a bitter opposition at the time of its projection some 15 years ago, time has proved the benefit of the measure, and it is one of the strongest laws now on the New York statutes. The railway men stand with the public in demanding its retention, as their interests as well as those of the public have been better served.

"The Interstate Commerce Commission should also be empowered to exercise a more complete jurisdiction over railroads, and this includes the interurban roads as well as the steam roads. The electric properties have so developed within the last 20 years as to practically distance steam roads. Fifty years ago there were 9,000 miles of steam road in this country, while in 1900, 193,000 miles had been in operation, and this number was increased to 300,000 miles in 1905.

"Traction properties in the last 20 years have greatly exceeded that record, the growth being phenomenal, and the beginning is but reached. Hence, there should be legislation commensurate with heir growth and value.

"In Massachusetts the state has given plenary powers to the state commission, and as a result the roads there are in better condition financially than in any other state. Their securities are more stable and better, while the market price commanded is equitable and firmly established.

"You are entitled to franchises longer than for a period of 25 years. In smaller communities, the 25-year limit is too small, not giving time enough to capitalists to realize fully on their investments. In consequence, where this limit is in vogue, the roads are not maintained in good repair, and at the end of that time when the franchise is forfeited the right-of-way is about the only thing that has a salable value."

President Charles L. Henry of the Indianapolis and Cincinnati Traction Company, made an interesting talk, urging the members to observe their rights always and to remember that the electric lines are intended largely for the accommodation of the common people. In closing, he invited all to attend the next meeting of the association, which will be held in Indianapolis two months from this time.

Harrie P. Clegg's talk was in a humorous vein, and he stirred up quite a bit of amusement before he sat down. In closing, he presented Mr. Spring a beautiful silver decanter, as a tribute of the friendship and esteem in which he is held by the members of the Ohio association, over which he has presided with signal ability. Henry W. Blake, editor of the Street Railway Journal, was next introduced. He made an interesting impromptu address, in which he placed Ohio in the front rank in electric-railway development, and said that the work of the new association will be watched with growing interest by railway men all over the country. The establishment of a state railroad commission was advocated by T. Russell Robinson of Boston, and the need of greater speed for traction lines was made prominent. Judge C. W. Reilly of Detroit said that electric roads would eventually supplant the steam lines in the passenger service in ordinary travel, and illustrated his point by the possibilities that are now open through the connection of lines of three states and the equipment that many of the roads are securing. Frequent service, he said, appeals to people more than cheap fares, and he urged that rates be fixed upon an equitable basis, as repairs on properties, after a certain number of years, will require a fair profit.

National conditions were discussed by Bernard V. Swenson, secretary of the American Street and Interurban Railway Association. Means of securing desirable legislation were discussed by Attorney J. Sprigg McMahon of Dayton. He said a committee should be appointed to push the matter, but that it should be done in a different way from that ordinarily used by the lobbyist. Any legislation asked for should subserve both the interests of the roads and the public. Attorney A. F. Broomhall of Troy advised the managers to look out for the little things that cause trouble, and especially to treat the farmers and rural population fairly and courteously. Minor damages to live stock and property should be compromised at the earliest moment to prevent bad feeling and consequent loss of business. Edward W. Hanley of Dayton was the last speaker on the list. His talk was in a humorous style, but he made some excellent points on the different systems of interurban-railway operation.

C.

Electrical Section of the Western Society of Engineers.

The Electrical Section of the Western Society of Engineers held its January meeting in Chicago on January 26th, at which meeting the officers for the year were elected. George A. Damon presided, and he appointed as the nominating committee James R. Cravath, H. R. King and Kempster B. Miller. The committee presented the names of the following gentlemen for office, who were unanimously elected: Chairman, Samuel G. McMeen; vice-chairman, P. Junkersfeld; director for three years, Otto E. Osthoff. Professor P. B. Woodworth has still two years to serve as director and George A. Damon one year, one new director being elected each year.

Types of cars for city service were discussed at the meeting. Introducing this subject, Mason B. Starring, general manager of the Chicago City Railway Company, described the general features of the new Indiana Avenue cars in Chicago, followed by H. B. Fleming, chief engineer of the company, who described the electrical features. These speakers made use of numerous lantern slides to illustrate their remarks, and some time was afterward consumed in discussing the various features of merit of these new cars, which are really models of their kind.

Following the gentlemen from the Chicago City Railway Company, Mr. Damon presented a communication from John A. Beeler, vice-president and general manager of the Denver City Tramway Company, describing the central-entrance cars used in that city. Mr. Damon also contributed some data of his own on the construction of city cars, showing by means of lantern slides some plans embodying several features not as yet tried, but which he thought might be practicable under certain conditions.

The cars of the Chicago City Railway Company have already been described in the Western Electrician (September 16, 1905), practically covering the remarks of Mr. Starring and Mr. Fleming, but the Denver cars have not, and the substance of Mr. Beeler's communication will be found on page 107 of this issue.

A Long Trolley Trip.

A company of prominent traction men who represent the moving interests in the interstate association of electric-railway lines that was formed at Dayton, Ohio, on January 25th is said to have made the longest trip ever taken entirely over interurban electric lines and entirely by trolley. The party is said to have traveled 3,700 miles, the trip representing the establishment of through interurban service between the electric railways of Michigan, Ohio, Western Pennsylvania and Indiana. The car used was a regular passenger car from the Detroit, Monroe and Toledo Short Line, and the members of the party included Matthew Slush, president of the Detroit, Monroe and Toledo Short Line, C. A. Black, Judge Reilly, Alexander McPhee, George Delisle, H. A. Gilmartin, J. H. Clark, M. R. Gilmartin of Detroit and George Warnuth and W. D. Hord of Indianapolis.

The party left Detroit and went to Findlay, a distance of 110 miles, and then to Dayton, where the company attended the convention and banquet of the Ohio Interurban Railway Association. From Dayton they went to Indianapolis over the Dayton and Western and the Indianapolis and Eastern. Anderson, Marion and Fort Wayne were reached from Indianapolis over the lines of the Indiana Union Traction Company and the Wabash Valley Traction Company, and thence the party went back to Dayton and Cincinnati, and then to Hamilton, Columbus and Springfield. Judge Reilly was the spokesman of the party. He said that Ohio, Indiana and Michigan can boast of a larger number of interurban railroads than any other political division in the world, and that to Indianapolis is justly due the credit for its terminal station and facilities.

Electrical Trades Association of Chicago.

The Electrical Trades Association of Chicago held its tenth annual meeting at the Coliseum Annex, Chicago, on the evening of January 24th. Probably never before in the history of the electrical industry were there as many men interested in credits gathered together for the discussion of this important feature in every trade. There were present at the meeting 125 representative electrical manufacturers and jobbers located in the central, western and southern states, and covering the territory embraced between Cleveland and Denver, and from Detroit to New Orleans and Dallas, Texas.

FREDERIC P. VOSE.

The total lack of formality and stiffness and the evidence of an abundance of good feeling everywhere manifested all contributed to make the dinner an unqualified success. The courses were well selected, tastefully prepared and well served.

Owing to the unavoidable absence from the city of E. R. Gilmore of the Western Electric Company, president of the association, and also the inability of Vice president Seymour Guthrie to be present, Mr. Frederic P. Vose was made chairman of the meeting. Mr. Vose is one of the moving spirits in the association and is well known from the fact that he is counsel for the association and advises in the directing of its affairs. He conducted the meeting admirably, interspersing a sprinkling of merriment here and there.

The secretary's report showed the membership in the Chicago association to be 155 manufacturers and jobbers, and a total membership in the allied associations of Boston, New York, Philadelphia, San Francisco, Montreal and Chicago of 335. The total number of persons who has become slow pay or did not pay their bills at all in the trade is 9,746. The total amount of slow accounts reported by the association is $609,201.93, and the total amount of settlements secured is $471,908.90.

After the report of several committees the election of officers was held, resulting as follows: President, Frank S. Beardslee, Beardslee Chandelier Manufacturing Company; vice-president, Seymour Guthrie, Kellogg Switchboard and Supply Company; secretary and treasurer, Frederic P. Vose (counsel for the association); executive committee—Thomas I. Stacey of the Electric Appliance Company, E. R. Gilmore of the Western Electric Company, S. E. Kennedy of the Central Electric Company; member national board, James Wolff, New York Insulated Wire Company.

At the conclusion of the business meeting James Wolff was introduced as toastmaster. The first to respond was Charles W. Wilkins of Patrick, Carter & Wilkins, Philadelphia. Mr. Wilkins is the founder of the association. He spoke most happily and gave expression to his well-known conviction as to the efficacy and thorough practicability of the Electrical Trades Association's co-operative plan of credit protection, which he regards as very important.

Other gentlemen on the programme were: Frank M. Pierce, Manhattan Electrical Supply Company; F. B. Uhrig, Western Electric Company, Kansas City; A. B. Conover, John A. Roebling's Sons Company; Charles E. Gregory, Guarantee Electric Company; W. E. Phelps, The Phelps Company; Henry L. Walker, Detroit; J. E. Erner, the Erner Electric Company, Cleveland; S. E. Kennedy, Central Electric Company; Harry Parsons, Western Electric Company; Thomas R. Mercein, Milwaukee, and Willard S. Sisson of the D. & W. Fuse Company, Providence, R. I. After the speaking programme, through the kindness of the directors of the Electrical Trades Exposition Company, the courtesies of the Electrical Show, which was in session at the Coliseum, were extended to the members.

Agree to 85-cent Gas in Chicago.

The gas companies of Chicago and the City Council committee on gas, oil and electric light have come to an agreement on the subject of the future price of gas to consumers. As a result the committee has presented an ordinance, which the companies have agreed to accept, fixing the price, for five years, at 85 cents a thousand cubic feet. The council deferred action on the ordinance, and 1,000 copies were ordered printed for the benefit of the aldermen and others interested, as the report is considered an important contribution to contemporaneous gas literature.

The 85-cent rate was arrived at as follows: The accountants who examined the gas company's books had showed 45.45 cents a 1,000 feet as the cost of making and distributing gas, allowing six cents for repairs and renewals, but all the experts had agreed on 10 cents for this item, and, accepting their figure, would bring the cost up to approximately 50 cents. [illegible] fund and [illegible]

The [illegible] age.

Some [illegible] authority [illegible] 25 per cent [illegible] and 70 per cent [illegible] than passed through them. [illegible] all the meters in Chicago are too fast.

Power Plant Economics.[1]

By H[illegible] G. S[illegible]

PART I.

Three years ago the steam power plant for the generation of electricity had apparently settled down to an almost uniform arrangement of standard apparatus in which one power plant differed from another only in details of construction of engines, generators and auxiliaries. As only about 20 years had then elapsed since the first central station was put in operation on a commercial basis, this uniformity of design seemed to indicate that in the near future it would only be necessary to purchase a standard set of power-plant drawings and make the necessary changes in size of units in order to have a station of the best type known to the art.

The internal-combustion or gas engine had from time to time been brought forward as a candidate for the position of prime mover, with every prospect of improved economy in fuel consumption; but with the exception of a few special instances it was not looked upon with favor, as shown by the almost universal use of the steam engine.

After a long period of development a new factor in power-plant design, namely, the steam turbine, was placed on the market in commercial sizes. It is safe to say that during the last three years no other piece of apparatus has had so stimulating an effect upon the power plant. Its effect upon the entire plant has been most beneficial, for it has revived the apparently moribund superheater. This has now been so developed and improved that superheat of 200° or 300° F. can be safely and economically obtained. With the development of the superheater further study of the problem of combustion has improved the efficiency of the furnace; and this most important subject is apparently susceptible of still further development.

One other important result of the steam-turbine development has been the development of condensing apparatus to such a point of efficiency that a vacuum within one inch of the simultaneous

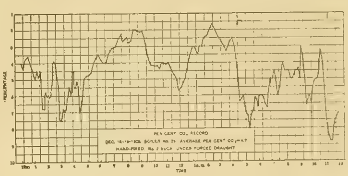


FIG. 1. PER CENT. CO_2 RECORD, FORCED DRAUGHT.

barometer reading can now be maintained without difficulty.

Another change in the power plant has been the reversion to high-speed generators, resulting in decreased cost of the generator and its foundations, as well as saving in floor space.

Last but not least the steam turbine has put the reciprocating engine and the gas engine on the defensive and has actually been unkind enough to throw out hints in regard to the application of Dr. Osler's proposed methods in the treatment of older apparatus.

The reciprocating engine and internal-combustion engine have not been slow in accepting this challenge; they have responded by showing so improved an economy (especially in the gas engine) that the situation has become most interesting to the power-plant designer. It is safe to say that the developments of the next ten years will show very marked improvement in power-plant efficiency.

In regard to this development the author wishes to direct the attention to the basic fact that in power plants one should not look merely for increased efficiency in the prime mover, but should also investigate and analyze the entire plant from the coal to the bus-bars; first, in regard to efficiency; second, in regard to the effect of load factor upon investment; and third, the effect of

1. A paper presented at the meeting of the American Institute of Electrical Engineers, New York, January 26, 1906. Mr. Stott is superintendent of motive power of the Interborough Rapid Transit Company of New York.

[illegible]

TABLE I.

[illegible]

DISCUSSION OF ITEMS IN TABLE I.

Item 1. B. T. U. per Pound of Coal Supplied. The thermal value of the coal used is [illegible] the entire plant. The method of purchasing coal

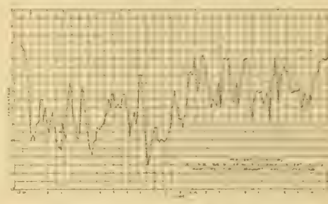


FIG. 2. [illegible]

used in the plant from which the heat balance is derived is that of paying for B. T. U. only, with suitable restrictions on the maximum permissible amount of volatile matter, ash and sulphur.

A small sample of coal is automatically taken from each filling of the weighing hoppers, so that the final sample represents a true average of a boat-load of coal. This final average sample is then pulverized and tested for heat value in a bomb calorimeter, after which a proximate analysis is made of another portion of the sample. This method of purchasing coal has been in use for two years, with highly satisfactory results.

Item 2. Loss in Ashes.—It is doubtful whether a further saving in this item can be made, as the extra care and labor necessary to accomplish any improvement would in all probability offset the saving in coal.

Item 3. Loss to Stack.—This is one of the most vulnerable points to attack, as the loss of 22.7 per cent. is very large. Recent investigations show that promising results may be obtained by the use of more scientific methods in the boiler room. In practically all cases it will be found that this loss is due almost entirely to admitting too much air to the combustion chamber, resulting in cooling of the furnace. This result is usually produced by "holes" in the fire; these "holes" may be due to several causes, but usually are due to carelessness on the part of the fireman.

Fortunately a very valuable piece of apparatus has been placed upon the market in the shape of a CO_2 recording instrument. The results of a series of tests made with this instrument are shown in Figs. 1 to 4.

Fig. 1 shows the average condition of a furnace using small sizes of anthracite with forced draught. The conditions are such that approximately 40 per cent. of the thermal value is being lost.

Fig. 2 shows what improvement may easily be obtained by watching the CO_2 record, and indicates a saving of about 10 per cent. over the previous case. In the combustion of the small sizes of anthracite it is necessary to use a draught of not less than 1.5 inches of water; this breaks the crust of the fire in the thin spots, allowing the air to come through in such volumes that an enormous amount of heat is wasted in raising the temperature of the surplus air and at the same time causing inefficient combustion in the entire furnace.

Fig. 3 shows a record taken from a stoker boiler while the recorder was covered up to prevent the fireman from seeing the record.

Fig. 4 shows a record taken from the same stoker boiler with the fireman watching the CO_2 indications, resulting in a saving of over 12 per cent.

Later records show that even better results than an average of 11.4 per cent of CO_2 can be obtained.

Fig. 5 shows the calculated losses in fuel corresponding to various percentages of CO_2 for three different temperatures of flue gases.

From a consideration of the above tests it seems reasonable to assume that the 22.7 per cent. loss to stack can, by scientific methods in the fire room, be reduced to about 12.7 per cent., and possibly to 10 per cent.

Before the installation of the CO_2 recorder a long series of evaporative tests was made to determine the most economical draught to carry when a high-grade semi-bituminous coal was burning on the automatic stokers. The results shown in Fig. 6

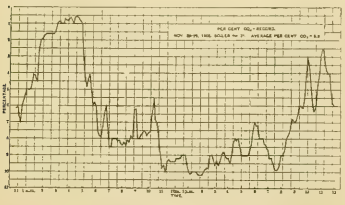


FIG. 3. PER CENT. CO_2 RECORD.

were so remarkable that they were repeated under different conditions in order to confirm them. Since the installation of the CO_2 recorder, however, the explanation is apparent; as the draught giving maximum evaporation per pound of combustible corresponds to the point of maximum CO_2, illustrating the inherent difficulty of maintaining efficient conditions in the combustion chamber with high draught. This is well illustrated by Fig. 7, showing the draught, per cent. of rating and percentage of CO_2.

Item 4.—The loss in boiler radiation and leakage, amounting to eight per cent., is largely due to the inefficient boiler setting of brick, which, besides permitting radiation, admits a large amount of air by infiltration. This infiltration will increase with the draught, thus tending to exaggerate the maximum and minimum points on Fig. 6. The remedy for this radiation and infiltration loss is evidently to use new methods of boiler setting, such as an iron-plate air-tight case enclosing a carbonate of magnesia lining outside the brickwork.

Mr. W. H. Patchell[1] of London, who recently

FIG. 4. PER CENT. CO_2 RECORD FOR STOKER OPERATION.

visited us, has introduced very large boilers, assembling two in one setting; each boiler has a normal evaporation of 33,000 pounds per hour, and in this way has cut down to a minimum the radiating surface per square foot of heating surface. He has also introduced the iron case with magnesia lining, and with good results.

The question of boiler leakage is one in which the choice of the lesser of two evils is necessary; for in the tubular or cylindrical boiler the leakage will undoubtedly be less than in the water-tube type, owing to the smaller number of joints in the water space. But these two advantages are offset by the increased difficulty of construction, and the danger of using large boilers of the tubular type, especially with high-pressure steam.

It is now generally admitted that there can be no more difference in the efficiency of different types of boilers under similar conditions than there can be in electric heaters, press agents to the contrary notwithstanding.

Item 5. Returned by Feed-water Heater.—The importance of getting the feed water to the maximum temperature obtainable is generally recognized, and would seem to indicate that all auxiliaries should be steam-driven so that their exhaust may be utilized in the feed-water heater; in this way the auxiliaries may operate at about 80 per cent. thermal efficiency.

Item 6.—Owing to the difficulty of pumping water at temperatures above 150° F., when under pressure, it becomes necessary to install economizers for the purpose of increasing the feed-water temperature to 200° or 250° F. As this increase of temperature is obtained from the waste gases at no expense for fuel, it only becomes necessary to consider the load factor, as will be shown later, in order to decide whether economizers should be installed or not. In practically all cases where the load factor exceeds 25 per cent. the investment will be justified.

In deciding upon the size of economizer to be installed it is important to consider first, the influence of the economizer upon the available draught due to the obstruction it offers and also due to the reduced stack temperature; the second important consideration is to equate the interest and depreciation charges against the saving in fuel, and so determine the amount of investment justified in each particular case.

Item 7. Loss in Pipe Radiation.—By the use of two-layer pipe covering, each layer being approximately 1.5 inch thick, and sections put on in such manner that all joints are broken, the radiation losses have become practically negligible.

Items 8 and 9. Heat Delivered to Circulating and Boiler-feed Pumps.—As these auxiliaries may be either electrically driven or steam-driven, it is interesting to note that the thermal efficiency of the electrically driven pumps would be equal to the thermal efficiency of the plant, multiplied by both the efficiency of conversion from the alternating to direct current and by the motor efficiency. In this case there would be a net thermal efficiency of $10.3 \times 0.93 \times 0.90 = 8.63$ per cent., whereas the thermal efficiency of the steam-driven auxiliary discharging its exhaust into a feed-water heater at atmospheric pressure would be approximately 87 per cent.

Item 10. Loss in Leakage and High-pressure Drips.—The loss in leakage should be infinitesimal,

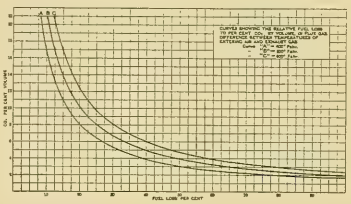


FIG. 5. CURVES SHOWING RELATIVE FUEL LOSS TO PER CENT. CO_2.

and the high-pressure drips can be returned to the boilers, so that practically all the loss under this heading is recoverable.

Items 11, 12 and 17.—These are probably unavoidable and of so small a magnitude as not to merit much consideration.

Item 13. Loss in Engine Friction.—Recent tests of a 7,500-horsepower reciprocating engine show a mechanical efficiency of 93.65 per cent. at full load, or an engine friction of 6.35 per cent. As this forms only 0.8 per cent. of the total thermal losses it is relatively unimportant. Attention is called to the method of lubricating all the principal bearings by what is known as the flushing system, whereby a large quantity of oil is put through all the bearings by gravity feed from elevated oil reservoirs common to all the units; after passing through the bearings the oil is returned by gravity to oil filters in the basement and then pumped up to the reservoir tanks again. About 200 gallons per hour are put through each engine, and of this quantity only about 0.5 per cent. is lost. This method of oiling undoubtedly contributes to the general result.

Item 14.—As large electrical generators can now be obtained which give from 98 to 98.5 per cent.

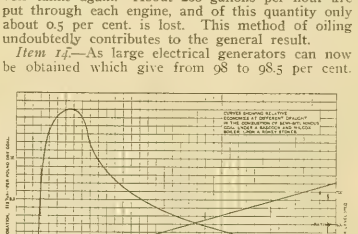


FIG. 6. CURVES SHOWING RELATIVE ECONOMIES AT DIFFERENT DRAUGHTS.

efficiency, it would seem as if the limit in design had been reached and that hereafter the problem of design is to be merely one of altering dimensions to suit varying sizes and speeds. While this is true as far as the efficiency is concerned, other problems are continually arising, such as the design of generators for an overload capacity of 100 per cent. to meet the demand for apparatus capable of taking care of great overloads economically for short periods, corresponding to peak loads of a railroad or lighting plant.

Item 15. Engine Radiation Losses.—This source of loss has evidently been reduced to a negligible quantity by the use of improved material and methods of heat insulation.

Item 16. Rejected to Condenser, 60.1 per Cent.—This immediately introduces the thermodynamics of the steam engine, a subject so broad that it will be impossible to do more than touch upon some of the most important points in considering steam-engine efficiency.

The efficiency of any heat engine can be expressed by the ratio of $E = \frac{T_1 - T_2}{T_1}$ where T_1 is the absolute temperature of the steam entering the

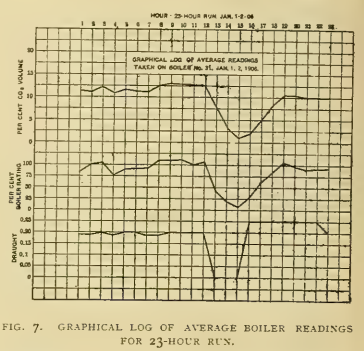


FIG. 7. GRAPHICAL LOG OF AVERAGE BOILER READINGS FOR 23-HOUR RUN.

engine and T_2 the absolute temperature of the steam leaving the engine. Thus in the engine whose steam-consumption curve is given in Fig. 8, if the initial pressure is 175-pound gauge and the vacuum at the low-pressure exhaust nozzle is 28 inches, then the maximum thermal efficiency is $\frac{837 - 560}{837} =$ 33 per cent. This would be true for any form of engine or turbine working between the same temperature limits.

In Fig. 8, however, it is seen that the point of

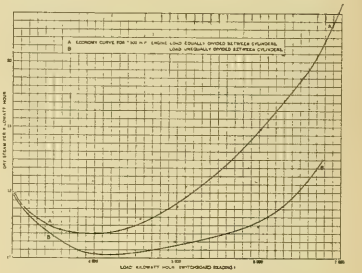


FIG. 8. ECONOMY CURVES OF 7,500 HORSEPOWER ENGINE.

maximum economy shows a steam consumption of approximately 17 pounds per kilowatt-hour, which is equivalent to 20,349 B. T. U. per hour. One kilowatt-hour is equal to 3,412 B. T. U. per hour, so that the actual efficiency of the steam engine and generator is $= \frac{3{,}412}{20{,}349} = 16.7$ per cent. As the generator efficiency at this load is approximately 98 per cent. the net engine thermodynamic efficiency is $\frac{16.7}{0.98} = 17$ per cent.

The difference between the theoretical efficiency and the actual is then $33 - 17 = 16$ per cent., of which 6.35 per cent. has already been accounted for in engine friction, so that the balance of 9.65 per cent. is due to cylinder condensation, incomplete expansion and radiation.

As the engine friction in a two-bearing engine with high-pressure poppet valves and low-pressure Corliss valves has by careful design been reduced to less than 6.5 per cent., gain cannot be expected here, so attention must be centered on the loss due to cylinder condensation, etc., amounting to 9.65 per cent., in order to effect any improvement.

Superheated steam is the only remedy at hand, and with it we can probably effect an improvement of five or six per cent. by using such a degree of superheat in the boilers that dry steam will be had at the point of cut-off in the low-pressure cylinder.

Any greater amount of superheat than this will merely result in loss to the condenser; for it should be remembered that the cylinder losses increase with the difference in temperature between the steam and exhaust portions of the cycle; in other words, the greater the thermal range of temperature the greater the condensation loss. This would seem

1. See paper read December 7, 1905, before the Institution of Electrical Engineers, by W. H. Patchell.

to point to the use of more cylinders; but this involves additional first cost and friction as well as more space and higher maintenance charges.

Fig. 9 shows what may be gained by reducing the temperature at the end of the cycle by means of increased vacuum, but in the case in point the maximum vacuum obtainable in practice was used so that no additional economy can be expected in this way.

SUMMARY OF ANALYSIS OF HEAT BALANCE.

The present type of power plant using reciprocating engines can be improved in efficiency as follows:

Reduction of stack losses	12 per cent
Reduction in boiler radiation and leakage	5 per cent
Reduction in engine losses by the use of superheat	6 per cent

resulting in a net increase of thermal efficiency of

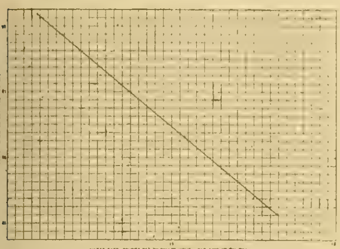


FIG. 9. CURVE OF WATER RATE IN POUNDS PER KILOWATT HOUR.

the entire plant of 4.14 per cent., and bringing up the total thermal efficiency from 10.3 per cent. to 14.44 per cent.

THE STEAM TURBINE.

A typical economy curve of a steam turbine is shown in Fig. 10. An inspection of this curve, which represents what is probably the best results obtained up to date, shows—first, that the best economy on dry saturated steam is practically equal to that of the reciprocating engine in Fig. 8; second, that 200 degrees superheat reduces the steam consumption 13.5 per cent. But calculating the total heat units in superheat from $H_1 = H + 0.48 (t_2 - t_1)$ the B. T. U. per kilowatt-hour are 20,349 for dry saturated steam, while for 200 degrees superheat they are 19,008, or a net thermal saving of 6.6 per cent. The shape of the economy curve, however, is much flatter than that of the reciprocating engine, so that the all-day efficiency of the turbo-unit would be considerably better than that of the reciprocating engine, with the other great advantage of costing approximately 33 per cent. less for the combined steam motor and electric generator.

HIGH-PRESSURE RECIPROCATING ENGINE WITH LOW-PRESSURE TURBINE ON ITS EXHAUST.

The inherent principles involved in the design of the steam turbine show that it can be expected to

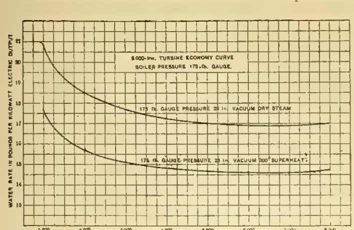


FIG. 10. ECONOMY CURVE OF 5,000-KILOWATT STEAM TURBINE.

give an almost perfect adiabatic expansion, as there are no thermal cycles of heating and cooling at every stroke as in the reciprocating engine; there is an almost ideal thermal drop from the steam valve to the condenser. It is also evident that the expansion will be relatively more nearly adiabatic in the low-pressure stage of the turbine than in the low-pressure cylinder of the engine, so that it has been proposed that the reciprocating engine should be run high pressure where relatively it is more efficient than the steam turbine, utilizing the turbine for the low-pressure part of the cycle. In other words, use each where it is most efficient.

The following calculations show approximately what might be expected from such a combination. Assuming that the 5,000-kilowatt reciprocating unit would take 50 per cent. more steam when operating non-condensing than when condensing there would then be (see Fig. 8) a consumption per kilowatt-hour of 25.5 pounds.

Steam expanding between the absolute pressure of 190 pounds and 14.7 pounds would give up 165.3 B. T. U. per pound, or a total of 4,215 B. T. U. per kilowatt-hour.

The total heat in th[illegible] 1,197 [illegible] bine would [illegible] (1,197 [illegible]) the B. T. U. per [illegible] operating on d[illegible] were 20,349 [illegible] at atmospheric pressure [illegible] bine would [illegible] 70 per cent [illegible] low-pressure turbine would be [illegible] B. T. U. The total power [illegible] generator would then be 4,5?7 [illegible]

We thus find that [illegible] B. T. U. we now get 5000 kilowatts [illegible] reciprocating unit, and 4,567 kilowatts from the turbine unit, or a total of 9,867 kilowatts [illegible] 15,502 B. T. U. per kilowatt-hour.

This turbo-unit would be interposed directly between the exhaust nozzle of the reciprocating engine and the condenser and would have no valve or governing mechanism whatever. The generator would be connected directly to the other generator leads without any switching apparatus, except possibly knife switches to disconnect for testing purposes; and in operation no attention whatever would be required beyond the ordinary lubrication of bearings. Such a unit it is evident could be built at a very small cost per kilowatt hour.

THE INTERNAL COMBUSTION OR GAS ENGINE.

The gas engine has probably developed more slowly than any other piece of modern apparatus, as it is now 30 years since the Otto gas engine was introduced. It is only within the last 10 years that the larger type of engine, from 500 to 2,000 horsepower in size, has appeared. The delay in bringing forward the most efficient motive power known is chiefly due to the difficulty experienced in developing an efficient and inexpensive method of making gas. As far as the production of gas from anthracite and non-caking bituminous coals is concerned, this problem has apparently been solved, but it is still in a more or less unsolved condition

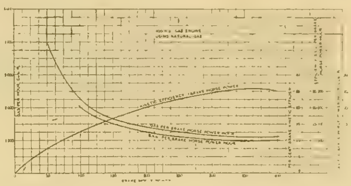


FIG. 11. OPERATING CURVES OF 400-HORSEPOWER GAS ENGINE USING NATURAL GAS.

for the richer bituminous and semi-bituminous caking coals of the eastern states.

The following heat balance is believed to represent the best results obtained in Europe and the United States up to date in the formation and utilization of producer gas.

ANALYSIS OF THE AVERAGE LOSSES IN THE CONVERSION OF ONE POUND OF COAL CONTAINING 12,500 B.T.U. INTO ELECTRICITY.

	B.T.U.	Pr. Ct
1. Loss in gas producer and auxiliaries	2,500	20.
2. Loss in cooling water in jackets	2,375	19.
3. Loss in exhaust gases	3,750	30.
4. Loss in engine friction	813	6.5
5. Loss in electric generator	62	0.5
6. Total losses	9,500	76.0
7. Converted into electrical energy	3,000	24.0
	12,500	100.0

The great objection to the use of the gas engine for electrical purposes has been first, its lack of uniform angular velocity; second, its uncertainty in action and high cost of maintenance; and third, its inability to carry heavy overloads. Recent developments have removed the first and second objections; and a period of vigorous development has resulted in placing the gas engine in the front rank of claimants for attention as a prime mover.

The total investment for a gas-producer plant, all auxiliaries, gas engines and electric generators, has been reduced by the elimination of the gas-holding tank to a point where it is now practically on a par with a first-class steam plant using high-grade reciprocating engines.

Where natural gas or blast-furnace gas can be obtained the gas engine has outdistanced all competitors; and now that some of our large manufacturers have taken up in earnest the problem of designing producer-gas plants, it is safe to say that rapid developments will result.

The records of operation of several important installations of gas engines in power plants abroad and in this country seem to indicate that only one important objection can be raised to this prime mover, and that is that its range of economical load is practically limited to between 50-per cent. load and full load, as shown in Fig. 11. This lack of overload capacity is probably a fatal defect for the ordinary power plant, more especially for the average railroad plant operating under a violently fluctuating load, unless protected by a storage battery of comparatively large capacity.

[To be concluded.]

Shoeffler Engine Indicator and Overload Alarm.

[illegible]

[illegible]

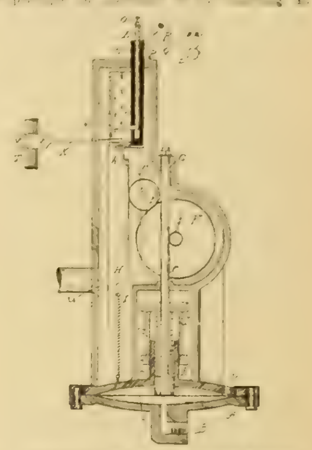


FIG. 1. [illegible] ENGINE INDICATOR.

indicating finger (K) to that part of the valve or governing mechanism which has a movement that varies uniformly as the load on the engine or the steam pressure varies. Indicating finger (K) is attached to the governor rod of the Corliss engine or valve-stem of the automatic, locomotive or marine engine. The diaphragm shell (A) contains a diaphragm plate (W) of known construction connected with the steam supply of the engine at (B) and with the exhaust pipe at (Y). One of the ends of the rod (C) enters the diaphragm shell (A) and rests firmly against the enclosed diaphragm plate (W), by means of which contact with the diaphragm plate the rod (C) moves as the steam supply or exhaust pressure varies. The gland (D) encloses a spring (V) which rests against the piston (X), which is provided with a packing ring, as shown. Gland (D) is locked in position by means of the lock nut (E), when the proper adjustment of the spring is secured. The purpose of the spring (V) is to regulate the movement of the rod (C).

The double gear (F) is pivoted at (f) to the frame of the instrument, the teeth of the small gear of the double gear (F) engaging with the teeth of the rack bar (C), as shown. The extension of the rod (C) passes through the journal (G). The teeth of the large gear of the gear (F) engages the teeth of the intermediate gear (F'), which is adjustably pivoted at (f'), as shown. Rack bar (H) enages the teeth of the gear (F'), this rack bar having attached at one of its ends a spring (I). The purpose of this spring is to take up any lost motion that may be present. The rack bar (H) at its end (h) is attached to the graduated scale-plate (J) and overload contacts (L) and (R), and moves the scale and contacts as the steam supply or exhaust pressure varies, thus securing a compensatory movement of the scale-plate (J) and overload attachment, thereby making the indicating finger (K), which derives its movement over the scale from the valve stem, governor, rod, etc., of the engine to which it is attached, a true indicator of the horsepower developed in the cylinder of the engine in plain figures at all times.

The object of the adjustable bearing (f') is to admit of the substitution of gears of different diameter to secure the correct movement of the scale-plate (J) for different engines. (T) represents the valve stem, governor, rod, etc., of an engine to which the index finger (K) is attached.

The overload attachment (S) is constructed as follows: (L) is a metal electrode with a recess or notch at (M) and a binding post (O), which receives the electric wire of one side of a circuit and at the other end of the electrode (L). The contact finger (N) is enclosed by a slotted tube

(P), constructed of guttapercha. Tube (P) is provided with a metal ring (Q), carrying a binding post to receive the other side of the electric circuit and the brush (R), the end of which rests over notch (M). Tube (P) is enclosed by a metal tube (S), which is fastened rigidly to the back of the scale-plate (J), as shown.

The alarm device is adjusted by placing the brush (R) just over the notch (M), and not touching the electrode (L). Tube (P), with the enclosed electrode (L), is pulled out or pushed in the tube (S) until the overload finger (N) is on the point on the scale indicating the maximum load that it is desired the engine shall not exceed. Should the load exceed the predetermined limit, the index finger (K) strikes the overload index (N), moving the electrode (L) with the notch at (M), bringing it in contact with the brush (R), closing the circuit and ringing the bell, thus giving the alarm.

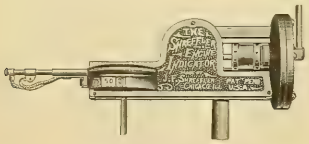


Fig. 2. Front View.

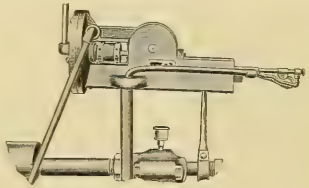


Fig. 3. Rear View.

SHREFFLER ENGINE INDICATOR AND OVERLOAD ALARM.

To verify the correctness of the instrument, the engine is placed on the center or blocked so it will not run, with the throttle valve open, and the pressure indicated on a scale on a tube (not shown) is noted. If the reading corresponds with the pressure indicated by the standard steam and vacuum gauges, the index finger (K) should stand at zero on the scale-plate (J) when the throttle valve is closed and there is no back pressure or vacuum in the exhaust pipe. If not correct, it may be corrected by adjusting the gland (D) or by readjusting the valve mechanism.

Cable Construction for Long Island Railroad.

Owing to the increasing amount of underground work for all classes of electric service, corresponding attention has been paid to the design of the necessary cables. The differentiation carried on along other lines in the electrical field has been followed in this territory as well, and the results of this selective process are well shown in the cable equipment for the recently electrified Long Island Railroad.

For the interior wiring in the generating station and sub-stations of this railroad there was installed about 19,000 feet of 11,000-volt varnished-cambric-insulation braided-finish cable, shown in Fig. 1. All of this cable was tested by the manufacturer with 30,000 volts for 30 minutes after it had been immersed in water for 24 hours, and was again tested with the same potential after installation.

Varnished-cambric insulation was selected as the best available insulating material for this use, as it is asserted that cables insulated with this material are better for withstanding high voltage than the best rubber cables and are not subject to deterioration from static discharges or heat. Furthermore, the fact that these cables could be used without lead sheaths avoided the installation of a large number of end bells.

Varnished-cambric insulation with the braided finish was also used for the low-tension wiring in the generating and sub-stations, where in all about 36,000 feet of cable in sizes from 2,000,000 circular mils down to No. 2 was installed for this work. Several of the reasons governing the selection of varnished-cambric insulation for the high-tension work applied with equal force in this case, with the additional advantage that in the large cables the heating of the conductor, due to overloads, could not soften the insulation and allow the conductor to decentralize.

Taking up now that portion of the transmission circuits which is underground in this installation, it is found that lead-covered paper-insulated cable is employed. For this purpose about 135,000 feet of three-conductor 250,000-circular-mil cable, guaranteed for 11,000 volts, was used. This cable was also tested with 30,000 volts for 30 minutes by the manufacturer, and the test was repeated after the cable was installed. The selection of paper cable for this service was determined primarily by the fact that it was considerably cheaper than varnished-cambric cable. While it was conceded that the varnished-cambric cable would be the best for service, it was felt that satisfactory life and service would be obtained with the paper cables, assuming that proper care was taken to preserve their lead sheaths from deterioration, due to electrolysis or corrosion.

For carrying the high-tension circuits under water, where the drawbridges interrupt the overhead circuits on the line across Jamaica Bay, there was used 3,500 feet of the three-conductor 250,000-circular-mil rubber-insulated leaded and wire-armored sub-marine cable shown in cross section in Fig. 2 (less than two-thirds actual size). As in the previous cases, this cable was tested at 30,000 volts before and after installation. The cable weighs 18 pounds to the foot and is one of the heaviest ever manufactured. The armor is No. 4 B. & S. gauge, and the finished diameter about three inches.

In connection with the third-rail circuit for jumper cables at grade crossings and in places where the third-rail was shifted from one side to the other of the main track 65,119 feet of 2,000,000-circular-mil varnished-cambric leaded, with a jute and asphalt finish, was installed. Cables for this service operate under particularly severe conditions, as they are subject to heavy overloads and to deleterious electrolytic action. The overhead feature rendered rubber insulation undesirable, while the difficulty of maintaining the lead sheath in good condition proved an equal barrier to the use of paper. The varnished-cambric insulation, being free from the weaknesses of both of these types of insulation and yet possessing all the good points of both types, was therefore used. The jute and asphalt jacket was put on these cables to protect the lead from mechanical injury and corrosion, since the cables are in many cases buried directly in the earth.

To carry the third-rail circuits and also the track circuit around the drawbridges at Jamaica Bay, 5,600 feet of 2,000,000-circular-mil rubber-insulated lead-covered and wire-armored cable were installed. The submerging of these cables maintains them at a low temperature, which tends to preserve rubber, and justifies its use in this case.

As a reinforced feeder for the third rail there was installed, in conduit, 9,438 feet of paper-insulated low-tension cable, selected as the cheapest available construction for the service, since the installation was regarded as being of a more or less temporary nature, and because the ultimate life of the cable was not an important feature.

All the above cable as well as the necessary wire and cable for the cars was furnished by the General Electric Company. The aggregate length of all kinds of wire and cable supplied for this installation was 637,243 feet, the sizes ranging from No. 12 to 2,000,000 circular mils. The entire equipment is now in service and giving satisfaction.

It is said that the General Electric Company will also supply the high and low-tension cables for the electrification of the New York Central, comprising about 164,000 feet. These will include a three-conductor No. 0000 11,000-volt cable, said to be the largest 11,000-volt cable ever made, and a 1,250,000-circular-mil single-conductor cable for track connections operating at 700 volts. Because of the successful use of these cables over half a million feet of both high and low-tension cables have been ordered from this company by the New York Edison Company for its requirements in 1906. These range in size from three-conductor 250,000-circular-mils 6,600-volt up to 1,000,000-circular-mil low-tension feeder cable.

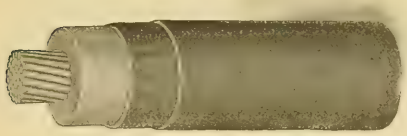


Fig. 1. 11,000-volt Varnished-cambric Cable.

Fig. 2. Three-conductor Submarine Cable.

CABLES FOR LONG ISLAND RAILROAD.

9,700-horsepower Hydraulic Turbine for California Gas and Electric Corporation.

An interesting point in connection with the recent purchase by the California Gas and Electric Corporation, San Francisco, of a 9,700-horsepower single-horizontal spiral-case reaction hydraulic turbine is contained in the fact that this turbine will operate under a 550-foot lead at a speed of 400 revolutions per minute, which is said to be the highest head under which a turbine of this type has ever been installed. Until recently manufacturers of secondary machinery have avoided the operation of their apparatus on high speeds. This prejudice, however, has to a great extent been overcome, and it is only a question of time when this type of hydraulic turbine will be constructed for still higher heads than the present practice will allow. This turbine and accessories will be furnished by the Allis-Chalmers Company of Milwaukee, and is destined for installation at Chico, Cal., where the corporation controls the water rights.

Convenient Tube for Soldering Flux.

Shop and construction men who have occasion to use soldering paste for flux know the disadvantage of using the paste when put up in the usual flat box. The Climax flux tube here illustrated is a convenient receptacle for the flux, and by its use just enough flux can be squeezed out at a time necessary for the work in hand.

CONVENIENT TUBE FOR SOLDERING FLUX.

The spout of the tube is of aluminum—an important feature. This allows of the paste being applied directly to the joint simultaneously with the heat without soldering up the vent. The maker of this device, the Climax Manufacturing Company of Boston, asserts several advantages for it, among which are: No stickey jobs from too much paste; no tools daubed from lying in the paste box; no splints needed to apply the flux; no waste of flux from the accumulation of dust and dirt; can be carried in the upper pocket like a screwdriver for use in soldering overhead wires. The paste is said to be the best flux made, being insulating and non-corrosive.

Chicago Street-railway Situation.

Mayor Dunne has signed the $75,000,000 Mueller certificate ordinance passed by the council recently as a substitute for the franchise-extension ordinances reported by the majority of the local transportation committee. The mayor is quoted as saying that some amendments were suggested to the ordinance, but after careful consideration by himself and legal advisers the strictest examination failed to show the necessity for them. The mayor said he had no intention at present of again putting forward his contract-plan ordinance, nor would he have any more suggestions to make on the municipal-ownership line. He would take a rest until the people had decided at the April election whether they wanted municipal ownership.

As the time approaches when the street-railway tunnels under the river must be lowered, necessitating the abandonment of the cable cars by the traction companies, it is expected the traction officials will soon ask the council to do something definite in the way of permitting it to substitute trolleys for the cables when the tunnels come out. It is said that if it becomes necessary the Union Traction Company will ask Judge Grosscup for an order permitting the substitution of trolleys.

Marcus Pollasky sent to the council this week his old subway ordinance submitted several years ago. It provides for a loop with four to six tracks in the district between the river and Twenty-second Street, with four branches connecting with the four elevated roads. Inclines are provided giving the surface street cars ingress and egress to the underground loop. The ordinance grants the Chicago Central Sub-railroad Company, which is the corporation seeking the franchise, the right to build branches under the river to reach the North and West sides. The fare is to be five cents. A 50-year franchise is asked. The proposed ordinance was sent to the local transportation committee, where it probably will remain.

Scribner Automatic Signaling Patent Not Infringed in Galesburg Case.

About a year ago, as set forth in the Western Electrician at the time, Judge Seaman of the United States Circuit Court decided for the defendants in the case of the Western Electric Company, complainant, against the Galesburg (Ill.) Union Telephone Company and another, defendants. The suit was brought for alleged infringement of patent No. 660,708, issued March 12, 1901 (on application filed February 28, 1895), to Charles E. Scribner for "Apparatus for Telephone Switchboards." This patent is owned by the Western Electric Company. The defendant company operates an exchange in Galesburg and employs a form of signaling apparatus made by the Sterling Electric Company, which was alleged to embody the invention of the patent in suit. The case was regarded as of some importance, because the patent was alleged to be the pioneer patent relating to common-battery automatic signaling boards. Edward Rector and George P. Barton were the counsel for the complainant and Charles A. Brown argued the case for the defendants. The patent contains 17 claims, and infringement was alleged on the sixth, seventh, eighth and eleventh of these claims.

Judge Seaman's decision has now been affirmed by the Circuit Court of Appeals for the Seventh Circuit, consisting of Judges Grosscup, Baker and Landis. The decisions in favor of defendants in this suit and in the suit upon patent No. 550,411, referred to in the Western Electrician of last week, are thought greatly to clear the patent situation, so far as the Independent telephone interests are concerned.

Inasmuch as the opinion of the Court of Appeals in the Galesburg case is of considerable technical interest, it is given herewith in full.

Claim No. 6 may be taken as a single comprehensive statement of the invention claimed. That claim is as follows:

6. The combination with a telephone line, of a relay responding to currents in the line, a local circuit including a source of current, a resistance-coil, and a line-signal lamp, controlled by the relay, the line-signal being associated with a spring-jack of the line, a connecting plug for use with the spring-jack, a clearing-out-signal lamp associated with the connecting-plug, and switch-contacts adapted to close a shunt-circuit, through the clearing-out-signal lamp about the line-signal lamp and the contact-points of the relay when the plug is inserted into the spring-jack, substantially as described.

This claim when applied to the art shows a combination within a combination, with means connecting the inner with the greater; and it is essential, in determining the scope of the patent, to keep in mind, as separate entities, this greater combination, this inner combination, and the specific means that connect them.

The greater combination is the telephone line, fully equipped with the signaling system described.

The inner combination is the signaling system—two signal lamps so placed in parallel branches of a local circuit that when either branch is open the lamp on the other will be luminous, and therefore a signal; but when both branches are closed, both lamps will be "effaced," and therefore neither a signal; this concept being mechanically embodied in the line lamp associated with a spring jack of the line, the connecting plug for use with the spring jack, the supervisory lamp associated with the connecting plug, the switch contacts, and the resistance coil controlling the flow to the lamps.

The means connecting the inner combination with the greater combination is the relay responding to currents in the main line, whereby the local circuit is connected electrically with the main line.

We see no invention in the mere selection of this connecting means—the connecting of the inner combination with the greater combination by means of the relay—relays to put electric lamps on local circuits into connection with the main lines of electric-lighting systems being in common use.

We see no invention in the mere selection, as signals, of electric lamps. The electric lamp, in the patent sense, is as old as sunlight. So also the placing of two or more lamps upon parallel branches of the same circuit. We do not think that the mere adaption to a telephone line of electric lamps as signals—apart from the special concept that the lamps should be so balanced, that on a massed current each lamp would be luminous, while on a divided current both would be non-luminous, and the mechanical embodiment of that concept—is patentable invention. The only new element, therefore, in the combination patented, is the concept named, together with the mechanical means in which it is embodied.

But here again, when we come to look at the prior art, there must be a further elimination.

That concept, to repeat what has been said before, is the so placing of two signal lamps in parallel branches of the same circuit that when either branch is open the lamp on the other will be luminous, but when both branches are closed neither will be practically luminous—a concept proceeding upon this thought, that a current might be so predetermined or pitched, that going through one of two lamps of identical character it would be sufficient to make that lamp practically luminous, but being divided in equal parts, between the two lamps, it would be so insufficient that neither lamp, practically, would be luminous.

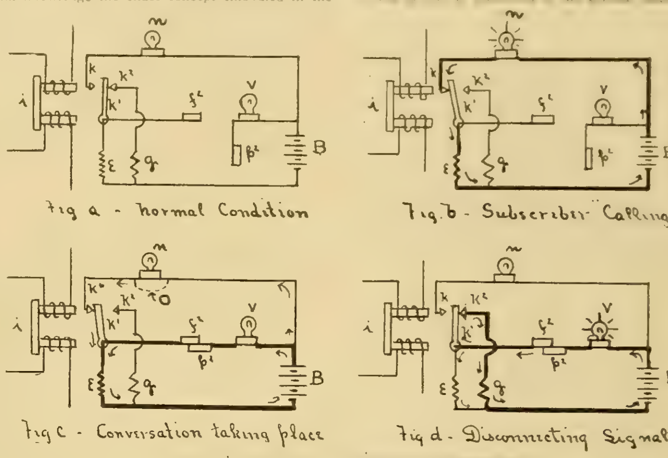
Now, except for this specific concept of the dif-ference of effect [illegible] massed and [illegible] to the point [illegible] the whole [illegible] being [illegible] 550,616, issued to [illegible] patent Scribner [illegible] indicator [illegible] associated with the [illegible] necting plug for use with the [illegible] visory signal associated with [illegible] and switch contacts [illegible] ent in suit. The [illegible] closing of the two [illegible] were located, at the same time [illegible] current of electricity, whereby [illegible] least, the current was divided [illegible] the difference, that whereas [illegible] each lamp present an equal [illegible] the current approximately [illegible] divided, in the earlier patent the signals present differing resistance, so that, though the current was [illegible] eled in differing voltage through both [illegible] the smaller current was so small that the signal placed upon it did not operate. Indeed, while Scribner, in the earlier patent, may not have contributed to electrical knowledge the exact concept embodied in the inner combination of the patent in suit, he did contribute there the thought that led up to his later thought; and, what is certainly to the point, the precise mechanism, save as such mechanism is modified by the substitution of electric lamps for indicator signals, and save also that for signals presenting differing resistances, he substituted, in the later patent, signals of identical resistance.

Here, then (considering that the mere choice of lamps as signals is not patentably a new thing), is the only element of the patent in suit not found in the previous art—identity of signal lamps, and an exact predetermined pitch of current, the identity of the lamps being essential because any difference of resistance would break the fine balancing of current upon which the whole conception rests; and a predetermined pitch of current, neither too high nor too low, being essential, because a current pitched too high, though it might make the lamps more luminous, would not, when divided, efface the lamps, while a current pitched too low, while when divided making the effacement more complete, would not, when massed, give sufficient luminosity.

The new element thus bounded and identified must not be lost sight of; for unless it is found substantially in appellees' device, the combination constituting appellees' device cannot be held to be an infringement.

The patent in suit, based on this element, had its defects. Theoretically, an equal division of current cuts such current into halves. But practically, the current being divided, the resistance is so diminished that each line of the divided circuit gets considerably more than one-half of the current massed. The effect of this is, that there is not such a wide difference between the luminosity of the lamp fed by the current massed and the current divided, as the inventor perhaps anticipated; so that, accessory to making the signals practical, these three things at least were added: The lamp was covered with a lens, not solely for radiating the light, but to partially smother it; the uniformity of the lamps had to be maintained—that is, the lamps not only had to be uniform when put in but replaced the moment that, through use, a difference in uniformity developed; and the batteries had to be kept at a given voltage—a variation of voltage or diminution of the flow destroying the fine balance upon which alone the luminosity and non-luminosity of the lamps are maintained.

That these defects were actual is shown by the fact that the patent in suit has not gone into gen-[illegible] light." [illegible]



DEFENDANTS' LOCAL CIRCUIT IN GALESBURG TELEPHONE CASE.

line by means of the relay, just as appellant's system is. But this does not make it an infringement; for, as already indicated, the mere insertion of such signaling system into a general telephone line, and the means by which that insertion is brought about, were, in the field of electric mechanics, as shown by the previous art, so obvious that they constitute separately no part of whatever was patentable in the patent in suit.

The appellees' system employs the device of a signaling lamp associated with a supervisory lamp, each being on a circuit alone at times, and both being upon a circuit together at times, with the result that when each is on the circuit alone it is a signal, but when both are on the circuit at once, neither are signals; together with the resistance coils, spring jacks, connecting plugs and the like, that mechanically bring this about. But this device, save that the association is on the main line, instead of a local circuit connectable, when signaling is needed, with the main line, and save also that the signal is an indicator instead of a lamp, is present, in all substantial respects, in patent No. 550,616; and as already stated, the mere substitution of an electric light for an indicator, and the mere placing of the signaling device on a local instead of the main line, do not constitute patentable invention. But even if they did, it would be of no consequence in this suit unless the inner element—the so placing of the lamps that they followed the law of the patentee's conception—is to be found substantially in appellees' combination. And that brings us to the system used by appellee.

The following diagrams show the appellees' system (1) in normal condition; (2) subscriber calling; (3) conversation taking place, and (4) disconnecting signal:

When the subscriber in appellees' system removes his telephone from its hook, the calling relay (i) attracting the armature (k") closes the circuit from the battery through the resistance coil (e), and the signal lamp (n) as shown by the heavy lines. The whole current being through (n), the lamp lights up and becomes the signal.

The operator now inserts the plug into the corresponding spring jack, thus closing the plug contact. Now the circuit being divided, if the lamps were of equal resistance, the current would be divided, as in the patent in suit, both lamps becoming partially non-luminous. But in appellees' system, appellees' lamp (v), interposing very much less resistance than lamp (n), and the current taking the path of least

resistance, the current practically passes almost altogether through lamp (v), according to the heavy lines in Fig. 3, leaving a small portion, if any, to pass through lamp (n), and thus electrically short-circuiting (n), just as signal (h) in patent No. 559,616 is electrically short-circuited by interposing in the path of the current a resistance higher than through the signal (e).

This diversion of current through (v) does not light the lamp, however, because (v) being a lamp of different character from (n), it requires a voltage greater than the whole voltage of the current when subjected to the resistance (e), the supervisory lamp in both cases considered to be in circuit. So the circuit through the resistance coil (g) is introduced, closed by the subscriber replacing his telephone; and (g) interposing a less resistance than (e), a voltage enough greater than the voltage through (e) alone is obtained that the lamp (v) is lighted.

Now compare this with what we have found to be the actual concept of the patent in suit. The patent in suit employs a single predetermined pitch of current, as it reaches the lamps through resistance (m), and would operate under no other conditions; the appellees' system carries a current varying according to the lamps to be lighted, and would operate under no other conditions. The patent in suit provides for extinguishment by an approximately equal division of the current, and looks in pursuit of this purpose to no other provision; the appellees' system provides for extinguishment of the line lamp by practically short-circuiting, and the supervisory lamp by a high candlepower, and would operate in no other way. The patent in suit involves the necessity of lamps of identical character—lamps so delicately matched that in dividing the current the flow through each lamp will be equal—and the patent in suit would operate under no other conditions; the appellees' system employs lamps so differing from each other in character that any close balancing of the lamps is a matter that is not involved. In the patent in suit the current must be pitched to almost an exact predetermined point, involving battery action constantly up to a certain point, and a resistance that is constant; the operation of appellees' system cannot be said to hinge in the least upon pitch of current. When we have thus passed over all that is old in art, reaching the actual concept covered by the patent in suit, the differences pointed out become fundamental. They mark two substantially differing lines of thought. And they have resulted in two distinct signaling systems, in the one of which the defects in the other have been escaped chiefly by avoiding all in it that was new, while readapting certain things in it that were old. This, in our judgment, differentiates the essential element under consideration in appellees' device from the element that gives to the patent in suit any patentable invention, if, indeed, it have any patentable invention. Wherefore it follows that the one combination is not an infringement upon the other.

The audible test being governed by the same consideration need not be further discussed.

The decree of the Circuit Court is affirmed.

Nebraska Independent Telephone Association.

The Nebraska Independent Telephone Association held its annual convention in the Lindell Hotel, Lincoln, Neb., on January 23d and 24th. At the opening session on Tuesday afternoon over 50 companies were represented by more than twice as many delegates. The forenoon was given over to inspecting the exhibits of jobbers and manufacturers who had representatives at the convention. The meetings were open only to members. At the first session reports of officers and committees were heard, and these were more encouraging than at any previous meeting. The outlook for the Independent men was declared to be much brighter than a year ago. Theodore Gary of Macon, Mo., vice-president of the National association, and Mr. Fisher of Shenandoah, Iowa, spoke at this session. Mr. Gary described improvements in instruments and equipment, and Mr. Fisher told of the advances made in long-distance Independent lines. He said it was possible to telephone over Independent lines from almost any town in Iowa to St. Louis, Kansas City and the principal towns in Nebraska except Omaha.

In the evening the Telephone Traffic Association conducted the meeting. This association is a sort of clearing house, which serves the companies by effecting equitable divisions of toll rates when long-distance calls have to be sent over several lines.

At the session on Wednesday afternoon plans were discussed whereby Independent men may get a franchise in Omaha, so that connection may be made with outside lines. Resolutions were adopted stating that, whereas there are about 8,000 Independent telephone stockholders in Nebraska, all business men, and as these men desire to deal with jobbers who have Independent telephones, the cities whose jobbing houses have no Independent telephone facilities cannot expect the trade of these stockholders. This resolution was intended to influence Omaha business men to exert their influence toward the granting of Independent entrance into Omaha. The legislative committee which tried to secure enactment of a law compelling the city of Omaha to admit the Independent telephone lines was continued. It includes Frank Woods and A. W. Field of Lincoln and W. E. Bell of York.

The association voted to divide the state into five districts, each to have an association subordinate to the state association. Secretary Mattison and the executive committee will have charge of organizing the districts, each of which will have a presiding officers, who will be a vice-president of the state association. G. J. Garlow of Columbus and Frank Woods of Lincoln addressed the afternoon meeting.

Officers for the ensuing year were elected as follows: President, Frank H. Woods of Lincoln; vice-president, W. Clapp of Kearney; secretary and treasurer, R. E. Mattison of Lincoln; members of executive committee, F. H. Woods, W. Clapp, R. E. Mattison, W. E. Bell of York, Thomas Parmelee of Plattsmouth and G. J. Garlow of Columbus.

The traffic association will endeavor to gain admission to the National-Interstate association, and elected delegates to attend the convention in St. Louis in June. The officers of this association and the delegates are: President, T. T. Pollock of Plattsmouth; vice-president, W. E. Bell of York; secretary, R. E. Mattison of Lincoln; treasurer, F. H. Woods of Lincoln; delegates, F. H. Woods, T. H. Pollock and W. E. Bell.

The convention closed on Wednesday night with a banquet at the Lindell Hotel. The banquet was given to the members of the association by the manufacturers and jobbers, and an elaborate dinner was served. A. W. Field of Lincoln was toastmaster and the following gentlemen responded: "The Sign of the Times," Theodore Gary, Macon, Mo.; "Looking Into the Past," I. D. Clark, Papillion; "Friends and Foes," A. J. Munro, Omaha; "Twenty-five Years Hence," G. A. Briggs, Elkhart, Ind.; "To See Ourselves as Others See Us," William J. Crawford, Chicago; "Between Now and Then," G. J. Garlow, Columbus.

Indiana District Telephone Meeting.

The third quarterly meeting of the eighth district of the Indiana Independent Telephone Association was held in Richmond on January 24th. Representatives were present from every county and a majority of the companies of the district. A. C. Lindemuth, president of the district organization and vice-president and member of the executive committee of the state association, presided. George Watts of Knightstown acted as secretary in the absence of C. A. Phelps. The morning session was devoted to the regular order of business, including reports from committees, after which the 20 delegates and visitors present were the guests of the Richmond Home Telephone Company at dinner at the Westcott Hotel.

At the afternoon session W. G. Thompson, general manager of the Home Telephone Company of Hamilton, read a very interesting paper entitled "Two Independent Telephone Companies as an Investment, and Their Management," the two companies referred to in the paper being the Valley Telephone Company, with seven exchanges, operating in Warren and Trumball counties, and the Home Telephone Company, operating at Hamilton and throughout Butler County, Ohio, both being under one management. The paper clearly demonstrated that Independent telephone companies, established even under the most unfavorable conditions, can be made to pay dividends and placed on a solid basis if right business methods are employed.

William M. Bailey, superintendent of the Richmond Home Telephone Company, read a paper entitled, "How Can We Improve Our Local Telephone Service?" in which he discussed the relative speed of service through common-battery and local-battery magneto systems. His paper indicated a comprehensive and practical knowledge of the entire conditions that make for better service. Both of the papers brought out a spirited discussion.

The latter part of the evening session was devoted to a general discussion of the Independent interests in the district and in perfecting traffic relations among the various members. It was the unanimous opinion of those present that the outlook for the Independents in the state was never better.

Extension-telephone Litigation.

The Chicago Telephone company has filed a bill for an injunction to restrain the Madison Electric Company from installing private telephones connecting with its wires. The two corporations have been fighting a year and a half. The Chicago Telephone Company charges varying rents for trunk lines, switchboards and extension telephones. The electric company installs extensions for customers and sells the fixtures outright, asserting that each telephone subscriber, with unlimited service, has a legal right to use his telephone every minute of the 24 hours of each day, and that extensions simply assist the telephone company to transact its business, are a convenience for the subscriber, and neither take from the telephone company anything that belongs to it, nor increase the value of the service beyond the point that patrons are entitled to. The bill charges a conspiracy, and says that it is impossible for the telephone company to keep its system up to the standard without instruments of uniform character.

Ohio Telephone Notes.

A meeting of the stockholders of the Federal Telephone Company was scheduled to be held at East Orange, N. J., February 1st, to take action to enable the board of directors to handle the properties of the company or make such changes in the business as may be deemed best for all concerned.

The regular quarterly dividend of one per cent. was declared by the Columbus Citizens' Telephone Company a few days ago. Reports of officers show that new telephones at the rate of 125 per week are being installed now.

Stockholders are well pleased with the annual report of the Akron People's Telephone Company, which is just out. The company has 4,230 subscribers and outstanding bonds of $338,500, drawing five per cent. interest. The gross earnings for 1905 were $96,568, in comparison with $90,515, the year before. The surplus was $22,606 and in 1904 it was $21,218.

Superintendent Hanna of the Dayton Home Telephone Company stated that there was nothing in the story that a two-party line service would be introduced. Rumors have been afloat to the effect that such a service would be installed and that the rate for residence telephones would be $1.50 a month and for business houses $2.50 a month. In addition, it was said that the automatic switchboard would be increased in capacity to accommodate the additional service.

Bills introduced in the Legislature at Columbus prohibit the granting of free telephone service to officeholders.

A dispatch sent out from Toledo declares that a movement has been started to merge all the Independent telephone companies between Pittsburg and Kansas City into one company. This it would seem, is in opposition to the policy of grouping the companies in a smaller way, although the report may refer more especially to the long-distance lines.

Mayor Whitlock of Toledo has taken the stand that he will pay for the telephones in his residence and that the city must pay for the telephone service furnished it. The mayor says that under a recent decision of the Supreme Court no city has a right to accept favors from a telephone company, and he proposes to live up to it and have the city do so.

The Clarksfield Telephone Company of Clarksfield has been incorporated with a capital stock of $9,975 by H. F. Fletcher, E. E. Rowland and others.

At Fisher the Farmers' Telephone Company has been incorporated with a capital stock of $2,500 by W. Dalton, R. W. Patterson and others.

The Fonogirl Company of Columbus has been incorporated with a capital stock of $30,000 by Charles B. Thomas, Fred N. Sinks, J. L. Raymond, C. M. Addison and others. The company will have offices in the Columbus Savings and Trust Building, where a force of stenographers will be employed and will take dictation over the telephone. A similar enterprise has been in operation in Cleveland for some time.

C.

Indiana Telephone Items.

The Richmond Home Telephone Company has elected A. C. Lindemuth president, E. H. Gates, vice-president; J. W. Moore, secretary; W. P. Orr, L. M. Flesh and W. M. Bailey, directors. The company now has 2,577 telephones in service in the city. Those in the rural districts and throughout the county makes the total 5,000 or more. It is understood that the matter of consolidating all the Independent companies in the county was discussed, and it is probable that such a course will be taken soon by the larger companies, and these in turn will be formed into a co-operating company which will extend its lines over the entire country.

The Citizens' Telephone Company of Columbus has elected Thomas D. Sheerin president; C. S. Norton, vice-president; M. S. Hosea, secretary, treasurer and general manager. H. B Sale, formerly secretary, resigned, but retains his place on the board of directors.

The Newcastle Independent Telephone Company is asking the City Council for a new franchise. As matters now stand, there is a mixed agreement between the town, the telephone company and the light, heat and power company, all using the same poles.

The New Long-distance Telephone Company has been granted a franchise for both a local system and a long-distance station in Spencer. It is understood that a local company will be organized to install and operate the local system.

The Dillsboro Telephone Company has elected F. H. Sale, president; George F. Heffelmeyer, vice-president; Fred Lubbi, secretary-treasurer. The board decided to build and equip a new and modern telephone plant.

For some time the Central Union Telephone Company has been trying to locate its office in a downtown district in Rushville, meeting the opposition of the local Independent company. At last an agreement has been reached between the two companies whereby the Central Union people are allowed to place a long-distance booth in the local company's exchange, on the written condition that it will cease its efforts to get a franchise for a complete city plant for local service in Rushville.

S.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has completed arrangements for the complete control of the Minnesota Central Telephone Company with headquarters at Willmar, Minn. The company has a mileage of 2,000. The auditing department will be removed to Minneapolis.

The Twin City Rapid Transit Company will extend wires to Big Island in Lake Minnetonka, from Excelsior, Minn., in order to have a telephone dispatch system for managing its system of interurban electric cars from Minneapolis, and the lake boats to the island from Excelsior.

William Buchholz, formerly manager of the Mankato (Minn.) office of the Northwestern Telephone Exchange Company, has gone into the lumber business at Morgan, Minn.

The Tri-State Telephone Company seeks a franchise at Crookston, Minn., for a competing local exchange.

The Sedan Telephone Company has been formed at Sedan, Minn.

The Great Northern Telephone Company of Williston, N. D., is putting in an exchange at Culbertson, Mont.

The New State Telephone Company of Sioux City, Iowa, has purchased the Northeastern Nebraska Telephone Company's toll lines, embracing more than 200 miles. The company will construct a new toll line to Omaha.

James Fisher and others have incorporated as the Western Crawford County Farmers' Telephone Company of Eastman, Wis.

The Boone County Telephone Company will expend $15,000 in improvements to its system at Ames and Boone, Iowa.

J. E. Quinlan and others of Rock Valley, Iowa, have incorporated as the Klein Rural Telephone Company, with a capitalization of $2,000.

The Hawkeye Telephone Company will install a new switchboard at Valley Junction, Iowa, and otherwise improve its system.

The Wisconsin Telephone Company will move its exchange into a larger building at Neenah, Wis. Extensive underground work will be done at Neenah and Menasha this year.

The Iowa Telephone Company is planning to install an entirely new central-office apparatus. R.

New England Telephone News.

Two telephone exchanges in Eastern Massachusetts were visited by fire within the last week. At Woburn, Mass., Miss Lillian S. Graves, chief operator, distinguished herself by coolly using the fire extinguisher and putting out the blaze before much damage had been done, although the switchboard was out of commission for about two days. At Manchester, Mass., the building in which the local exchange is located was gutted, and the loss to the telephone company was about $10,000, covered by insurance. Here, also, the operator, Anna Haraden, displayed much courage, giving the alarm for the fire, which started in the boiler room and spread to the exchange.

The New England Telephone and Telegraph Company has declared its regular quarterly dividend of 1½ per cent., payable February 15th.

At Portland, Maine, Judge Strout issued a temporary injunction on January 23d, restraining the majority of the stockholders of the Northeastern Telephone Company of that city from issuing $200,000 of its preferred stock. Notice could not be served on Clerk O. H. Hersey, the only Portland resident officer of the company, as he was not in the city. B.

NEW COMPANIES.

The Central Exchange Telephone Company of Paloma, Ill., has been incorporated by J. W. Henry, O. H. Lawless and Joseph Dickhut.

The Citizens' Mutual Telephone Company of Vantown, Mich., with 20 members and a capital stock of $6,000, has filed articles of incorporation.

The Menno Rural Telephone Company of Pierre, S. D., has been incorporated with a capital stock of $25,000 by G. W. Munsmer, M. H. Claggett and Peter Gundmunson.

The Lakewood (Ill.) Mutual Telephone Company has been incorporated with a capital stock of $2,500 to operate a telephone line. The incorporators are Charles H. Duckett, J. E. Bowman and E. A. Weakley.

The Oregon City Farmers Independent Telephone Company has been incorporated at Oregon City, Ore., by W. H. Bonney, C. G. Huntley and C. G. Caufield. The company has an authorized capital stock of $5,000.

Among the recently incorporated telephone companies are the following: Star Telephone Company, Hallam, Neb.; Lilly Local Telephone Company, Lilly, S. D.; Garrett Telephone Company, Garrett, Kan.; Northwestern Mutual Telephone Company, Weatherford, Okla.; New Cambria Telephone Company, New Cambria, Kan.; Pioneer Rural Telephone Company, Hitchcock, S. D.; Deer Creek and Lamont Telephone Company, Lamont, Okla.; Kinsman Independent Telephone Company, Kinsman, Ill.

GENERAL TELEPHONE NEWS

A new telephone exchange [illegible] at Rome, Ga., [illegible] Company.

The Quincy [illegible] Company of Quincy, Ill., [illegible] stock of $2,000 [illegible] F. J. [illegible] and S. [illegible]

The Colorado Telephone Company is planning [illegible] installation of a new system [illegible] The company's line between [illegible] and Albuquerque is almost completed.

The Sunset Telephone and Telegraph Company of San Francisco has announced [illegible] improving its system at [illegible] lines will be replaced by two-part [illegible]

The City Council of Kirksville, Mo., has granted a franchise for 20 years to Matthew Murdock, who will put in an Independent exchange, which will form part of an unbroken Independent line from St. Louis to Des Moines, Iowa.

Superintendent M. B. Speer of the Charlotte division of the Southern Bell Telephone Company has succeeded in purchasing for his company the local exchanges at Laurinburg and at Gibson, N. C. These, with the exchange at Hamlet, N. C., will be managed by J. B. Maxwell, former manager of the exchanges at Laurinburg and Gibson.

By a slip of the pen the name of Albert G. Wheeler was given as president of the Chicago Telephone Company in a summary of the annual report of that company in last week's issue. As is well known, the name should have been Arthur D. Wheeler, who is the president of the Chicago Telephone Company.

Preliminary steps were taken last October in Cincinnati to form an organization to have as its object the increasing of knowledge concerning problems of modern telephone practice. Organization has now been completed and the society will be known as the Cincinnati Society of Telephone Research. There is already a good membership and the officers are: President, R. Hiltbrand; first vice-president, C. Durham; second vice-president, B. Seavers; secretary and treasurer, F. Arens.

The Michigan State Telephone Company's directors have approved estimates of expenditures for improvement extensions for 1906 aggregating $1,260,000. At least 20,000 more telephones will be installed, it is predicted. Dudley E. Waters, president of the Grand Rapids National Bank, has been elected vice-president to take the place of Truman M. Newberry. Approximately $600,000 was spent in maintenance for the year ended April 30, 1905, all of which was charged directly to expenses.

Hitherto it has been found impracticable to communicate by telephone between Frankfort, Germany, and Vienna, Austria. The difficulty did not arise in any way on the side of Austria, it is said, the Austrian government having done its utmost to facilitate matters. The chief cause of the delay has been the unsuitable character of the wires through Bavaria, but as these have now, it appears, been replaced by larger ones, recent experiments have given favorable results, and it is probable that the line will shortly be open for public use.

Stockholders of the Missaukee (Mich.) Telephone Company at a recent session at Lake City elected H. S. Lamb president, Fred Rose vice-president, Mrs. M. M. Peck secretary and treasurer, George S. Stout general manager. It was decided to increase the capital stock to $20,000, and in addition to the regular quarterly two per cent. cash dividend theretofore authorized, a special stock dividend of six per cent. was declared. The company will purchase the Lake City Telephone Exchange, now owned by Mrs. M. M. Peck and G. S. Stout.

Henry T. Scott of San Francisco is to succeed the late John I. Sabin as president of the Pacific States Telephone Company, according to a statement credited to President Fish in the Boston Transcript of January 23d, which says: "President F. P. Fish of the American Telephone and Telegraph Company has returned from a three weeks' trip to the Pacific Coast. He made a careful investigation into the affairs of the Pacific States Telephone Company, a lessee of the American company, and was greatly pleased with the telephone development in the far West. Mr. Fish states that Henry T. Scott, formerly president of the Union Iron Works of San Francisco, will be elected president of the Pacific States Telephone Company to succeed the late John I. Sabin. In the territory covered by the Pacific States company, namely, Washington, Oregon, California and Nevada, there are more than 200,000 telephones. No consideration has been given to any new financing plans."

An attractive folder from the Stromberg-Carlson Telehone Manufacturing Company of Rochester, N. Y., takes up the subject of transmitters, giving some general facts about this part of the telephone and also describing in detail the Stromberg-Carlson transmitter as exemplified in its latest products.

Types of Cars for City Service.

[illegible]

DENVER CENTRAL-ENTRANCE CAR.

car is illustrated herewith, while the following is taken from the communication of Mr. Beeler, which was forwarded in due course.

The length of the car over all is 41 feet six inches; width of aisle, 23 inches; seating capacity 48. The car is constructed with a forward and a rear compartment divided by the center entrance space. The car is semi-convertible and is equipped with GE-58 motors. Its weight is 37,000 pounds.

This type of combination car was adopted by the Denver company for several reasons, one of which was the climatic conditions which obtain in that locality. The car is well adapted to the climate on account of the warm days and cool nights which are common all the year round. Even during winter months, many of the people prefer to ride in the open air. During the warm summer days the entire car is opened, but during the evening the front compartment is closed, making a comfortable place for those who do not care to ride in the open. In case of a sudden storm, also, the front compartment can be closed in at a moment's notice. During the winter the forward compartment is closed and heated electrically, but those who do not care to ride in a heated car patronize the rear compartment, where fresh air is always obtained, owing to the wide center entrance, which is never closed.

This type of car is safe to operate, as the conductor is at all times at or near the only entrance, even when collecting fares his average distance from the entrance being only one-fourth the length of the car. The company also finds the central entrance facilitates loading and unloading, as the passenger cannot walk more than half the length of the car in getting to the door. In collecting fares the conductor has the advantage, since by the time he is half through collecting he is at the entrance, and much "dropping off' is thereby prevented, which is an item of considerable financial importance.

Another feature in the operation of the Denver system is the use of trailers during the rush hours. The trailers are similar to the motor cars, except that they are lighter in construction, the weight being 12,300 pounds. They are readily attached during rush hours. They are safer than independent units on the street, as they are handled by regular motormen instead of "extras" who would be employed during rush hours if each car was a motor car. Each trailer accommodates practically as many passengers as a motor car; it requires no motorman and carries less dead weight, all of which contribute to the economy of its operation. A four-motor car as above described requires 2.5 kilowatt-hours per car-mile; when hauling a trailer, one kilowatt-hour per car-miles is required in addition.

After presenting the communication from Mr. Beeler, Mr. Damon showed to the Electrical Section a number of lantern slides of diagrams of cars suitable to city service. These diagrams represented no cars actually constructed, but embodied several practical ideas which might be adopted in the construction of such cars.

Power Transmission Projects in South Africa.

Robert Hammond of London, the well-known electrical engineer, does not think the proposed 745-mile electric power transmission from Victoria Falls to Johannesburg is commercially practicable under existing conditions. He writes to the London Times as follows:

"Mr. W. B. Esson has recently estimated the total cost of the transmission line, to deal with 20,000 horsepower, at £2,000,000, a figure which I am able fully to confirm. Allowing 10 per cent. for interest on capital and for maintenance and renewals, we have a total annual cost of the transmission line of £200,000. On the credit side in favor of the waterpower scheme we have the great economy resulting in the saving of the entire coal bill of a steam station, together with various subsidiary economies such as a saving in wages, waste, oil, water and stores. If, therefore, the coal bill of a steam plant dealing with a similar output approaches £200,000, we have at once a convincing proof that the waterpower scheme has the advantage. On the other hand, if the coal bill is considerably less than £200,000, it is obvious that the waterpower scheme could not possibly compete with one relying upon steam. Now, sir, coal, having a calorific value of 11,000 B. T. U.'s per pound, can be delivered into the bunkers of the steam station which I have in view for 5s. a ton, and at any point on the Rand for 10s. 6d. a ton. On the basis of a maximum load of 20,000 horsepower, or 15,000 kilowatts, and on the basis of the load factor adopted in this controversy, the output would amount to 87,500,000 units per annum. Assuming the reasonable rate of consumption of four pounds per unit, the coal bill of a steam plant would amount to £43,750 on the basis of 5s. per ton for coal, or £91,875 on the basis of 10s. 6d. per ton. Taking the higher figure, it appears that Mr. Wilson Fox's scheme saves £91,875 per annum plus a small sum to cover other minor savings, and in order to do it the annual expenditure of £200,000 is necessary."

Another scheme proposed is the installation of an electric generating station at Vereeniging, capable of developing 100,000 horsepower, for supplying the needs of the Witwatersrand. Vereeniging is 32 miles in a straight line from the Rand, and it is intended to utilize the coal fields in the Vereeniging district, where a plentiful supply of water is also available. The promoters of the scheme contemplate the provision of electricity for power purposes and for the supply of light and heat to the whole reef, including Johannesburg and the neighboring towns. They anticipate that the scheme will enable large economies to be effected in capital expenditure in the various mines and in the working costs.

Extensions to South Side Elevated.

The South Side Elevated Railroad Company of Chicago at its annual meeting reported net earnings of $660,385 for the year ended December 31, 1905. This is the best report in the history of the company. The total earnings were $1,713,347, and the total operating expenses $1,052,962. The elevated road to Englewood was practically completed during the year and is now in partial operation. Extensions during 1905 cost about $2,500,000. President Carter said that 82 per cent. of the new third track had been erected. The express service could not be established, however, until all the work had been done. He said 150 new cars had been ordered and were arriving. These operate successfully in trains with the present equipment, and all can be used for either local and express service. Power was greatly added to during the year by the completion and putting on the line of an additional storage battery of 1,000 kilowatts capacity. The addition to the power house he said would provide two new engine-driven units of 2,000 kilowatts capacity each. They should be ready for operation in the spring.

Books Received.

"Electric-wiring Diagrams and Switchboards." By Newton Harrison. Published by the Norman W. Henley Publishing Company, New York. Price, $1.50.

"Modern Machine Shop Construction, Equipment and Management," by Oscar E. Perrigo. Published by the Norman W. Henley Company, New York. Price, $5.

"The Practical Engineer's Handbook—the Care and Management of Electric Power Plants." By Norman H. Schneider. Published by Spon & Chamberlain, New York.

Mayor Dunne has vetoed the order requiring the removal of turnstiles on the elevated loop. He said the order had been passed on the ground that the turnstiles were causing public inconvenience. He said he had investigated as to whether the turnstiles were a nuisance and had been assured that they were a necessary and usual adjunct to the service and ought not to be removed.

CORRESPONDENCE.

Great Britain.

London, January 17.—Surface-contact traction systems in this country tend to become quite numerous. It is well known that for some time the Wolverhampton Corporation has had the Lorain system working a fair mileage; it will also be remembered that the Dolter company has parliamentary powers to construct lines upon its system at Torquay, and in fact the lines are now in course of being built. Further, I have recently reported that the Lincoln Corporation had in course of construction an experimental mile upon the Griffiths-Bedell system. This latter has now been opened. I propose to give a few further particulars of this installation shortly. In addition to these cases there is now being built a six-mile section of line on the Dolter system between Mexborough and Swinton in Yorkshire, in connection with which a scheme embodying the lighting of three towns, and tramway communication between them, is now being undertaken.

At Lincoln 1¾ miles of single track and half a mile of double track has been equipped with the "G. B." system, which I described in the Western Electrician some time ago and which, I believe, is familiar to American engineers. As at Wolverhampton, the contractors for the line have had to undertake the withdrawal of the system should the result be unsatisfactory after a short time. A feature of the line is that a level crossing exists at one portion of the route where the lines of the Great Northern Railway Company cross those of the tramway. With this system the contact studs do not project above the surface of the roadway, and the conductor is carried in a glazed earthenware pipe in which it is supported on porcelain insulators. The skate underneath the car, which is magnetized, causes a small switch-piece to descend onto the conductor and so to give the necessary connection to the car. Besides reliability, great cheapness is claimed for the system. A stud, it is stated, will last as long as the rails, and it is estimated that it will not cost any more to renew the studs over one mile of track than to replace a similar length of trolley wire. The results at Lincoln will be watched with interest.

For many years the postoffice authorities have been worried by the inclination of the various chambers of commerce throughout the country to expedite the laying of additional underground cables for both telegraph and telephone purposes to the north of England and Scotland. Realizing the business necessity for such additional communication, the laying of a cable and the first section was completed some years ago between London and Birmingham. From that point to the north of England and on to Glasgow geographical and other difficulties have greatly hindered the work; hence it is that only quite recently has the complete cable been laid and opened for traffic. The Birmingham section of the cable consists of 76 paper-insulated lead-covered cables, each weighing 150 pounds a mile; from Birmingham to Warrington there are 74 100-pound wires, and similar cables on the section between Warrington and Glasgow, but laid up in a different manner. The total length of the cable is 409 miles.

The opposition in the next Parliament to the various electric-power companies throughout the United Kingdom promises to be keener than ever, and already an organization of the various petitions is being put in hand. In Lancashire all the local authorities have combined to fight the Lancashire company and the same thing will apply to the various companies in London, while more than one borough council in London has decided to oppose the scheme of the London County Council, and it is the boroughs that the latter has to look to most for its business.

Instances frequently occur of the need for a revision of the law relating to vibration in neighboring premises set up by plants which have to give, by law, a public supply of electricity. Under some conditions the owners of the electricity works is liable for heavy compensation in respect of any such vibration, while under another law he is not. An attempt has been made in a general act to exempt public works, such as are electric-generating stations, from the operation of such acts, but without success. This year a large number of authorities are seeking individual powers of this character. A recent case of what does happen in this connection has occurred at Manchester, where the owner of some property adjoining the municipal electricity works has practically forced the corporation to pay him $5,000 a year instead of taking the matter into court. As the law now stands the corporation would either be bound to remove its works or abate the nuisance, which is really infinitesimal, but yet a nuisance in the legal sense.

The recent orders of British makers of turbines show that there is a great field for this type of machine here. Willans & Robinson, makers of the well-known Willans engines, have had no less than 50,000 kilowatts under construction in one year, the largest size being 5,000 kilowatts. These machines are of the Parsons type and are made under license.

A return has been issued having reference to the mileage and other details concerning street tramways in Great Britain. Since the year 1878 the length of route open for traffic has been increased from 269 miles to 2,117 miles in 1904-5, the capital expenditure from about $21,500,000 to $272,500,000, and the number of passengers carried has increased from 146,000,000 to 2,069,000,000. The actual length of line worked electrically is 1,780 miles, and the remainder, making 2,117 miles, are worked by horses and steam, but the next two years at most will see these displaced by electric traction. Municipal undertakings have increased during the last year from 160 to 174, and the number belonging to companies has diminished in the same period from 150 to 146. About $1,000,000 was paid by local authorities toward the relief of rates from tramway revenue during the year 1904-5. G.

New York.

New York city, January 27.—On Wednesday at Albany the Interborough-Metropolitan Company of New York was incorporated with a capital of $15,000 for the purpose of holding the stocks and bonds of the companies operating the transportation lines in Greater New York and vicinity. This company has a charter for 999 years, and details were made public today of the manner in which the stock of the Interborough and Metropolitan companies will be held or reorganized with a total paper capitalization of $225,000,000. The directorate of the holding company includes John B. McDonald, the constructor of the New York subway, who, it will be remembered, left the Belmont concern to supervise the proposed subway schemes of the Metropolitan Street Railway Company. Mr. McDonald is now definitely connected with the Belmont interests and ceases to be identified with any rival schemes. Then there is Walter G. Oakman, who is president of the Hudson tunnel companies; Peter A. B. Widener of Philadelphia and Morton F. Plant. Mr. Oakman has been elected temporary chairman of the new board, and a board of voting trustees has been formed which includes the above with the addition of August Belmont, Thomas F. Ryan and Cornelius Vanderbilt. The actual details of the financing of the merger are too complicated to be mentioned here, except to state that about $3,000,000 cash is to be forthcoming and that each of the two chief traction companies will deposit two-thirds of its stock with the holding company. Nothing has been divulged to show that the Pennsylvania Railroad has any relations with the merger, but it is not clear about the position of the Brooklyn Rapid Transit.

Plans are awaiting approval of the city authorities for the lengthening of the local subway platforms to accommodate eight-car trains in place of the five-car trains now used. The express stations will not have to be altered. A discussion is pending as to the necessity of guard rails at various stations, but these rails have this week been put up at Fourteenth Street.

In May last year the Interborough Rapid Transit Company was denied an application to construct a third or express track on the Third Avenue Elevated line, but, according to the allegations of the City Club, the company is proceeding illegally to lay the track, in proof of which photographs have been forwarded to the mayor.

A bill has been introduced at Albany to provide for an eight-hour working day for subway employes.

Gossip is current that the New York, Westchester and Boston railroad has acquired a controlling interest in the Port Chester scheme, but the affirmations and denials of the presidents on both sides are so emphatic as to leave confusion worse confounded. The Westchester has a franchise for an electric road in the Bronx and defeated a similar application made by the Port Chester company. That the Port Chester company anticipates ultimate success is shown by an attempt it has made to bind the labor unions down to a three-year contract.

Compressed air escaping from the McAdoo Tunnel under Greenwich Street, Manhattan, forced its way through 30 feet of earth this morning and raised a portion of the sidewalk five feet above its normal level. The air has been escaping through the loose soil in small quantities for several days past.

Thirty-one bodies were represented at a meeting held at the Board of Trade on Thursday afternoon for the discussion of the effective control by the city of all future subway systems. Brooklyn delegates were solid for city subways, but Manhattan representatives indulged in some heated discussion. A meeting for a similar purpose will be held in Brooklyn on Monday.

District Attorney W. T. Jerome is said to be in possession of a confession of a man who avers that he was formerly hired by the Metropolitan Street Railway Company for the purpose of influencing juries in damage suits. The documentary evidence implicates men higher up.

A. C. Shand, now assistant, will become chief engineer of the Pennsylvania Railroad on March 1st, when Chief Engineer W. H. Brown retires on a pension.

The Great Eastern Telephone Company is busily canvassing all the boroughs for private and commercial business and in some cases offers an unlimited residental rate of $1 a month, with the first six

months free to the first 10,000 subscribers. The lowest business-message rate is two cents, and the Interborough rate will be five cents within a five-mile limit. The form of contract makes it possible to bind the company down to these low rates for as long as five years. Long distance connections with 200,000 instruments are guaranteed.

The Duplex Ignition Company of 150 Nassau Street has put a new spark plug on the market which is so made that by pulling out a sleeve the inductance equals the capacity (by operating what is in reality a miniature Leyden jar), so that any stoppage of the action due to soot, etc., is immediately overcome.

Bids for the annual contracts for the electric lighting of Brooklyn are returnable on February 1st, but it is not anticipated that any change either of contractor or prices will result. D. W. W.

Dominion of Canada.

Ottawa, Ont., January 27.—A large American telephone supply company, having headquarters at Elkhart, Ind., has written the city clerk of Ottawa as to the city's business advantages, rail and water facilities and the mineral resources of the district, with a view to locating a branch house here.

The Canadian commission that studied electric smelting in Europe was satisfied with results obtained in the case of hematite, but it remains to be seen whether magnetite ores, which so largely abound in Ontario and Quebec provinces, can be smelted at an equally low cost.

The Canadian Gazette contains notice of the incorporation of a big construction company with a capital of $6,000,000, and headquarters in Montreal. The principal promoters of the company are A. MacArthur, A. F. MacArthur, Chicago; J. R. MacArthur, New York; W. J. Poupore and G. C. Foster, Montreal. In addition to a general constructing business the company will carry on the business of an electric-light, heat and power company in all its branches.

Something new in the steel industry is Canadian steel made direct from sulphurous ores by electric furnace. A sample of this steel has been sent to the Ontario director of mines by J. W. Evans, mining engineer, of Deseronto, Ont. This sample was accompanied by other samples of steel made by the same electrical process from titanium ores. Although the experiments in the treatment of the ores were carried out only on a laboratory scale, they are nevertheless considered most encouraging. Titanium in iron ore has been considered a drawback in the reduction of the ore in the blast furnace. Too much sulphur has also resulted in an inferior quality of iron. In Ontario there are iron deposits that can be made of great advantage should the electrical process prove the success that the experiments now promise it will. W.

Winnipeg, January 27.—The city is about to force the Winnipeg Street Railway Company by legislative enactment to put air brakes on all street cars in the city, to install electric push buttons at each car seat and to prevent smoking in car vestibules.

The power for electrifying the Temiscaming railway is to be developed from the Montreal River, which is on the line of the railway not far from Cobalt, Ont. This will help the mining industries there.

The St. John (N. B.) Electric Railway Company has offered to again supply the city with electric lights at a reduced charge if the present contract is renewed, which expires next August. The city proposes to seek legislative sanction to expropriate the street-railway company's plant.

The Toronto and York Radial Electric Railway has given notice of an application to the Legislature for an act to empower it to operate the Toronto and Scarboro Electric Railway, Light and Power Company, the Toronto and Mimico Electric Railway, Light and Power Company and the Metropolitan Electric Railway, and conferring on the Radial company all the powers already held under the acts of the separate companies. Authority is also asked to construct and operate several branches.

The London electric street railway has re-elected the old board of directors. The report shows a slight increase of earnings. A dividend of six per cent. was declared.

The Port Arthur (Ont.) City Council has carried the by-law for the running of Sunday cars and is now making application to the Legislature for permission to build a belt line through the residential portion of the town. This also equally applies to Fort William, which is joint owner of the railway.

The Edmonton (N. W. T.) City Council has decided to build three miles of electric street railway and run it as a municipal undertaking.

Chairman Hendrie of the Railway Commission has completed the draft of the government bill for the regulating of electric railways in the Province of Ontario. It contains clauses preventing the giving of perpetual franchises by municipalities, allows expropriation to interurban lines, regulates freight cars, etc., on radial and interurban electric railways whose lines are on the public highways, and there are provisions for the protection of crossings. Bonding privileges are also clearly defined in the act, which also contains regulations as to rates. Reference of disputes between municipalities and railways to a federal [illegible] is also provided [illegible] as to the [illegible] should be [illegible].

G. W. [illegible] [illegible] which had [illegible] for new equipment, etc. [illegible] expended on [illegible] feed lines, etc., and [illegible] substations, etc., the [illegible] being to bring [illegible] station up to a higher state of efficiency. H.

New England.

Boston, January 27.—The [illegible] over the proposition to establish a municipal electric-light plant in the city is getting warm, and trade organizations like the Boston Chamber of Commerce, Merchants' Association and other influential bodies are taking a hand. The two named have formally expressed their disapproval by vote of the directors, and the business men generally are opposed to the scheme.

Of course the Edison Electric Illuminating Company of Boston is following the proceedings with a watchful eye. The wonderful growth of that company and the fact that its service is appreciated fully by many of the largest merchants of Boston make it a factor in the situation. There are lots of business men who believe that the cost of an electric lighting equipment on the part of the city would be a costly thing for the citizens as a whole, and especially for them as heavy taxpayers.

The law under which municipalization of electric-light plants is authorized in Massachusetts is very advantageous to existing electric-light plants and shuts off competition by compelling the purchase of existing public-service corporation plants at a valuation based upon the market value of these plants, earning capacity, etc., taken into account. It is not the mere cost of duplication, therefore, which has to be considered, but the cost of putting existing industries out of commission and of reimbursing stockholders for the supplanting of their investment with a governmental monopoly.

The proposed new Lowell and Boston interurban elevated electric road is making a large bid for popularity and the promoters are meeting with a large degree of success. The route will be only one-tenth of a mile longer than an air-line between the two cities would measure. Private way, immunity from curves and a possible run of 25 miles is a little over one-half an hour, are the features of the project. Permits have been obtained in Lowell this week for necessary track locations and a station site. It is proposed to connect with the Boston elevated road at Sullivan Square. Congressman Butler Ames, grandson of General Benjamin F. Butler, is president of the company.

The Bangor and Northern, formerly known as the Penobscot Central, a trolley line extending from Bangor, Maine, to Charleston, a distance of 26 miles, was sold on January 21st to the Bangor Railway and Electric Company. The absorbing company now controls all the Bangor and suburban electric railway properties. B.

Southeastern States.

Charlotte, N. C., January 27.—A bill has just been introduced in the South Carolina Legislature providing that all electric lines outside of towns shall provide separate cars for white and colored people. It is provided that motormen shall be held responsible in case of violations of this act.

It is announced in Frederick, Md., that the syndicate owners of the Frederick and Middletown Electric Railway are preparing to receive bids for building a road from Baltimore to Hagerstown to cost $6,000,000, the line to take in a large number of intervening cities. Two mountains will be tunneled at a cost of $1,000,000 each, and a big power plant will be constructed at Monocacy River. The contract for this part of the work will, it is understood, be given out first. The entire cost of the work is calculated at from $6,000,000 to $8,000,000.

A new concern has been launched at Anderson, S. C., to develop Gregg Shoals, about 17 miles from the town. S. M. Orr of Anderson, J. E. Sirrine of Greenville and others are interested. The company is known as the Savannah River Power Company. The principal office will be in Anderson.

Application for a charter has been filed at Columbia, S. C., by J. U. Jackson, vice-president of the Augusta-Aiken electric railway, for a new company to be known as the Augusta and Columbia Railroad Company, which will connect Columbia and Augusta by an electric line. Steam will be used for freight and electricity for passenger traffic, it is said. The new line will be about 100 miles in length, 22 miles now being in operation between Aiken and Augusta.

It is announced that during 1906 the Georgia Railway and Electric Company of Atlanta will double track all of its lines in Fulton County, spending $250,000 and erecting a house for employes.

The Reed River Power Company has been organized at Laurens, S. C., to develop a nearby water power, the capital being $50,000.

The Central Carolina Power Company, with [illegible]

[illegible] interests. L

Ohio.

Cleveland, January 27.—[illegible] the [illegible] and Light C[illegible] at [illegible] as follows: President, Henry A. [illegible] vice-president, W. J. [illegible]; second vice-president and manager, Charles Currie; secretary, [illegible] treasurer, J. R. [illegible] an increase in the [illegible] before. Physically and financially, the company is in good condition, and it is expected that the gross earnings will go over the [illegible] year.

Preliminary steps have been taken to consolidate the four traction lines that cover the distance between Cleveland and Erie, Pa. Myron H. [illegible] and W. J. Hayes are engaged in securing [illegible] on the stock of the Cleveland and Painesville [illegible] stock of the Cleveland, Painesville and Eastern, the Pennsylvania and Ohio, and the road that operates from Conneaut to Erie is all closely held and can be voted at any time. Competent traction men have agreed that these roads can be more profitably operated together than individually.

Representative Reynolds' bill providing for heating the motormen's vestibules has been passed by the lower house of the General Assembly without a dissenting vote.

Reports of officers at the annual meeting of stockholders of the Columbus Railway and Light Company show that the gross income for the year was almost $1,800,000, and that the net income for the year was a little over $900,000, the expenses being about 49 per cent. of the gross earnings. This is the smallest expense ratio shown by any road in the state so far. The number of passengers carried, including transfers, has increased from 18,000,000 in 1900 to 50,000,000 in 1905. R. E. Sheldon was elected president, and E. K. Stewart, general manager.

The Licking Electric Light and Power Company of Newark will erect a new power house at a cost of about $100,000 in order to keep pace with the growth of the town.

Senator Vanover has prepared a bill that will place the work of assessing all railroads, electric railways, telephone companies, telegraph companies and other semi-public corporations in the hands of a commission consisting of the governor, state treasurer and state auditor, with two private citizens. The franchises and physical property shall be valued and the taxes shall be paid into county where the property is located. The bill does away entirely with the present method of fixing valuations.

The sixteenth annual meeting and dinner of the Cincinnati Postal Telegraph Managers took place at the Business Men's Club in that city on Tuesday of this week. E. J. Nally of Chicago, E. W. Collins of Cleveland and A. W. Reinhart of Pittsburg were among the guests.

A bill now before the Legislature provides that a franchise must be granted interurban railroads in cities where there is but one track on the streets desired, providing the consents of property owners are secured. The interurban must bear the expense of moving the existing track to one side. This bill is intended to provide terminal facilities for interurbans, and does not mention a city service.

Preliminary work on the Galion Southern electric-railway line is being prosecuted with vigor. It is the intention to build a line between Galion and Fredericktown. Mayor W. L. Ball of Fredericktown has the matter in charge.

It is said that the Lake Shore Electric is contemplating the purchase of the Toledo, Port Clinton and Lakeside, in order to make a direct connection between Sandusky and Toledo. The report has been denied in some quarters.

The School Board of Cleveland is considering the establishment of lighting plants in four school buildings. A small plant in one of the buildings has proved successful, and this has induced the board to take up the matter relative to the other buildings, especially where night schools are held.

The Thomson-Houston Electric Company has brought suit against the Sackett Mine Supply Company of Columbus to restrain the manufacture of a suspended switch and traveling contact, claiming infringement of patents owned by the company.

Sidings are being built at intervals of one mile

by the Toledo, Bowling Green and Southern, in furtherance of its plans to carry produce from the farms directly to the markets. In addition, sidings have been built in front of many farms. The road is now carrying wheat and other grain, poultry, eggs and produce of all kinds to the markets, and returning goods that are purchased in the city directly to the purchasers. The plan bids fair to be a big success, although the expense of the sidings is considerable.

Options have been secured near Ravenna by the Cleveland, Alliance and Ravenna Traction Company. It is said the projecrors of this line will make it an almost water-level air line, and that it will be one of the best equipped in the country, giving Cleveland an excellent southern outlet.

Reports are current that the Lake Shore Electric is negotiating for the Sandusky, Norwalk and Mansfield line, which is in operation between Norwalk and Plymouth, a distance of 20 miles.

The Columbus and Miami Valley Railway Company of Xenia has been incorporated with a capital stock of $10,000 by Gwynne Dennis, J. M. Dawson, Charles Follett, W. H. Thomas and J. W. Jones. The company is formed to build a line between Columbus and Xena, with a branch to Oregonia.

The Lake Shore Electric Railway Company will probably make some important improvements the coming year in the way of additional power and the purchase of 15 new cars. It is also possible that a double track will be built from Avon Beach to Cleveland, in order to take care of the increasing business.

J. R. Harrigan, it is reported, has resigned as general manager of the Columbus, Buckeye Lake and Newark and the Columbus, Newark and Zanesville, effective February 1st, to become general manager of the Canton-Akron road, with headquarters at Canton. This road has about 90 miles of track.

O. M. C.

Indiana.

Indianapolis, January 27.—The Indiana Rapid Transit Company, a new enterprise, proposes the construction of an interurban line from Logansport to Crawfordsville and a branch to Indianapolis.

The Wabash-Northern Railway Company has filed articles of incorporation. The purpose is to build a line from Wabash to Winona and Warsaw. J. A. Barry, G. D. McGee and J. R. Wilson are the incorporators.

It is given out among traction men that an organization of eastern capitalists is backing a project to build an electric railway connecting Grand Rapids, Mich., with Indianapolis.

The work of surveying the Crawfordsville and Northwestern traction line between Crawfordsville and Hoopston, Ill., by way of Attica, is almost complete. The work is in charge of J. W. Farrell and Spencer J. Hunt.

With J. W. Foutz as joint agent, with offices in the terminal freight station, Indianapolis, the officials of the merger companies in Indiana have worked out and adopted plans for handling and transporting through-freight and express matter. Rate sheets and schedules have been issued and traffic arrangements made with connecting lines in Ohio and Michigan. Comfortable waiting rooms are being opened at stations along the lines and an agent put in charge to sell tickets and take care of the freight and express matter.

According to the incorporation papers of the United Traction Coal Company, it is the purpose of some of the Indiana traction companies to mine and transport their own coal. The capital stock of this corporation is $300,000. The company will open mines in Sullivan County at a point soon to be reached by an interurban road, with connection with Indianapolis, where the headquarters and distributing office of the company will be maintained. The directors are William Sampson, J. V. Von Asdell and H. C. Carpenter, all connected with the Indiana Union Traction Company.

The commissioners of Allen County have granted a franchise right-of-way through the county and the town of Arcola to the Fort Wayne and Winona Interurban Company from Fort Wayne to the county line. This completes the right-of-way the entire distance.

The Indiana Supreme Court has decided that a steam or interurban railroad may run trains through the country and over public crossings at as high a rate as they please if they give the statutory signals and maintain proper crossings. This rule, however, does not apply to towns and cities.

The Town Board of Centerville is preparing to construct an electric-light plant. A committee headed by John Clark will negotiate with contractors and supply men.

G. W. H. Roush of Monroe City has petitioned for a franchise to construct and install electric-light plants in Monroe City, Algiers and Otwell.

John T. Wynn, an electrician, is reported to have accepted a position with the Fort Wayne and Wabash Valley Traction Company to take charge of the work of distributing electricity to the farmers along the company's line. Wires will be strung from the feed-wires to farm yards to convey current for light and power purposes.

The Indianapolis Heat and Light Company has just completed the installation of a large motor generator in its uptown station. The motor generator will be used in the conversion of 4,000-volt alternating current from the Mill Street power station into 250-volt direct current, which practically provides two distinct plants, either being capable of furnishing current sufficient for present demands. This improvement was made to provide for emergencies.

S. S.

Michigan.

Grand Rapids, January 27.—At the meeting of the stockholders of the Grand Rapids Edison Company, recently held in this city, directors were elected for the ensuing year and the following officers were chosen: President, Daniel McCool; vice-president, McGeorge Bundy; secretary and treasurer, Thomas F. Bechtel; general superintendent, A. F. Walker. It is said that the company contemplates increasing the present capacity of the plant within the next year.

At the recent annual meeting of the Grand Rapids Railway Company, the newly elected directors elected C. M. Clark, president; L. J. Rindge, vice-president; Benjamin S. Hanchett, general manager secretary and treasurer. The company expects to expend $270,000 during the year in the improvement of the property.

Condemnation proceedings have been brought by the South Bend and Southern Michigan Interurban Railway Company against farmers who are not willing to sell right-of-way at a reasonable figure. In one township the company paid $3,700 for right-of-way across four big farms. In another township $3,250 was awarded to three farmers for right-of-way. The company expects to have the line completed to St. Joseph by May 1st. A sub-station is in course of construction at Niles for the transmission of power to either the South Bend or Berrien Springs lines, and within a few days the company's 4,000-horsepower engine will be started at Scotdale, high-tension wires having just been completed from that point to Niles for the transmission of the power.

Superintendent Dawson of the Rapid Railway announces that in the early spring some of the handsomest suburban cars built would be placed on the line between Detroit and Port Huron. The cars will have motors of 112 horsepower instead of 76 horsepower, as at present, and ball-bearing trucks. The interior will be finished similar to parlor cars and will have all modern conveniences. The new cars will be much heavier than those used on the line at present.

The town of Morrice has signed a contract with the Saginaw Electric Lighting Company for lights. Bancroft and Perry will also be supplied. A power house will be built at Shiawassee. The lights are to cost $50 each.

The Manistee River Power Company of Cadillac has received its franchise from the supervisors. The dam and power house on Manistee River are to be in readiness for business by April 1, 1910.

B.

Pacific Slope.

San Francisco, January 26.—The Stanislaus Electric Power Company, recently incorporated under the laws of Connecticut by California and eastern financiers, and capitalized at $10,000,000, has opened an office at 909 Kohl Building, San Francisco, with Beach Thompson and Howard P. Veeder in charge. Construction work will be pushed this season on the initial installation, amounting to 20,000 kilowatts, and 2,000 men will be employed by next summer. The Union Construction Company, controlled by Sanderson & Porter, the Stanislaus Electric Power Company engineers, will construct the entire plant.

At the directors' meeting of the United Railroads of San Francisco, held on January 25th, Thornwell Mullally was chosen assistant to the president and executive head of the company in San Francisco. Patrick Calhoun will remain president of the company. Charles Holbrook was made chairman of the board of directors.

W. D. Larabee, H. M. French, J. W. Evans and R. A. Phillips of Los Angeles, organized under the name of the United Railway Company, have bought a controlling interest in the Orange Traction Company of Portland, Ore. The new owners have applied to the City Council for a franchise for the operation of additional railway lines. The application states that if the franchises are granted the company will guarantee to expend in excess of $400,000 in construction work.

Grading has been begun by the San Francisco, Oakland and San Jose Railway Company on new extensions to the Key Route system. The application of S. O. Holmes for an injunction restraining the company from laying these extensions has been denied.

The Vallejo-Vaca Electric Railway and Steamship Company has been incorporated at San Francisco with a capital stock of $3,000,000, of which $80,000 has been subscribed by W. H. Hodgkin, W. H. Sullivan and Daniel Kelley. The company plans to build electric railways and operate a ferry from San Francisco to the east side of San Francisco Bay.

The Trinity County Water and Power Company has been incorporated in San Francisco for the purpose of constructing a waterpower plant in Trinity County, Cal. The capital stock of the company is $500,000. The incorporators are C. A. Gray, Bart Burke, H. Cherini, A. K. Barrows, O. F. Cooper, F. C. Lewis and C. A. Rose.

An ordinance has been introduced in the City Council of Los Angeles calling for a vote upon the proposition of issuing bonds to the amount of $1,000,000 for the purpose of constructing a municipal electric-light plant.

The Board of Trustees of Alameda, Cal., has awarded a contract to Charles C. Moore & Co. of San Francisco for a new engine for the municipal electric-light plant. The National Electric Company of Milwaukee was awarded a contract for a generator for the same plant on its bid of $4,670.

J. M. Farland has been granted a franchise to establish an electric-light plant at Half Moon Bay, San Mateo County.

A.

PERSONAL.

Arthur O. Einstein has many friends who will be interested in the knowledge that he is again traveling for the Manhattan Electrical Supply Company of Chicago.

Harry S. Ward, chief engineer of the British Columbia Electric Railway Company, was accidentally killed at the Goldstream (B. C.) power house. He grasped the copper on two switches at once.

There was a large number of out-of-town central-station men in attendance at the Chicago Electrical Show. Among them were L. D. Mathes, general manager of the Union Electric Company of Dubuque, and M. A. Beal, manager of the Rockford Edison Company.

George L. Ratcliffe has been made general superintendent of the Cleveland Electric Railway Company's lines, and A. E. Duty becomes assistant general superintendent. Mr. Ratcliffe had his first experience in railroading as a conductor on the old Broadway line in Cleveland.

Cuthbert Schaefer, who for 10 years was in the contracting business in New Orleans, and who for the last two years has been in the Chicago office of the B. F. Sturtevant Company of Boston, Mass., on February 1st became assistant western manager in the Chicago office of Evans, Almirall & Co. of New York.

Dr. H. J. P. Sprengel, the inventor of the mercury air pump, which, as subsequently improved, made possible the commercial incandescent lamp and the X-ray tube, died in London on January 14th. He was a highly educated chemist, born in Germany in 1834, but long resident in England. He was elected a fellow of the Royal Society in 1878. He described his air pump to the Chemical Society in 1865.

John F. Gilchrist has been appointed by President Blood of the National Electric Light Association as reporter on the free installation of electric signs. Mr. Gilchrist's large experience with the Chicago Edison Company will enable him to prepare an interesting and instructive report on this subject for presentation at the twenty-ninth convention of the association, to be held at Atlantic City, N. J., June 5th, 6th, 7th and 8th next.

C. T. Mordock of Terre Haute, Ind., has been appointed by President Blood to report to the twenty-ninth convention of the National Electric Light Association, to be held in June next, on "Methods of Theft of Current." Past-President Ernest H. Davis will make a new compilation of the laws of the different states governing theft of current, bringing the same to date. This is an important subject, and the report should be valuable.

Benjamin Kauffman, who for the last year has been assistant western manager of Evans, Almirall & Co. in their Chicago office, on February 1st became western manager for the concern. He succeeded to the position resigned by Frank N. Jewett, who went with the Wagner Electric Manufacturing Company. Mr. Kauffman was for several years connected with the Paul System Company and with the Thomas & Smith Company of Chicago, as well as with the Western Kieley Steam Specialty Company.

Frank N. Jewett has been appointed by the Wagner Electric Manufacturing Company district manager for the states of Minnesota, Wisconsin, Eastern Iowa, Northern Illinois and Indiana, and Northern and Western Michigan, with offices in the Marquette Building, Chicago. The appointment became effective on February 1st. Mr. Jewett is a native of New York state, born in 1870. In 1893 he graduated from Cornell University and immediately entered the employment of B. W. Payne & Sons of Elmira, N. Y., manufacturers of boilers and engines. After two years in the experimental department and one in the sales department he went with the West Side Street Railway Company of Elmira and constructed its power house. He then entered the employment of Evans, Almirall & Co. of New York, contract-

F. N. JEWETT.

ors for heating, ventilating and power plants. Six years ago he opened this company's western office in Chicago and has been western manager ever since. In accepting the district managership of the Wagner company Mr. Jewett succeeds George B. Foster, who is now district manager in Chicago for the Allis-Chalmers Company.

ELECTRIC LIGHTING.

A franchise will soon be granted for an electric light plant in Broken Arrow, I. T.

Bonds for the establishment of an electric-light plant have been voted by the city of Red Cloud, Neb.

The Consolidated Light, Power and Ice Company has been granted a franchise for a plant at Carterville, Mo.

Bonds to the amount of $10,000 have been voted to put in a municipal electric-light plant in Carrington, N. D.

The Idaho Light and Power Company of Salt Lake City has been incorporated with a capital stock of $30,000.

The Cassville Mill and Supply Company is about to install a system of electric lights for the city of Cassville, Mo.

The Dewey Electric Light and Power Company has been incorporated at Nampa, Idaho, with a capital of $1,000,000.

The sub-station of the American Falls Power, Light and Water Company at Blackfoot, Idaho, was destroyed recently by fire. The plant will be rebuilt.

George Chambers & Co., proprietors of the water-power mill near Calhoun, Ga., have been granted a 25-year franchise for an electric-light system in the city.

The Consumers' Electric Lighting Company of New Orleans will erect a six-story building on Rampart Street, near Common, to be used as the general headquarters of the company.

The Ottawa and Streator (Ill.) Power, Light and Traction Company has been incorporated, with headquarters in Chicago. The capital is $50,000 and the incorporators, M. Thorne, W. E. McLean and M. W. Kelly.

E. S. Parker of Ottumwa, Iowa, has devised a small electric headlight for attachment to the tongue of a buggy or wagon on dark nights. It is only a two-candlepower lamp, but the light is so magnified by a lens that the result is said to be a good light thrown 150 feet or more ahead of the horse. The device is about 1½ inches in diameter.

The Board of Aldermen of Yonkers, N. Y., has declared in favor of municipal ownership of the city's lighting plant. At a recent meeting a resolution was passed that the city attorney be directed to prepare and submit to the Common Council a proposed act of the Legislature authorizing the city of Yonkers to own, equip and operate a municipal electric-lighting plant for the purpose of lighting the city streets by means of electricity. The contracts for electric street lighting are held by the Yonkers Electric Light and Power Company, and expire in 1908 and 1909.

ELECTRIC RAILWAYS

The Hutchinson (Kan.) Interurban Railway Company has been incorporated with a capital of $100,000.

The Indiana Railway Commission has instituted suit to determine whether, under the new law, steam and interurban roads shall be permitted to issue free transportation to other than those in their employment. The railroad companies are making a fight more to protect their own interests than from any desire to retain permission to give passes to the general public. The case was scheduled to be argued January 30th. It is also understood that Governor Hanley will ask the Legislature to pass a two-cent-a-mile passenger rate for Indiana.

The Detroit, Flint and Saginaw Electric Railway Company of Saginaw, Mich., has decided to establish a museum. In the construction of its line through Bridgeport an Indian burying ground was encountered. Some skulls were sent to the University of Glasgow in Scotland. The road was asked to secure specimens, if possible, for the state museum at Lansing, and from other sources requests came in. The company now realizes the importance of the route, and all that are dug up hereafter will be retained and kept in a [illegible] museum at Bridgeport. The greater part of the hill where the Indians were buried will be penetrated in the [illegible].

The New York [illegible] says that negotiations for the sale of the Lackawanna and Wyoming Valley Rapid Transit Company by the Westinghouse Electric and Manufacturing Company have been practically closed. The Lackawanna and Wyoming Valley Rapid Transit Company was organized in 1900. It controls, by stock ownership, the Lackawanna and Wyoming Valley Railroad Company and several smaller companies, together forming a line from Carbondale to Wilkesbarre, passing through Scranton and Pittston. The road was acquired by the Westinghouse company largely to conduct experiments in electric traction to develop the merit of various forms of electric equipment. The road was built in a very substantial manner, with 90-pound steel rails, stone ballast, and steel bridges, and is suitable for operation by steam locomotives. The line is operated by the third-rail system, and cars are run over it singly and in trains under multiple-unit control. At present only passenger service over the line is operated by electricity, steam locomotives being used for the freight service.

AUTOMOBILES.

The Chicago automobile show will be held in the Coliseum and First Regiment Armory from February 3d to 10th. It will be all one show; the two factions which exhibited separately in New York will not be in evidence here. General Manager Samuel A. Miles has planned a uniform scheme of decoration which will, it is said, make the exhibits and the general view more attractive than any show ever held. An extraordinary fine lighting effect is to be produced. The two buildings are utilized because neither is big enough to accommodate the exhibitors.

PUBLICATIONS.

The Fletcher Manufacturing Company of Dayton, Ohio, is sending out Catalogue No. 555, which contains a complete listing of electrical construction supplies, together with prices and illustrations.

Catalogue No. 16 of Pass & Seymour of Solvay, N. Y., is of pocket size and attractively prepared. In compiling the catalogue the object has been clearly and comprehensively to illustrate and describe the product, which may be said to have been done very effectively. One good feature is the giving of shipping weights per one thousand of each of the specialties listed in the catalogue. These specialties include tubes, cleats, porcelain knobs, receptacles, rosettes and many other articles of a kindred nature. A new price list of P. & S. specialties is being sent out at the same time.

TRADE NEWS.

The Wolfe-Lovett Electrical Company of Omaha, Neb., has been incorporated with a capital of $25,000.

The address of the Memphis (Tenn.) office of the Columbia Incandescent Lamp Company has been changed from No. 302 Scimitar Building to No. 480 Randolph Building.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until February 13th, for furnishing eastern navy yards with the following: Schedule 344, arc lamps, brackets, etc., miscellaneous electrical supplies; schedule 345, bells, rheostats, contact makers, copper wire, tape and other electrical supplies; schedule 346, motors, incandescent lamps; schedule 348, electrical tape. Specifications and blank proposals can be obtained at the navy pay office in New York or upon aplication to the Bureau at Washington.

Machado & Roller (Chicago office, 421 Monadnock Building) note that they have closed one of the largest orders for instruments for an isolated plant that has ever been taken in this country. This order covers the instrument equipment of the College of the City of New York, and calls for illuminated-dial, round-pattern and portable instruments of both the direct-current and hot-wire alternating-current types. There are over 70 illuminated-dial instruments in the list, 12 of which are extra large, having scales 27 inches long.

It is reported that the General Electric Company has sold, to a syndicate headed by Lohrke, Rosen & Co., all its interest in the preferred stock of the [illegible]

[illegible] rubber [illegible] the first time. The New York [illegible] Brooklyn. The officers of the company are: President, Edwin W. Moore; [illegible]; H. Cooke, treasurer; [illegible] H. S. Wallston. [illegible]

Joseph P. Devine of Buffalo, an expert in vacuum drying apparatus, announces that the Joseph P. Devine Company has been organized to conduct his business as a company, manufacturing the Passburg vacuum drying and impregnating apparatus under the Passburg patents. Mr. W. [illegible] has become vice-president of the new company. He has been for 20 years a member of the firm of Emil Passburg, Berlin, Germany, and the J. P. Devine Company will have the benefit of his experience and advice, and also the assistance and advice of the European firm itself, which turned over its entire interest in the American business to the new Joseph P. Devine Company.

The electrical testing laboratories of New York city test everything electrical from dry cells to turbo-generators. If too large or in too great quantity to be sent to them, they will send experts to the factory and test the goods before shipment. Manager Wilson S. Howell says: "It is important to know that your specifications are fulfilled, that the goods are exactly what you contracted for. If you pay 100 per cent. of the contract price, you should demand goods of the 100-per cent. quality and not be content with less. If you would maintain the proper balance between quality and price, your contracts should be so carefully drawn that goods which do not conform strictly to the specifications agreed upon may be rejected by your representative after a careful test for you at the shop of the maker. We have for years represented many of the largest and most successful central-station companies in this manner and have inspected and tested for them goods to the value of many millions of dollars, saving them a considerable percentage on the purchase price by the rejection of faulty or unsuitable goods and securing to them the best efforts of the manufacturers."

BUSINESS.

The excellent results obtained with Holophane reflectors are well known. The Holophane Glass Company of New York city directs particular attention to its new Pagoda reflectors for 8, 10, 16 and 32-candlepower lamps, which are made in two styles—one to concentrate and the other to distribute the light.

The New Brunswick Refrigerator Company and the Union Refrigerator Company, both of New Brunswick, N. J., have been consolidated under the name of the Brunswick Refrigerator Company. The capital is $2,000,000. The officers elected by the new board of directors include J. W. Johnson of New Brunswick, T. Clark of New York, T. G. Phinney of New Brunswick and Theodore Frelinghuysen.

Following the entrance of the Allis-Chalmers Company into the field of steam turbine manufacture, orders have already been received which will tax the capacity of the manufacturing department until the new turbine shops at West Allis can be made ready for use. Several of the turbine generating units of 500-kilowatt capacity each have recently been contracted for, among them the city of Jacksonville, Fla., which has recently concluded the purchase of additional steam turbine units for the lighting of that city in addition to a 500-kilowatt unit installed there over a year ago. The new equipment will consist of two steam turbines coupled to two 500-kilowatt, three-phase 60-cycle, 2,300-volt generators. These units will be the first steam turbines of Allis-Chalmers manufacture to be installed in the South.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 23, 1906.

810,384. Electric Lamp Lighter. Peter W. Arduino and Amedeo A. Arduino, Stamford, Conn. Application filed April 22, 1904.

Igniting mechanism is carried by the lamp and operated by a battery. The battery comprise a jar having an upper reduced portion and means for holding the lamp and battery with their respective mechanisms in cooperative relation.

810,389. End-cell Switch. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company, New York, N. Y. Application filed October 14, 1904.

A main contact arm controls the devices and is adapted to move in either direction. Reversible actuating means for the arm, a reversing switch, a controller connected to control the switch and electric circuits and connections whereby movement of the controller to a given position causes movement of the main contact arm in the desired direction to a predetermined position are other essential parts.

810,444. Electric Drill. Charles W. Theil, Milwaukee, Wis., assignor of one-third to Alonzo D. Seaman and one-third to John T. Seaman, Milwaukee, Wis. Application filed June 1, 1903.

Combined with a suitable case or frame are a motor armature and a rotary drill holder mounted coaxially.

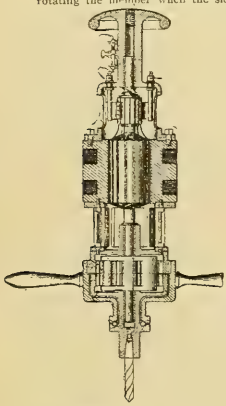
Differential internal gears, fixed one to the drill holder and the other to the case and a crank fixed to the armature shaft and provided with a pinion which meshes with both of the internal gears, the drill holder being rotable and the case stationary relatively to each other and the armature shaft complete the details. (See cut.)

810,466. Process of Making Incandescent Lamps. Frank H. Blackburn, Fostoria, Ohio, assignor to the National Electric Lamp Company, Cleveland, Ohio. Application filed March 2, 1905.

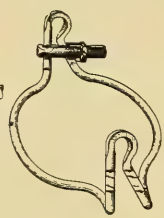
A process of making tipless incandescent lamps consists in taking a globe having a neck, forming a small opening in it near the point where the neck joins the globe proper, sealing off by heat the neck of the globe just below the opening and then blowing air into the globe through the opening by means of a tube unsealed thereto, the air blowing off the end of the neck.

810,473. Adapter for Incandescent-lamp Sockets. Samuel E. Doane, Cleveland, Ohio, assignor to the National Electric Lamp Company, Cleveland, Ohio. Application filed March 27, 1905.

An adapter for incandescent lamps embodies a sleeve formed to engage a lamp base and contact members carried thereby to engage the contacts of the socket. One of the members is rotatable independently of the other and accessible from within the sleeve and formed to allow the application of means within the sleeve for rotating the member when the sleeve is in the socket.



NO. 810,444.—ELECTRIC DRILL.



810,618.—INSULATOR CLAMP.

810,491. Telephone Toll Apparatus. George A. Long, Hartford, Conn., assignor to the Gray Telephone Pay Station Company, Hartford, Conn. Application filed January 9, 1904.

Combined with a set of telephone instruments including a receiver and a receiver-hook lever are a toll-collecting device comprising a coin channel, a coin stop pivotally supported at its lower end forming a coin pocket, independent plungers arranged at each side of the coin pocket adapted to be connected through a coin deposited on the coin stop to ring the bells at the called station and operative connections between the coin stop and the receiver-hook lever for rocking the coin stop.

810,501. Electric Fire-alarm and Thermo Indicator. Alfred H. McNeil, Clapton, London, England, assignor to the Pearson Fire Alarm, Limited, London, England. Application filed May 1, 1905.

In an electric fire alarm in which an electric circuit is completed at a predetermined temperature by the deflection of a thermal strip is a box or chamber having an opening in one of its sides, an insulated contact spring being fixed inside the box and normally closing the opening. An adjustable contact is also mounted within the box in close proximity to the spring contact, a thermal strip being fixed at its ends outside the box. A plunger is attached to the thermal strip and arranged to project into the opening in the side of the box and to operate the contact spring.

810,522. Voltmeter Switch. George N. Eastman, Chicago, Ill., assignor to the Minerallac Company, Chicago, Ill. Application filed April 26, 1905.

Blocks are provided on corresponding faces with series of contacts, with a binding post, for connection with a voltmeter, on each block being connected with the contacts thereon. Blocks alternating with and spaced apart from the first-named blocks are provided on corresponding faces with series of circuit-terminal contacts connected with binding posts. A rotary shaft carrying brushes is mounted in the spaces between successive blocks.

810,527. Electrical Switch. Joseph F. George, New York, N. Y., assignor to the Empire Electric Stage Lighting Company. Application filed October 7, 1904.

A pair of separated contacts inclosed in a protecting case and a partition having narrow openings are combined with a hinged cover carrying movable contacts arranged to be thrust through the openings adapted for joint operation.

810,536. Turning Switch with Lighted Handle for Electric Lines. Hans Holzer, Frankfort-on-the-Main, Germany. Application filed April 10, 1905.

An electric switch comprises main contacts connected with the line, a pivotally-mounted switch member for closing circuit through the contacts, the member having relatively long and short contact ends, a lamp for the switch member connected therethrough with one side of the line and an auxiliary contact connected with the other side, the auxiliary contact being out of the path of the short end and in the path of the long end of the switch member.

810,560. Electric-railway Signal. Helen W. Parkes and Stella L. Vincent, Cleveland, Ohio. Application filed October 17, 1904.

A conducting trolley track is mounted between the railway track. A trolley wheel borne on each vehicle engages the trolley track for signalling purposes.

810,609. Electrofluid Pressure Mechanism for Operating Railroad Appliances. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, Los Angeles, Cal. Application filed December 1, 1903.

An armature is operatively connected with the valve connection of the fluid pressure system on a railway vehicle. A solenoid magnet slidably receives the armature and is electrically connected with the trolley wire and an insulated section thereof. A second solenoid magnet slidably receives the armature and has ground connection and connection with a divergent branch of the trolley wire.

810,618. Insulator Clamp. Walter G. Clark, Seattle, Wash. Application filed April 13, 1904.

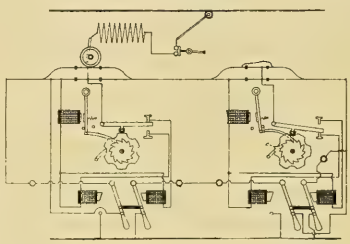
An insulator clamp comprises a body portion adapted to be secured to the insulator, the body being provided with open wire-holding loops formed in one continuous piece with the body and extending at an angle to the plane of the body, the loops being adapted to hold the wire down upon the top of the insulator when the clamp is in position. (See cut.)

810,646. Observation Trolley-car Railway. Louie J. Harris, New York, N. Y. Application filed July 14, 1905.

Constructional details of a large observation electric car are set forth in the patent.

810,664. Attachment Device for Electric Conductors. David B. Mills, East Orange, N. J. Application filed April 13, 1905.

An attachment device for electrical conductors comprises a ferrule with an opening in its wall, a terminal



NO. 810,705.—ELECTRIC-RAILWAY BLOCK SIGNAL.

with an opening coincident with the opening in the wall of the ferrule and a hollow riveting means uniting them adapted to permit the passage of an electrical conductor through the opening in the two parts.

810,674. Vehicle Motor-suspension Mechanism. Frank B. Rae, Detroit, Mich., assignor to the American Electromobile Company, East Orange, N. J. Application filed September 7, 1905.

A method of suspending the motor on the frame of an electric automobile is described.

810,687. System of Automatic Signaling for Electric Railways. Fitzhugh Townsend, New York, N. Y., assignor to the General Railway Signal Company. Application filed November 10, 1905.

Cross-bonds for the return conductors or rails of the railway are associated with means whereby the power current will be equalized in the return conductors to the source of power current.

810,705. Block-signal System for Electric Railways. Abram L. Bower, Boyertown, Pa. Application filed January 10, 1903.

The track is divided into blocks or sections with insulated rail sections between adjacent blocks. A feed-wire extends along the railway, a circuit-changing switch being at the end of each block. Main signal wires extend from one of the switches to the other, the switches arranged to connect the main signal wires terminating therein alternately to the feed wire and to the common return of the power circuit. Magnets operate the switch and electrical means cooperate with a car to energize the magnets alternately as successive cars arrive upon the insulated track section at the end of a block. (See cut.)

810,751. Electric Circuit-breaker. Frank O. Hartman, Mansfield, Ohio. Application filed April 6, 1903.

Features of primary importance are an operating shaft, switches movable simultaneously into normal position by the operating shaft, a loose and a fast disk carried by the shaft, one of the disks connected with the switches, the other of the disks adapted to operate the first-named disk, a single locking device for retaining the switches in normal position and an electroresponsive device for effecting the simultaneous release of the switches.

810,836. Electric-light Fixture. John F. Barrett and Nat C. Collins, Chicago, Ill. Application filed June 3, 1905.

Combined with a lamp are a socket, a drum, a frame for holding the drum adapted to be removably secured to the socket, an electrical cable adapted to be wound upon the drum, means for permitting the cable to unwind and an electrical connection between the lamp and socket.

810,841. Magnetic Separator. Henry F. Campbell, Melrose, Mass., assignor to the National Magnetic Mineral Separating Company, Boston, Mass. Application filed July 29, 1902.

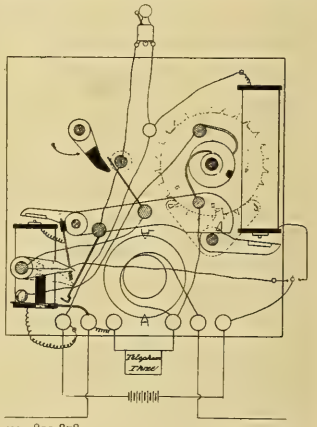
In combination in a magnetic separator are a magnet and a tray presenting an unobstructed surface at a due distance below the magnet, for supporting and conveying the material spread in a film of substantially uniform thickness under and past the magnet, and through an uninterrupted field of the magnet. A cover for the tray prevents the passage of magnetic particles to the sides of the magnet and other means impart a transverse shaking movement to the support.

810,866. Compass-indicating Apparatus. Benjamin V. How, Weston, Mass., assignor to the Arbecam Nautical Instrument Company, Boston, Mass. Application filed September 19, 1905.

A rotatable vertical shaft is supported on the binnacle top and carries terminally a sighting device and a radial indicator, in combination with a circular triangulation plate perforated centrally and graduated marginally in degrees. The plate is maintained frictionally and adjustably on the compass dial beneath the indicator and with a reduced downward extension of the shaft serves in the perforation as an axis of rotation for the plate.

810,878. Selective Call for Telephones and Telegraphs. William Palmer, Jr., Rincon, N. M. Application filed July 18, 1902.

A selective telephone and telegraph call comprises a subscriber's instrument having a local battery and two local circuits, a step-by-step escapement and a bell switch. Two electro-magnets are arranged one in each local circuit, one for working the step-by-step escapement and the other for adjusting the bell switch to ringing position. A vibrating shunting relay sends the local-battery current through either electromagnet by a reversal of the main-line current and a switch under the control of the subscriber enables him to exclusively introduce his telephone into circuit for private communication. (See cut.)



NO. 810,878.—SELECTIVE TELEPHONE AND TELEGRAPH CALL.

810,889. Process of Electrolytically Preparing Metals or Alloys for Lithographic Purposes. Otto C. Strecker, Darmstadt, Germany. Original application filed April 19, 1900. Divided and this application filed May 12, 1902.

The process for producing a water-retaining layer on metal plates or alloys for lithographic and printing purposes consists in submitting suitably prepared plates, furnished with lithographic designs, in a suitable electrolyte to the action of a continuous current, whereby an insoluble layer will be formed by the ions of the substances in the electrolyte which will combine with the metal of the plate and thus protect the plates against lithographic oil or grease and retain the water.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on January 29, 1906:

396,723. Electrically Operated Door Lock. C. B. Beers, Bridgeport, Conn.

396,727. Device for Controlling Electric Motors. H. H. Blades, Detroit, Mich.

396,734. Octuplex Telegraph. M. W. Dewey, Syracuse, N. Y.

396,748. Electrical Railway Signal. W. P. Kookogey, Brooklyn, N. Y.

396,749. Railway Signal. W. P. Kookogey, Brooklyn, N. Y.

396,750. Railway Signal. W. P. Kookogey, Brooklyn, N. Y.

396,769. Secondary Battery. J. S. Sellon, Hatton Garden, County of Middlesex, England.

396,770. Secondary Battery. J. S. Sellon, Hatton Garden, County of Middlesex, England.

396,791. Automatic Switch for Electric Motors. H. Whittingham, Baltimore, Md.

396,792. Electromagnetic Transmitter. J. T. Williams, Mount Vernon, N. Y.

396,795. Electric Signaling Apparatus. J. Young, Chicago, Ill.

396,836. Electric Lighting and Heating Cars. J. F. Shawhan, Dayton, Ohio.

396,867. Dynamo-electric Machine. P. Grant, Baltimore, Md.

396,870. Electric Battery. C. F. Heinrichs, New York, N. Y.

396,871. Electric Battery. C. F. Heinrichs, New York, N. Y.

396,886. Electric Switch or Cut-Out. E. R. Knowles, Brooklyn, N. Y.

396,897. Suspending Electric Light Lamps. A Siegrist, Buffalo, N. Y.

396,920. Electric Cut-out Device. J. Chester Chamberlain, New York, N. Y.

396,932. Regulator for Dynamo-electric Machines. A. J. Holt, Grand Rapids, Mich.

396,933. Insulating Jacket or Covering. W. J. Hulford, Lawrence, Mass.

396,940. Automatic Electric Cut-out. E. R. Knowles, Brooklyn, N. Y.

396,942. Commutator for Dynamo-electric Machines. E. R. Knowles, Brooklyn, N. Y.

396,958. Secondary Battery. J. S. Sellon, Hatton Garden, County of Middlesex, England.

396,983. Railway Telegraph. B. Cade, Louisburg, N. C.

397,006. Regulator for Dynamo-electric Machines. J. F. Kester, Terre Haute, Ind.

397,007. Dynamo-electric Machine. J. F. Kester, Terre Haute, Ind.

397,049. Railway Telegraphy. B. Cade, Louisburg, N. C.

WESTERN ELECTRICIAN

EVERY SATURDAY

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St. Gallen-Trogen Interurban Railway in Switzerland.

By Franz Koester

One of the most interesting and recent electric railway installations of Switzerland is that running from St. Gallen to Trogen via Speicher. This road is operated at two voltages, and has to overcome many steep grades and sharp curves. The total length of the line is 9.7 kilometers, using public streets principally, with the exception of a small percentage which traverses a private right-of-way.

To operate the railway, current is derived from a transformer station, receiving power at 10,000 volts from the power plant at Kubel. This substation, as seen in Fig. 2, is located at St. Gallen, at one-half load 87 per cent. The [illegible] the motor.

The switching room is separated from the motor-generator room by a wall and the switchboard itself, and is sufficiently large to contain all the instruments necessary for a third generator group. The apparatus is all mounted on white marble slabs. The high-tension apparatus is arranged in the first story, whence the feed wires, well protected with horn lightning arresters, leave the substation.

There are two feeder systems, one leading to St. Gallen and the other to Trogen. Each consists of two soft-drawn copper wires of 70 square millimeters cross-section each, and both are supported on the same poles on which the trolley is suspended. Both trolley wires are of hard-drawn copper, eight [illegible] equipped with a [illegible] air.

The motor of the [illegible]

FIG. 1. MOTOR CAR AND TRAILER ON ST. GALLEN-TROGEN LINE (FREIGHT CARS IN BACKGROUND).

and contains on the main floor two motor-generator sets receiving current at 2,000 volts, which is stepped down by means of 150-kilowatt static transformers in the basement. Two of these transformers are designed to furnish power for the railway, while a third supplies light, all being interchangeable. The motor-generators, of the Oerlikon type, consist of high-tension synchronous motors, direct connected to shunt-wound dynamos. The motors are of 155 horsepower, making 50 cycles at 490 revolutions a minute. The generators are of 104 kilowatts capacity each, with four poles. As seen in the illustration, they are placed on porcelain insulators, a common practice in Switzerland on account of the frequent electrical atmospheric discharges in the mountains.

A battery of 400 secondary cells is located in the basement of the building, and has a capacity of 198 ampere-hours. The normal discharge current is 121 amperes. The battery is divided into two equal parts, connected in series on discharge and in multiple while charging. The efficiency of the battery is, expressed in ampere-hours, 90 per cent., and in watt-hours, 75 per cent. The efficiency of the direct-current generator at full load is 90 per cent. and millimeters in diameter, suspended six meters above the rails.

The railway motors operate on two different voltages—from the St. Gallen station to the so-called "Schmidtstube" 550 volts, and from this point on 800 volts, supplied by the power plant at Speicher. The two systems are connected by insulators 40 millimeters in length. As this point is on a steep grade, and as a loaded car weighs 30 tons, it was found necessary to run a third wire (see Fig. 3) down to the beginning of the incline, so that in ascending, the trolley pole can be switched over to 800 volts. In descending this is, of course, unnecessary, as the momentum of the car will carry it past the dead point.

The trolley wires are interconnected every 250 feet in order to minimize the drop in potential, and are well protected by lightning arresters. In the city districts the poles are of iron, while in the outlying districts they are of wood, the latter being thoroughly saturated with blue vitriol. All poles are embedded in concrete. The suspension wires are of galvanized steel, and the insulators are tested for 10,000 volts. The rails act as returns.

The motor cars, shown in Fig. 1, which are of carry 18 horsepower for two hours, with a temperature rise of 60° C., and 25 horsepower for one hour, with a temperature rise of 70° C. The speed on the steepest grade is about eight miles an hour, while on the least it is about 15 miles. The motors are of the four-pole laminated type, with the magnet frame in two parts, hinged and mounted on the truck frame, the pinion of the motor operating a gear-wheel on the axle. The controller (Fig. 4) is designed for both series and multiple operation, and also, in exceptional cases, for the operation of a single motor. The controller is equipped for three running positions with the motors in series and one with the resistance all out. The same is true with parallel operation. The controller is equipped with a short-circuit device operating a solenoid brake; also with a rheostat. The rheostats are made up of sheet-iron disks, mounted in a box below the car and well insulated from the ground. The cars are heated by three units, operating in three steps with 1,200, 2,400 and 3,600 watts. For light there are two groups of six fixtures, of which five always burn. Each fixture contains two incandescent lamps, one for 110 and the other for 160 volts, in order to operate on either trolley system.

A special automatic double-throw switch is provided for changing the lamp connections at the point where the trolley voltage changes. This provision must, of course, also be made in the trailers. As these latter are of a shorter length, the heating elements are designed for 500, 1,000 and 1,500 watts only.

There are also a number of freight cars of six tons capacity. They are equipped with two motors developing 25 horsepower for two hours, with a rise in temperature of 60° C., and 40 horsepower for one hour, with a temperature rise of 75° C. These

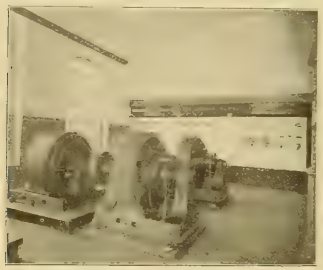


FIG. 2. SUB-STATION AT ST. GALLEN, SWITZERLAND.

cars are equipped with controllers, brakes, etc., similar to those on the passenger cars. All cars are well protected by lightning arresters. To this rolling stock must be added a motor-operated snow-plow. The entire electrical equipment of the plant and rolling stock was designed and installed by the Machinen Fabrik Oerlikon, of Switzerland.

The Proper Handling of Consumers' Meters.[1]

By George A. Barrett.

At the outset I desire to say that my experience has been confined almost wholly to one make of meter, and what I say in regard to the general care of meters has reference to that particular make. Broadly speaking, all meters used to any considerable extent perform the same functions, cause the same troubles, and in the long run produce the same results, regardless of the name plate.

There are a few general principles which seem to me might be followed by those in charge of a central station's meter department which will prove exceedingly profitable to the company and at the same time tend to inspire in the consumer a confidence in the meter he otherwise might not have.

After carefully unpacking and numbering the meters, the manufacturer's and company's number, together with the capacity and type of each, are recorded in a book kept especially for that pur-

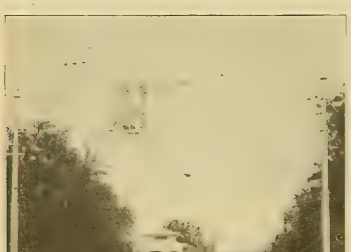


FIG. 3. ST. GALLEN-TROGEN INTERURBAN LINE.—TRANSITION FROM 550 TO 800 VOLTS.

pose, the meters are taken to the testing room and subjected to a reasonably careful test.

The label on the back of the meter, "This meter has been carefully tested on various loads and found to be correct," does not always mean just what it says. Instances have come under my observation where the various connections in the meter were not all properly made; others, where essential parts were entirely missing, and still others where the meter was so far out of proper adjustment as to utterly preclude the possibility of a careful test having been made in the factory.

I do not wish to be understood by this as saying that these conditions exist to any great extent, but such things do occur altogether too frequently. I would therefore urge that each company make its own test of all meters before placing them in service and not depend entirely on the factory test. It requires but little time and acts as a check on any mistakes which may be made by the manufacturer. It is a right beginning, and things begun right are more likely to remain so and produce correct results than things not so begun.

Installing the Meter.—This statement in itself sounds simple, but I do not hesitate to say that it is the source of more trouble than apparently few station managers appreciate. Any Tom, Dick or Harry ought not to be allowed to install meters. A man to do this work should have an intimate knowledge of the delicacy of the instrument. In handling a meter it is always well to bear in mind that it is not a rubber ball, nor a rag doll, nor anything of the kind, but a finely adjusted piece of mechanism that a slight jar will sometimes cause to get out of adjustment, thereby rendering its readings faulty. I doubt not you will be surprised when I say that in my humble judgment a hammer should never be used in fastening a meter to its support, nevertheless it is done and, I fear, oftener than you think. The old trick of the carpenter hammering a screw three-quarters or more of the way into place and then giving it a few turns with the screwdriver—provided the slot in the screw is not battered so badly that the screwdriver cannot be inserted—is one which should never be resorted to in installing a meter. The proper tools and screws should always be at hand so that the meter may be securely fastened with the least possible jar.

So much has been said and written about selecting the best location for the meter that I hesitate to take your valuable time in discussing it here. I will only say in passing that the wonder is that you central-station managers have not given this subject the attention it deserves. Think of the time lost by meter readers and testers hunting step-ladders, carrying them up and down several flights of narrow stairs to say nothing of the extra labor required in the operation. I say the wonder is that you have not given the subject more thought and applied the remedy, which is so simple—issue instructions to your men to install no meter until the wireman completes his work, which among other things would include the running of wires to some suitable location in the building for the installation of the meter. In installing a two-wire meter where the system has a grounded neutral, great care should be exercised to see that the outside wire is connected to the fields of the meter, for if the neutral in the building becomes grounded the registration will be very small, if anything at all. This I think cannot be too strongly emphasized

After the meter has been installed and in service it should, ordinarily, give satisfactory results for a period of six months, when it should be inspected and cleaned and so far as possible brought to its original condition. In this I wish to be understood as saying that under ordinary conditions twice a year is sufficient to clean up and inspect meters.

We now come to what, to me, is one of the most difficult problems confronting the company, that is, taking care of customers' complaints. A customer comes into the company's office and makes complaint on the amount of his bill, and should be listened to attentively, and unless some reasonable explanation can be given to him by the office man, such as his bill covering a period of possibly five or six weeks on account of the date of the installation of his meter—the complaint should be turned over to the meter department for adjustment.

A man to adjust complaints of this kind must, in the first place, be intelligent; he must have tact, be polite and gentlemanly under any and all circumstances, be able to convince the customer—if he be open to conviction—that he understands his business. Approach him, if possible, in a manner that will gain his confidence, discuss the matter with him openly and frankly, explain to him the previous test of his meter, how, when and where made, the result of such test. Inform him what you propose to do, invite him to accompany you and assist in the test if he cares to; in other words, get him interested in the operation of his meter. Avoid as far as possible all technical terms and phrases, which are Greek to the average man and in which he has little or no interest. He is under the impression that that particular meter is 20, 30, 40, yes, sometimes as much as 100 per cent. fast.

Take the cover off the meter and by turning on one, two, three, or any number of lamps and counting the number of revolutions made by the disk in say, 60 seconds, you can very readily tell whether the meter is very far out of the way or not. Having ascertained this, then ask him to turn on any number of lamps he chooses and you tell him from the speed at which the meter is running the number of lamps turned on or burning. Repeat the test with more or less lamps burning and tell him how many he turned on or off as the case may be.

You will be surprised to find the interest he will immediately take in the test and set about trying to ensnare you in error. Even though now and then you make a mistake of a lamp or two, the error will be so small as to not make any appreciable difference in his bill, which of course is the object sought. Should it be found that the meter is to some extent fast, then make a more careful test by using an indicating watt meter, or a volt and ampere meter, or any of the various methods used by the craft. Find out the exact per cent. fast, readjust the meter to run accurately, and of course discount the bill to the proper amount. On the other hand, should the meter prove to be slow, which will more frequently be the case, especially on one or two lamps, by the use of a little tact you will still be able to readjust it without incurring the ill-will of the customer. Now, while you have him interested, instruct him how to make a rough lamp test of his meter, urge him to do so frequently, and to read his meter at least once a week or oftener—in other words, show him that it is to his interest to become as familiar as possible with his meter. In a very little while he will become convinced that the meter can be relied on implicitly, and a good friend has been made out of what might otherwise have been a "chronic kicker."

Have any of you, I wonder, ever been trying to adjust something of this kind when another one of your customers happened along, and hearing the accuracy of the meter being questioned by his business friend would relate to him his own experience which was not unlike the present grievance; indeed, are they not all pretty much alike? How he was sure he was being robbed, that he burned less light this month than last; yet his bill

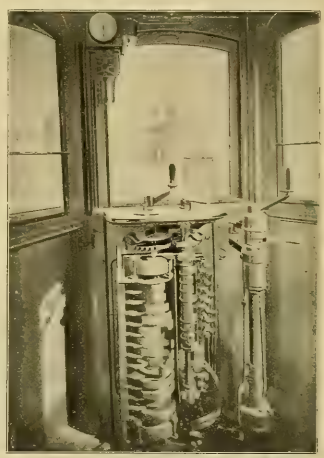


FIG. 4. CONTROLLER (WITH CASING REMOVED) ON ST. GALLEN-TROGEN CAR.

is considerably higher; that his neighbor burned twice as much light as he, yet his bills were smaller. How he had kicked, and kicked, yet it did no good, till finally in desperation he ordered the meter taken out entirely, that he positively refused to be held up longer. Then came the company's trouble man on the scene, and lo! all was changed, the crooked was made straight, the dark made light, and the mysterious was greatly simplified. He learned how to read and test his meter himself, and does so frequently, and knows it to be perfectly reliable.

Gentlemen, I need not say to you that a few such people can do wonders along this line, and I find that they not only can, but they do, and will, in fact most of them are anxious to, whenever the opportunity presents itself.

I do not suppose that complaints of this kind will ever be entirely eliminated from the business, but by educating the public along some such lines as these they can be reduced to a minimum.

To keep between 1,500 and 2,500 meters registering accurately on light loads is no small task. To clean and give any kind of a thorough test at all, a man cannot average more than eight or 10 meters a day, if indeed he can do that much, which means not more than 250 meters a month.

Two thousand meters would therefore require eight months' time to cover the entire system—that is to say, a man giving his whole time every day, with no other duties to perform, would not be able to visit each meter twice a year as has been suggested would be good practice. But the question arises, is it necessary in the great majority of cases to more than clean up and adjust for light load. I think not. A meter on full, or even a medium load, is usually not far from correct; it is nearly always the light-load accuracy that gives the central-station manager cause for worry. The revenue lost from this source alone must be considerable.

Let a man take a voltmeter—and I speak now

1. Paper read before the Northwestern Electrical Association at Chicago, on January 17, 1906.

of lighting loads exclusively, not power—and knowing the voltage at which the lamps are burning, he can arrive at approximately the amount of current passing through the meter and by the aid of a stop watch can in a very short time find what the meter is doing. It seems to me unnecessary to make a laboratory test of each meter at every visit. To clean the commutator, remove all dust, cobwebs, etc., examine the jewel and pivot and insert new ones where necessary, and make a rough test such as described above ought not to occupy or exceed from 20 to 30 minutes. On the other hand, if he must, in addition to cleaning and inspecting the meter, disconnect it from the circuit, connect in his indicating instrument and make a careful test on all loads, the time consumed in the operation will be probably double that which it was in the other case. And even then the test is often very unreliable unless there are two men present, one to read the indicating instrument and note the fluctuations, the other to time the revolutions of the disk of the meter under test. It is true that such tests are often found necessary, and of course should be made, but in the large majority of cases the simpler method will be found to answer the purpose very well.

In most if not all of the larger plants where it is not feasible for the manager to give the time to it, some system of inspection should be followed by some one, preferably by the head of the meter department, who has an intimate knowledge of the various conditions under which the meter or its readings may be faulty. The ordinary bill clerk takes the readings as they are handed to him by the meter readers, enters them in the record book and makes out the bill whether large or small, except possibly in extreme cases. This would not be so serious if we were to hear of the low readings as quickly as we do the high ones. The customer can be depended on to notify of over readings or fast meters, but the slow ones, that is another story. For instance, the jewel becomes cracked or chipped, which would cause the meter to record less than it ought to; this is not detected by the bill clerk, the damaged jewel is rapidly getting in worse condition, the readings become less and less, till finally the meter stops entirely. Then, and not till then, in too many cases is it turned over to the meter department to locate the trouble. Now, if some plan were adopted whereby every reading is scrutinized very carefully by some one having particular knowledge of the meter and its weaknesses, very material saving would result.

Supposing a meter having a constant of two should get into the record book as having one-half for its constant—a not unheard-of occurrence—the bill would of course be only one-quarter of what it should be. An error such as this having been made might be carried along for months or years even, without detection where the inspection is loosely or carelessly done. On the other hand, the man in charge of the meter department being peculiarly fitted for this class of work should readily detect the error. It is his business to know, and in fact he usually does know the various constants on different sizes and types of meters. Very often the company's number on the meter serves as a guide to him in determining its type.

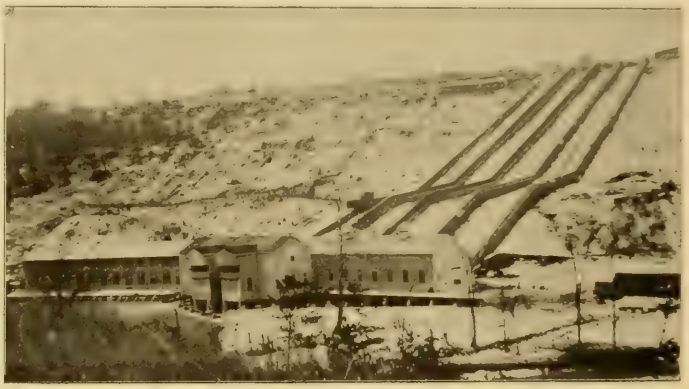
Meter manufacturers of late seem to be tending toward the kilowatt-hour meter in place of the watt-hour. This is bound to cause confusion and perhaps serious loss to the company unless watched very closely or the system of keeping records to some extent changed. Companies which have been heretofore accustomed to reading the first dial of the meter or fractions of a kilowatt may omit it altogether on all meters, and all will then read in kilowatt-hours and the danger from this source be eliminated entirely.

But, on the other hand, if an effort is made to keep them separated there is every possibility of the two becoming mixed and bills ridiculously small or excessively high being rendered, either of which should and can be avoided. There are some important details connected with this branch of the business left untouched, such as the proper metering of large installations, hotels, theaters, churches, etc., and meter readers who can and who cannot

Additions to DeCew Falls Power Plant.

By Orrin F. Dunlap

The Hamilton Electric Light and Cataract Power Company has been making notable additions to its installation in its power house at DeCew Falls, Ont. This power house is located in "Power Glen," 3½ miles from St. Catharines. Last year the company installed two 5,000-kilowatt three-phase 2,200-volt Westinghouse generators, that make 286 revolutions per minute, and are direct connected to hydraulic turbines of 7,100 horsepower, built by J. M. Voith of Heidenheim, Germany. Now the company is installing two 6,400-kilowatt three-phase 2,400-volt Westinghouse generators of 286 revolutions per minute, and which also are direct connected to Voith wheels. The revolving fields of these new generators weigh 37 tons. They are shipped by rail to St. Catharines, Ont., and from the Grand Trunk freight house they are transported by wagon to the power house. The final 3½ miles of the trip of these mammoth pieces of machinery is difficult, as the wagon carrying the machinery has to be drawn over the country roads. In making the haul 11 teams of horses were employed, and in descending the hill to the power house nine of the teams were employed in holding the load back, while two teams were on the wagon pole to steer. In addition to this, the precaution was taken to snub the wagon with ropes on each side, and in this way the fields were safely landed at the station. This work, and also the erection of the generators, was in charge of Mr. J. Simmons, erecting



DE CEW FALLS POWER HOUSE AND PIPE LINES.

on the outside. In passing down the hillside the direction of the pipes changes to correspond with the face of the bluff, making small angles with the horizontal for a short distance, as will be seen in the accompanying illustration.

At the power house the pipes pass underneath the main floor to the waterwheels, that stand in a row along the side. The wheels and generators are in the same room, and each generator has its individual wheel direct connected on a horizontal shaft. The Twelve Mile Creek serves as the tailrace for the discharge water. The roof of the power house is supported by steel trusses, and an electric traveling crane can be operated at any point over the wheels or generators, proving a material aid in the installation of the new machines.

In addition to the installation above described, there are two Stilwell-Bierce single-runner single-discharge-type wheels, each rated at 1,700 horsepower and 400 revolutions per minute. To each of these is connected a Royal Electric inductor alternator, rated at 1,000 kilowatts. There are also two wheels of the A. Riva Manneret make, single-runner single-discharge type, rated at 286 revolutions per minute and 3,300 horsepower. To each of these is connected a Canadian General Electric alternator of 2,000 kilowatts capacity. All of the

Transporting 37-ton Revolving Field of Alternator Along Country Road

Letting the 37-ton Field Down a Steep Grade in the Road

ADDITIONS TO DE CEW FALLS POWER PLANT.

wheels operate under a head of 268 feet, approximately.

The Westinghouse company has also installed in this station nine 3,400-kilowatt 2,200 to 40,000-volt transformers, equipped with the latest type C oil switches; also three motor-generator sets of 100 kilowatts, used as exciters.

Power from this station is transmitted to St. Catharines, a few miles away, and to Hamilton, Ont., a distance of 33 to 35 miles. The Welland Canal is lighted for its entire length by power from this station. Two transmission lines run from the terminal station to Hamilton. One of these takes the low level at the foot of the Niagara escarpment, and is 33 miles long. This is referred to as circuit No. 1, and the conductors are of stranded aluminum, three in number and having a cross-section of 320,000 circular mils. The circuit known as No. 2 extends along the top of the Niagara escarpment, and has six copper conductors, three of which are solid and three stranded. The voltage of transmission is 40,000. Energy from these transmission lines is delivered to two sub-stations in Hamilton, and to sub-stations in the towns of Beamsville and Grimsby, the electrical equipment of all the sub-stations being very complete. In Hamilton several large manufacturing plants have fine motor equipments operated with power furnished by the power company.

Lamme Alternating-current Motor.

Benjamin G. Lamme of Pittsburg, as is well known, is one of the foremost in the development of the single-phase motor which is adapted particularly to railway service. Mr. Lamme was recently

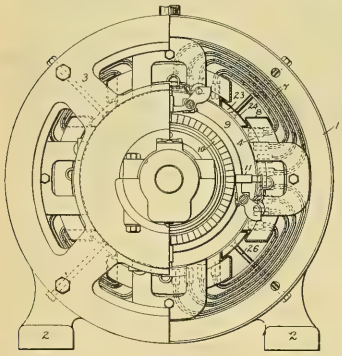


FIG. 1. END VIEW OF LAMME ALTERNATING-CURRENT MOTOR.

granted a patent (assigned to the Westinghouse Electric and Manufacturing Company) on a type of alternating-current motor, and the description which he gives of the machine in the patent specifications is interesting.

Direct-current motors may be operated by either single-phase or polyphase alternating currents provided the reversals of magnetism in the armature and in the field magnet occur simultaneously; but if a motor of the direct-current type is to be operated continuously by alternating currents its magnetic circuits should be laminated throughout and other minor alterations should also be made.

The self-induction of the armature of a motor of the direct-current type when supplied with alternating currents causes the current in that member to lag behind the impressed electromotive force, and unless such lag is neutralized the efficiency of the motor is impaired. Mr. Lamme proposes partially to neutralize the self-induction of the armature of an alternating-current motor by means of a stationary winding located in slots in the faces of the field-magnet pole pieces, and connected in series with the armature winding, being so distributed that the number of its ampere-turns in each pole face is equal to the number of ampere-turns in that part of the armature which is covered by the winding in such pole face. He proposes also to apply a current of one phase to the armature and neutralizing windings and a current of a different phase to the field-magnet winding. It follows from the disposition and arrangement of windings that the neutralizing effect of the stationary windings connected in series with the armature is instantaneous, that it is equal or proportional to the self-induction of the armature, and that the magnetic relations of the armature and field magnet are not otherwise modified or disturbed.

In the construction of motors having commutators and intended and adapted for operation by alternating currents it has been found to be advisable to provide definite field-magnet pole pieces between which are definite interpolar spaces, substantially as in ordinary direct-current machines, and in order to insure a satisfactory power factor in motors of this character it has been found desirable to provide armature ampere-turns, the number of which shall be relatively large as compared with the number of ampere-turns required to magnetize the field magnet. Under such conditions the field distortion caused by the armature ampere-turns would be very great if it were not for the neutralizing winding in the field-magnet pole faces, and even where such windings are employed they do not neutralize the armature ampere-turns in the interpolar spaces. In the case of direct-current motors the armature magnetomotive force in the interpolar space is relatively so small that it has but little effect on the operation of the motor. But in the case of an alternating-current motor having currents supplied to the armature that differ in phase from those supplied to the field magnet and having a large number of ampere-turns in the armature as compared with the number of field ampere-turns the armature magnetomotive forces exerted in the interpolar spaces may be relatively large. Experience has demonstrated that this effect may be so great under certain conditions as to set up a hunting action in the machine, during which the armature current rises and falls periodically. In such operation the magnetic effect in the interpolar spaces will also rise and fall periodically, and there will be a distorting effect in the field which will tend to cause the hunting action to continue. In order to eliminate this hunting effect Mr. Lamme proposes to place conducting plates of comparatively large cross-section and very low resistance between the pole pieces of the motor. These plates act as secondaries to the interpolar field set up by the armature currents, and therefore reduce the field to a comparatively small value, the hunting tendency being thereby substantially eliminated.

Fig. 1 is a view in end elevation of a motor embodying the invention, one-half of the end cap being removed. Fig. 2 is a face view of one-half of each of two adjacent pole pieces, their windings, and the plate located between them. Fig. 3 is an end view of a motor constructed in accordance with the invention and showing the supply circuits as well as the neutralizing windings and plates and is mainly diagrammatic.

While the invention is not limited to a motor having a specific number of poles, there is here indicated a four-pole motor, each of the laminated pole pieces (4) of which is provided with eight slots (5) adjacent to its face, in which are located neutralizing conductors. One-half of the neutralizing conductors in each pole piece are connected to the neutralizing conductors which are located in the slots of the adjacent half of the adjacent pole piece by means of connections (7), which may be either integral extensions of the conductors that are located in the pole-piece slots or separately

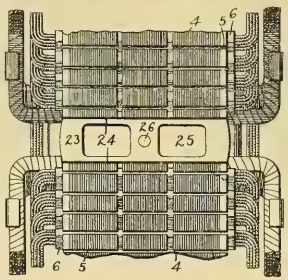


FIG. 2. ADJACENT POLE-PIECES IN LAMME MOTOR.

constructed connectors that are suitably fastened to the projecting ends of said core-slot conductors. In order that the end portions may not interfere with the application and removal of the magnetizing coils, they are bent outward in a plane substantially parallel to the end of the motor and then around the adjacent space between the pole pieces so that none of them cross such space.

As shown in Fig. 3, the neutralizing windings (6) (7) are connected in series with the armature winding by means of the brushes and commutator cylinder, and these series-connected windings are supplied with current from the secondary of a transformer (12), the primary of which is connected to conductors corresponding to one phase of a two-phase circuit, and the magnetizing field-magnet coils (8) are supplied with current from the secondary winding of a transformer (14), the primary of which is supplied with current from the conductors corresponding to the other phase of the two-phase system. This arrangement is such that the armature self-induction is effectually neutralized except in the interpolar spaces. Since the self-induction of the armature is thus neutralized the current of the phase which is supplied to the armature is maintained in phase with the impressed electromotive force; but the self-induction of the field magnet causes the current of the phase which is supplied to that member to lag approximately 90 degrees behind the impressed electromotive force, so that the currents in the two windings are ap-

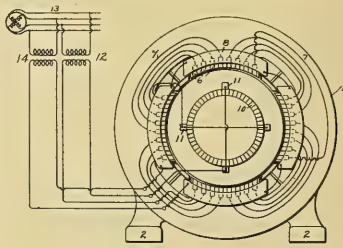


FIG. 3. DIAGRAMMATIC SKETCH OF LAMME ALTERNATING-CURRENT MOTOR.

proximately 180 degrees apart and the reversals of the magnetism in the armature and the field-magnet occur simultaneously, this being the proper condition for satisfactory operation.

High-pressure Electric Fire Pumps for New York City.

As a result of the recent ordinance authorizing the building of two new fresh and salt-water pumping stations for the Borough of Manhattan, bids were recently closed and contracts awarded to the Allis-Chalmers Company of Milwaukee by the Commission of Water Supply, Gas and Electricity. The equipment to be furnished consists of 10 multi-stage electrically driven centrifugal pumps, identical in design to those built by the Escher-Wyss Company of Zurich, Switzerland, and whose rights for this country are owned by the Allis-Chalmers Company.

This equipment will be installed in two stations now in course of construction, one at the northeast corner of Gansevoort and West streets, called the Gansevoort Station, and the other located at the northwest corner of Oliver and South streets, called the Oliver Street Station. The two stations are identical in every way, even to the arrangement of the interiors. These plants will be laid out to accommodate eight pumping units, the piping being so arranged that when the three future pumps are installed it will only be necessary to remove the blank flanges from the tees to make the present arrangement of piping suitable for the operation of eight pumping units.

The pumps will be of the horizontal shaft, multi-stage, centrifugal type, connected to 800-horsepower induction motors. Each pump will be constructed with six runners, i. e., the water will be handled in six stages, each stage raising the total required amount of water through one-sixth of the total required head. The pumps are designed to give their maximum efficiency when delivering 3,000 gallons of sea water each per minute at a speed of approximately 735 revolutions per minute and delivering against a discharge pressure of 300 pounds per square inch.

The induction motors are of the Allis-Chalmers type, in which resistance can be inserted at starting to limit the current taken from the supply lines. The motors are built in accordance with the specifications of the Department of Water Supply, Gas and Electricity, and it is expected that the stations will be in operation by the first of October.

Subterranean Wireless.

Preparations are reported to be under way by Father Joseph Murgas of Wilkesbarre, Pa., to test his theories on space telegraphy. He believes that messages may be transmitted through the earth as well or better than through the atmosphere, and to test this theory hopes to be able to dig two

shafts, each 3,000 feet deep, and lined with concrete, one shaft in the United States and one in Europe. The system which he will employ is one he has been working on for some years, and will be the same in principle as the ordinary printing telegraph apparatus, with the exception that the signals will be given in musical tones, each tone representing a letter of the alphabet.

An Experimental Gasoline-electric Car.

In conjunction with the American Locomotive Works the General Electric Company recently completed an experimental gasoline-electric car, designed as a self contained unit to meet the possible demand for railway service on branch lines or other localities where the traffic is so slight as to prohibit the investment sufficient for a steam or purely electric line. The first trial run of this novel car took place February 3d, when a successful trip was made from Schenectady to Saratoga, N. Y., and return, over the lines of the Delaware and Hudson Railroad. During the trip several features of this method of driving were demonstrated. While the car was not designed for high speed, the average running time was about 35 miles an hour, and several times the car attained a speed of 40 miles an hour. The smooth and rapid acceleration was favorably commented upon by the engineers present, as well as the complete absence of vibration, which might be thought to accompany the use of a gasoline engine.

The equipment consists essentially of a gasoline-driven electric generator furnishing current to electric motors geared to the driving wheels and controlled by a method similar to that employed in the ordinary electric car equipment. The car in question, as shown in the illustration (Fig. 1), is of the combination type, comprising a passenger compartment, smoking room, a baggage room, engine room, one toilet and a motorman's compartment. It is 65 feet long over buffers, and when equipped weighs 65 tons. A complete controller equipment is located at each end of the car, one controller being located in the engine room and a similar controller in a compartment at the other end. The car has seating capacity for 40 passengers, including seats for 12 in the smoking room. In general it is built on the lines of a standard

FIG. 1. AN EXPERIMENTAL GASOLINE-ELECTRIC CAR.

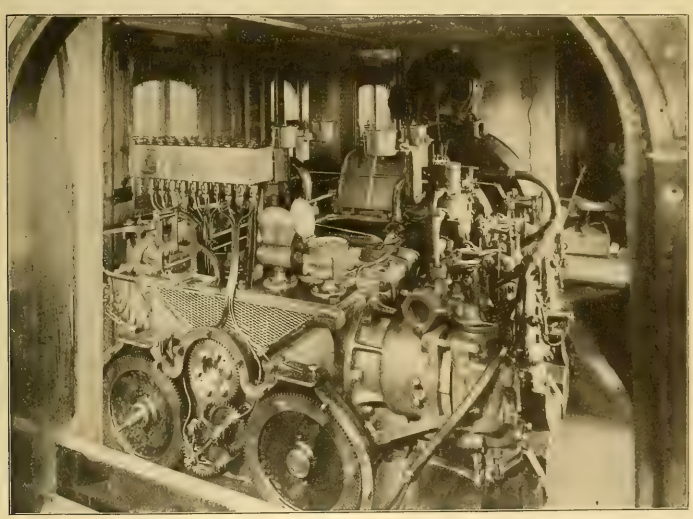


FIG. 2. ENGINE, GENERATOR AND EXCITER IN EXPERIMENTAL GASOLINE-ELECTRIC CAR.

Delaware and Hudson passenger coach, and is handsomely finished. Within, the passenger compartment is decorated in mahogany, with a birch wainscoting, the smoking room in quartered oak, and both the baggage and engine rooms in painted poplar. The outside of the car is painted and lettered in the standard Delaware and Hudson style, and Gould pattern bumpers and drawbars are provided.

The gasoline engine for this car was built by the Wolseley Tool and Motor Car Company of Birmingham, England, and is considered the most powerful unit yet constructed for this class of work. It develops 160 brake horsepower when running at 450 revolutions per minute. The cylinders are horizontal, opposed, six in number, nine-inch diameter and 10-inch stroke. All valves are mechanically operated, and the cylinders are water-cooled.

[illegible] bers. The chambers are identical, and use of the usual needle-valve type. Very flexible arrangements are provided to govern the air supply, so that it may be taken from the atmosphere or from the crank chamber, or from both, according to the conditions required. The mixture is heated to the required temperature in a small chamber, which itself is warmed by the exhaust.

In all details the engine is very complete. The lubrication is especially so, being force feed for main bearings and pistons and drip feed for all other working parts. Gasoline is stored in steel tanks beneath the car, and the burnt gases pass through the roof into mufflers, from which they exhaust into the air. The cooling system for the cylinders consists of two sets of radiating tubes, one located on the top of the car. Water for cooling is contained in the engine base. For heating the car a three-way cock is provided, which bypasses the circulating water through the usual pipe-heating system within the car.

Coming now to the electrical equipment, the main current is furnished by a 120-kilowatt direct-connected General Electric six-pole generator, designed for 600 volts. This generator is provided with commutating poles, which, in connection with the method of voltage control, permit a very flexible operating system. The advantage of commutating poles is evident when it is considered that the field excitation at starting is weak, and a large cur-

[illegible] In other words, the speed [illegible] by varying the field strength of the generator. With this method the speed of the engine remains constant after acceleration. The controller is semi-automatic, and can be set for any predetermined maximum acceleration. It is arranged for series-parallel control, the motor connections being changed from series to parallel by the operating handle. This latter has five positions, "series ahead," "parallel ahead," "off," "series reverse" and "parallel reverse." Arrangements are provided to prevent the motor connections from being changed from series to parallel until the resistance is put in the field circuit of the generator.

Further operating details comprise a General Electric combination straight and automatic air brake equipment and a special lighting equipment. The headlights are supplied with incandescent arc and incandescent lamps of the stereopticon type, one for each end of the car.

The trial trip of this car demonstrated the practicability of this equipment, and was entirely satisfactory to the engineers and officials present, so far as the tests indicated. The opinion was expressed that this was merely a step toward the final electrification of all service. A gasoline car would be useful in establishing a passenger traffic, but eventually the motive power for operation would be electricity.

Fig. 1 is a reproduction of a photograph of the car, taken after the arrival in Saratoga. Among the officials present from the Delaware and Hudson company were Axel Ekstrom, consulting electrical engineer; J. H. Manning, superintendent of motive power; J. W. Burdick, passenger traffic manager; James McMartin, chief engineer; J. B. Dixey, assistant to second vice-president; W. J. Mullin, assistant to second vice-president; D. F. Wait, superintendent Susquehanna division; E. F. Peck, manager Schenectady Railway Company.

From the General Electric Company the party included E. W. Rice, Jr., technical director; W. B. Potter, chief engineer; J. R. Lovejoy, general manager railway department; J. G. Barry, assistant manager railway department; W. J. Clark, manager transportation department; E. D. Priest, A. F. Bachelder and H. G. Chataine of the railway engineering department, and F. H. Gale, advertising department.

The Interstate Electric Railway Association, composed of electric-railway men in Northern Illinois and Southern Wisconsin, held a meeting in Joliet a few days ago, at which C. L. S. Tingley of Joliet was elected president and F. E. Fisher of Joliet secretary. Suggestions for making interurban travel more convenient were discussed at the meeting, and the use of interchangeable mileage was fully decided upon. Mileage books sold by one company will be good on any other of the roads belonging to the association. Included in the membership are the Rockford and Interurban, the Elgin, Aurora and Southern, the Aurora, Elgin and Chicago, the Joliet, Plainfield and Aurora, the Chicago and Joliet, the Illinois Valley Railway, the Illinois Traction Company and the Bloomington, Pontiac and Joliet road.

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CONTENTS OF THIS NUMBER.

St. Gallen-Trogen Interurban Railway in Switzerland. By Franz Koester. Illustrated 113, 114
The Proper Handling of Consumers' Meters. By George A. Barrett 114, 115
Additions to DeCew Falls Power Plant. By Orrin E. Dunlap. Illustrated 115, 116
Lamme Alternating-current Motor. Illustrated 116
High-pressure Electric Fire Pumps for New York City 116
Subterranean Wireless 116, 117
An Experimental Gasoline-electric Car. Illustrated 117
Editorial 118
Deterioration in Storage Batteries. By G. D. Aspinall Parr. Illustrated 119
Power Plant Economics. By H. G. Stott. Part II. Illustrated. With discussion 120, 121
Electrical Exports for the Year 1905 121
1,800-horsepower Gas Engine Direct-connected to Alternator. Illustrated 122
Advertising Exhibit for Atlantic City 122
Electric Hoisting Machinery. Illustrated 122
Searchlights to Aid Firemen 122
Not How Flat but How Steep 122
The Arc Light on Candlemas Day. Illustrated 122
Knostrain Socket Bushing. Illustrated 123
A Trolley Wheel of Pure Copper. Illustrated 123
Interborough Rapid Transit Company's Test of Subway Engines 123
Convention of Crocker-Wheeler Officials. Illustrated 123
Electrification of Victorian Railways in Australia 124
Pabst Brewery Power Plant 124
Niagara Power Proposed for Cleveland 124
The Erie Railroad Electrification 124
Searchlight "Morse" for Announcing Election Returns 124
Engineers' Club of Chicago 124
Large Induction Motors for Anaconda 124
Cheaper to Buy Current 124
Step-by-step Party-line Selective Telephone System. Illustrated 124, 125
To Test Telephone-rate Law in Wisconsin 125
Indiana Telephone Items 125
Southeastern Telephone Developments 125
Ohio Telephone Notes 125
The Telephone on the Pacific Slope 125
Telephone News from the Northwest 125, 126
New Companies 126
Telephone Men 126
Southern Indiana Telephone Men Meet 126
General Telephone News 126
Manufacturers and Dealers 126

DEPARTMENTS.

Correspondence 126, 127, 128
Great Britain 126
New York 127
New England 127
Southeastern States 127
Ohio 127, 128
Indiana 128
Mexico 128
Northwestern States 128
Pacific Slope 128
Personal 129
Electric Lighting 129
Electric Railways 129, 130
Power Transmission 130
Publications 130
Societies and Schools 130
Telegraph 130
Miscellaneous 130
Trade News 131
Business 131
Illustrated Electrical Patent Record 131, 132

DATES AHEAD.

Iowa Telephone Association (annual convention), Chamberlain Hotel, Des Moines, March 13th, 14th and 15th.

Indiana Independent Telephone Association (first annual meeting), Indianapolis, Ind., May 17th.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

National Electrical Contractors Association (annual convention), Cleveland, Ohio, July 18th.

As an encouragement to small industries the "industrial building" has often been suggested and has been tried in several instances with success. An "industrial building," like the office building, is designed to accommodate a number of tenants, these tenants, however, being small manufacturing concerns which would find the expense of building a factory of their own burdensome or prohibitive. In the "industrial building" all the conveniences of a large factory may be obtained, in the way of electric power and light, good ventilation, ample space, elevator service, etc. A branch telephone exchange may be operated by the landlord for the benefit of the tenants. Indeed such a building gives the small manufacturer the conveniences of his larger competitors and at a cost which will enable him to turn the proceeds of his business in channels which will tend toward its expansion rather than into the construction of a private factory building, the cost of which his business may not warrant. Though perhaps not practicable in a small city, such a building in a large city is a paying proposition, and central-station managers may well give more of their attention to the promotion of such enterprises as a promising field for the sale of current. It would be well if all the small manufacturing concerns were housed in commodious and convenient "industrial buildings," taking their light and power from the central station rather than from scores of small and inefficient plants.

Electricity cannot be adulterated. There is no way of substituting an inferior brand for the simon-pure article. It is true that fluctuations in the electromotive force sometimes occur, so that lights may go dim momentarily, but the quality of the current is always the same; the trouble is caused by some temporary difficulty in forcing enough of it through the wires to the point of consumption. In these days of widespread adulteration and substitution in articles of food and drink, in drugs, in textile fabrics and in many other products, it is a comfort to reflect that the "juice" furnished by the electric-light companies cannot be imitated or counterfeited in any way. It is hinted that sometimes the gas companies allow a little air to get in their pipes or mix one kind of illuminant with another which is cheaper to make and of inferior quality. This suspicion may be unfounded, but the central-station man has, with all his troubles, the advantage that a similar accusation is never leveled at him. The grocer may sand his sugar, the milkman water his milk, but the electrical man deals with a product that is absolutely pure and never questioned. Electricity is as fundamental as the attraction of gravitation. It is the same in Tibet and in New Jersey (for of course "Jersey lightning" belongs to quite a different category). Whoever utilizes it to help him in his work may rely with confidence on the knowledge that he is using something that men cannot analyze or imitate, although they are permitted to direct it into channels of useful employment.

Writing on the use of electricity in mines, Dr. W. M. Thornton makes an interesting comparison of direct and polyphase alternating current in the course of an article in the London Times Engineering Supplement. "As regards all-round electrical efficiency," he says, "there is little to choose between direct and three-phase current, but simplicity of construction, lower cost of cables and less need for skilled attention are in favor of the latter. Where much variation in speed is required, direct currents must be at present employed. Since, however, the conditions of motor running are much the same in traction and mining, the new series-wound single-phase traction motors might prove more immediately useful in mining than in railroad work. The generating and controlling machinery is simpler and requires less attention than any other system, though the efficiency is not quite so high. The cost of cables is about the same as for direct currents at the same pressure, and there is the possibility of transmitting at high pressure, transforming to lower voltage where desired. Any colliery at present using single-phase current for lighting might make the experiment." Loose connections are said to cause nine out of every ten of the difficulties of electric working in mines. Dr. Thornton thinks, also, that, for safety, no machine below ground should be worked at more than 650 volts and that every mining switchboard should be provided with an indicator to show abnormal leakage anywhere on the cables or machines. On the appearance of a leakage signal, which should rarely happen, warning should be at once issued.

Niagara power will be delivered in Syracuse, it is promised, next month. This will mark the farthest limit of power transmission from the great cataract yet reached, the distance being about 155 miles. For several years electrically transmitted power from Niagara Falls has been distributed to no greater distance than Buffalo, 22 miles from the point of generation. But more ambitious plans are now afoot, and a contract to deliver power as far as Syracuse has been entered into. There is talk, also, of extending operations to the west, and the possibility of transmitting current to Cleveland, nearly 200 miles from the Falls, is given consideration. Cleveland is the center of an important electric-railway development, and if it is economically feasible to transmit the current that distance (for no engineering difficulty is apprehended), no doubt the power will be largely utilized in railway work. At Syracuse, also, the current is to be used for railway operation, the New York Central agreeing, it is said, to take 25,000 horsepower. The power for this important transmission is generated on the Canadian side at Niagara Falls by the Ontario Power Company, but is sold in bulk to the Niagara, Lockport and Ontario Power Company on the American side. Thus Niagara is coming to be the center of a hydro-electric development remarkable for length of transmission as it has been for many years for the amount of power developed.

Electrical exports from the United States continue to increase steadily. Official returns for the month of December and the year 1905 are now at hand, and the total valuation of such exports is $13,057,677. Of this amount $7,400,242 is credited to electrical machinery and $5,648,435 to electrical appliances, including telegraph and telephone instruments. The total is over $2,000,000 larger than the valuation of electrical exports for 1904, which was the largest up to that time.

The exports of electrical machinery to the United Kingdom continue to show a falling off, which is perhaps to be expected, owing to the improved condition of electrical manufactures in that country, while the figures for British North America and Mexico exhibit good gains over 1904. The exports of electrical machinery to all South American countries increased slightly—from $474,234 to $520,799—which is encouraging, although the volume of business should be much greater. China took less electrical machinery from the United States in 1905 than in 1904, the respective valuations being $11,830 and $28,911. This showing is no doubt largely due to the boycott of American goods, which we hope has been or will speedily be removed. The Chinese Empire is destined, we believe, to be a large consumer of electrical apparatus within a few years, and the American electrical manufacturers should make every effort to secure this valuable market. Japan increased its quota slightly, but now that the war is over we may expect the energetic Japanese to make everything possible in their own factories, and it is likely that future years will show no great increase of American electrical exports to the mikado's country, but rather a falling off. China offers a much more promising field to the far-sighted electrical exporter, although, of course, Japan is not to be neglected, since it was our third best customer for electrical machinery in 1904 and our second best in 1905. British North America occupied first place in both years, the United Kingdom being second in 1904 and Mexico third in 1905.

The figures of the year's foreign electrical trade are given in greater detail elsewhere and are worthy of careful attention. Our electrical exports have now risen to very respectable proportions, and every effort should be made, by careful study and systematic endeavor, to keep up the constant increase which the last few years have so happily witnessed. Especially should we see to it that the countries on the American continent and bordering on the Pacific are carefully cultivated.

Deterioration in Storage Batteries.

Literature of no definite nature exists upon the deterioration of the secondary cell and its [illegible]. Certain impurities are inimical to the action of the lead sulphuric acid cell, as is fully realized, but knowledge of the exact amount of each impurity admissible is indefinite and practically a matter of conjecture. A great deal of interest, therefore, attaches to a paper which was read recently by G. D. Aspinall Parr before the Leeds Local Section of the British Institution of Electrical Engineers. The paper is based upon a series of tests recently commenced by Mr. Parr, which throw considerable light upon this hitherto little known subject. An abstract of the paper appeared in the London Electrician, from which the following information was taken:

Both the efficiency and capacity of secondary cells gradually diminish with the time of use, the falling off being due to (a) natural causes, (b) unnatural causes, which embrace the effects of ill treatment and impurities, respectively. Under heading (a) we have loss of active material and loss of porosity, and under (b) we have, first, the ill effects of excessive charge and discharge rates, short-circuits, and those due to allowing cells to rest in a discharged condition and never fully charging them up; second, the ill effects of impurities in the cell, which is the main subject of the present paper.

Impurities may be introduced through the medium of the plates, or through the electrolyte, or by reason of the salts formed by corrosion of the cell connections dropping into the solution. Plates of the Planté, or non pasted type, are given porosity in the course of manufacture by treatment in some oxidizing or so-called pickling solution, containing nitrogen compounds—for example, nitric acid, ammonia, nitrates of sodium, potassium, ammonium and ammonium sulphate. Manufacturers of such plates, however, take precautions to eliminate all traces of these compounds before the plates leave the works, and this is not difficult to do. Assuming that this is done, it remains for us to consider the main source of trouble—namely, the impurities liable to be introduced through the medium of the electrolyte. These may be present in either the sulphuric acid (the same grade of which from the same maker, varying greatly in purity), or the water with which it is mixed. According to Dr. G. Lunge, the greatest living authority on sulphuric acid, the concentrated acid of commerce may contain:

Sodium sulphate (135 parts in a million); potassium sulphate (more rarely); calcium sulphate (58 parts in a million); ferrous sulphate (291 parts in a million); lead sulphate (520 parts in impure and 172 parts per million in pure acid); aluminum sulphate; sulphate of ammonia (very largely); copper, zinc and other metals (rarely); selenium; arsenic (500 to 1,420 parts per million); hydrochloric acid; hydrofluoric acid; sulphurous acid; antimony (80 parts per million); arsenious acid (1,420 parts in impure and 31 parts per million in pure acid); compounds of nitrogen (always present).

Ammonia has been found in acid to the extent of 6,700 parts per million, but it is often present in 3.6 parts per million, and is the most common impurity. Sulphuric acid is prepared either from sulphur by heating it in a current of air to form sulphur dioxide or from sulphide of iron (iron pyrites). The former method gives what is known commercially as "brimstone" acid, the latter method an acid which (unless very carefully purified) contains traces of iron, arsenic and other metals. It is, therefore, safest to use "brimstone" (which is usually free from arsenic) acid for storage battery purposes, unless careful analysis is resorted to. Both kinds of acid are liable to contain traces of nitrogen compounds.

According to Dr. R. A. Smith, in his standard work "Air and Rain," 1872, rain-water has been known to contain the following impurities to the maximum extents given—namely:

Hydrochloric acid (chlorides, 560 parts per million), greatest at the sea coast; sulphates (1,226 in a million), greatest in large cities; ammonia (London—32 parts per million; Glasgow—9 per million); albuminoid ammonia (London—1.08 parts in a million; Liverpool—0.66 in a million); nitric acid (London—25 parts per million); nitrites. Other substances found in rain are organic substances, soda, potash, magnesia, alumina, carbonic acid, lime, oxide of iron and manganese.

Over 100 parts per million of foreign matter have been found in rain.

Water from town mains may contain sodium chloride, sulphureted hydrogen, sulphates of ammonium and potassium, magnesium and calcium, which latter two make the water hard but drinkable. Most impurities would be alternately oxidized and reduced with succeeding charges and discharges, and would thus help to discharge the cell irrespective of whether it is sending a current externally or not. It is well known that cells standing idle slowly discharge, the density of the acid becoming weaker. This loss of charge in a good cell amounts to from one to two per cent. of its total capacity per day, but may amount to from 40 to 50 per cent. if the cell contains impurities. Impurities in the form of metals which are more electronegative than lead [illegible] support [illegible] copper from corroded [illegible].

The lead [illegible] a specific gravity [illegible] perature of 15° C.

L. Jumau [illegible] tive much better than [illegible] and therefore that the best [illegible] capacity [illegible] obtained by [illegible] of the negative plate [illegible] tives. On the other hand [illegible] metals, such as tin, zinc, [illegible] harm in the solution. Manganese [illegible] with as an impurity in litharge, [illegible] owing to the formation of permanganic acid at the positive plate, and to the consequent [illegible] of the oxygen of the active material of the plate.

From the above remark it would appear that considerable risk is run by the use of either rain water or town water, and hence the only other option is to use pure distilled water. This [illegible] unfortunate in one way on account of the cost of it, but when carefully considered it is trifling compared with the cost of a new battery, which the use of impure water might entail. The practice which some central-station engineers adopt of using the condensed steam from the boilers is dangerous, because boiler water, in addition to its natural impurities, often contains some special alkaline-softening fluid. Another equally dangerous custom with some engineers is to add from one ounce to two ounces of ammonium sulphate, sodium, sulphate or sodium carbonate per gallon of the electrolyte, with the object of improving the condition of the cells. This practice, while giving a rich color to the plates, in time acts detrimentally on them, diminishing both capacity and efficiency. Accepting the limitations put by battery makers on the amount of impurities allowable it would seem that the electrolyte should be free from arsenic, nitrogen compounds, sulphuretted hydrogen, sulphurous acid and organic matter, and that it should contain only mere traces of hydrochloric acid and iron. Mr. R. W. Vicarey has recently found that from 10 to 0.1 per cent. of ammonia added to the solution decreased the capacity immediately by some 20 to 31 per cent., thus showing the deleterious effect of nitrogen compounds. The ammonia has a strong affinity for water and turns to nitric acid on the passage of a current.

The author of this paper has recently commenced a series of tests with a view to determining the maximum amount of any given impurity which may be present in a secondary cell without seriously affecting its capacity and efficiency. The tests, which will continue for many months and are at the present time, therefore, obviously incomplete, are being operated on 14 exactly similar cells. Each cell has one positive and two negative plates, all of the Planté type, and five by five by 0.25 inches in size, contained in a glass box 6¾ by 5½ by two inches inside. The normal charging rate is listed as two amperes and the discharge rate as 1.5 amperes for 10 hours (normal capacity 15 ampere-hours); two amperes for six hours and 3.5 amperes for three hours, with an electrolyte of a specific gravity of 1205. The manufacturers were asked to make them all under the same conditions, and particularly to ensure the elimination of all nitrogen compounds, both of which requests were carefully attended to. The sulphuric acid and the distilled water were analyzed and no impurities were found.

Eleven of the commonest impurities in sulphuric acid and in water have been chosen, and in amounts [illegible] ing points of the charge and discharge; that of No. 8 was, however, very low for both. Doubtless the effects will become more marked as the length of the tests proceed, and I much regret the incomplete nature of the results at this stage.

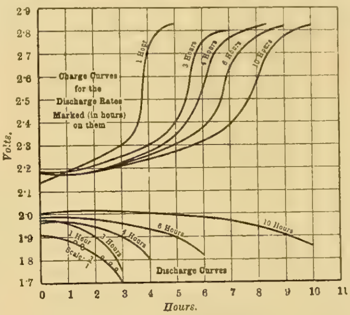


Fig. 1. Charge and Discharge Curves.

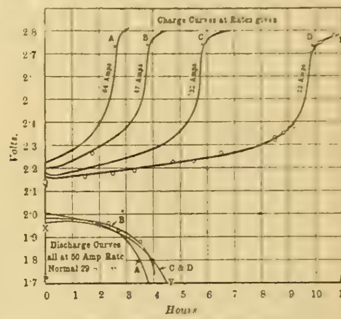


Fig. 2. Charge and Discharge Curves.

DETERIORATION IN STORAGE BATTERIES.

I now venture to give some curves showing the results of a lengthy series of tests which I made some time ago for a storage battery company on several large nine-plate storage cells having four Planté positives and five pasted negatives. The results are interesting and instructive as showing the effect of a variation in the charge and discharge rates on the capacity and efficiency of the cells which I have given in the accompanying table:

Discharge.			Ampere-hours		Watt-hours.		Efficiency.	
Rate in Hours.	Limit in Volts.	Current in Amperes.	Input	Output.	Input	Output	(Amp hour) Quan	(Watt-hour) Energy.
10	1.85	20.0	[illegible]	[illegible]	764	574	[illegible]	[illegible]
6	1.80	42.5	288	255	[illegible]	[illegible]	88.5	[illegible]
4	*1.80	50.0	224	200	[illegible]	[illegible]	[illegible]	74.5
3	1.75	70.0	[illegible]	[illegible]	[illegible]	402	[illegible]	[illegible]
1	1.70	134.0	168	[illegible]	414	[illegible]	80.0	[illegible]

*This should have been about 1.77 volts, and accounts for the efficiencies at this rate being disproportionate with the rest.

The normal charging current equals 32 amperes, discharging current equals 20 amperes at the 10-hour rate, and 134 amperes at the one-hour rate. Fig. 1 shows very clearly that the higher the discharge rate is the shorter the time of charging and the smaller the output. Fig. 2 shows that within the current limits taken the charging rate has but little or no effect on the output of the cell at the particular discharging rate taken. All the curves of Figs. 1 and 2 are the means of the last two or three out of some 10 charges and discharges at the particular rate shown. The cells had therefore arrived at a normal state for each rate.

Northwestern University of Evanston, Ill., is to have a school of technology, the nucleus of the fund for this purpose being the sum of $250,000 donated by Mr. and Mrs. Edward Swift. This will be one of the first undertakings of the new president of the university, Dr. A. W. Harris, who will be installed in July. Dr. Harris has been president of the University of Maine and is now president of the Jacob Tome Institute of Port Deposit, Md. He is a graduate of Wesleyan.

Power Plant Economics.

By H. G. Stott.

Part II.

New Type of Plant.

Over a year ago, while watching the effect of putting a large steam turbine having a sensitive governor in multiple with reciprocating engine-driven units having sluggish governors, it occurred to the author that here was the solution of the gas-engine problem, for the turbine immediately proceeded to act like an ideal storage battery; that is, a storage battery whose potential will not fall at the moment of taking up load, for all the load fluctuations of the plant were taken up by the steam turbine and the reciprocating units went on carrying almost constant load, while the turbine load fluctuated between zero and 8,000 kilowatts in periods of less than 10 seconds.

The combination of gas engines and steam turbines in a single plant offers possibilities of improved efficiency, at the same time removing the only valid objection to the gas engine.

A steam-turbine unit can easily be designed to take care of 100-per cent. overload for a few seconds, and as the load fluctuations in any plant will probably not average more than 25 per cent., with a maximum of 50 per cent. for a few seconds, it would seem that if a plant were designed to operate normally with 50 per cent. of its capacity in gas engines and 50 per cent. in steam turbines, any fluctuations of load likely to arise in practice could be taken care of.

We have seen that the thermal losses in the gas-engine jacket water amounted to approximately 19 per cent., and as the water is discharged at a temperature above 100 degrees, it can be used to advantage for boiler feed.

The jacket water necessary for an internal-combustion engine will probably be about 40 pounds a kilowatt-hour, assuming that the jacket water enters at 50° F. Then the discharge temperature will be $50 + \frac{19 \times 12{,}500}{40 \times 100} = 109.4°$ F.

As the steam turbine will require only about 15 pounds a kilowatt-hour, including auxiliaries, it is evident that only 37.5 per cent. of this heat, or 7.1 per cent. of the jacket-water loss can be utilized. The other loss in the exhaust gases of 30 per cent. can be utilized either in economizers or directly in boilers or superheaters. Thus by utilizing the waste heat in the gas engines for the purpose of assisting to make steam for the turbines, there can be saved approximately 37 per cent. of the total heat loss in the gas engine.

In the summary of analysis of heat balance it was shown that one can reasonably expect to bring the reciprocating-engine plant up to a maximum total thermal efficiency of 14.44 per cent., or possibly with steam turbines using superheat to 15 per cent.

Referring now to Table I. [Part I.] it will be noted that in item 2 the loss in ashes was 2.4 per cent., and the loss to stack in item 3 was 22.7 per cent. Now with the hot gases from the gas-engine exhaust it is evident that the loss in item 2 will not exist, and that item 3 will be reduced from 22.7 per cent. to about five per cent., as the process of combustion is completed in the gas engine. The total efficiency of conversion of this 30 per cent. of heat from the waste gases when used in the turbine plant would then be $15.0 + 2.4 + (22.7 - 5) = 35.1$ per cent.

The heat recoverable from the jacket water was shown to be 7.1 per cent. of the total heat in the coal so that there is 30 per cent. + 7.1 per cent. = 37.1 per cent. of the original heat in the fuel returned from the gas engine, and this can be converted into electrical energy at an efficiency of 35.1 per cent.

For each kilowatt delivered by the gas-engine plant, 3,918 B. T. U. will be simultaneously turned over to the steam plant, and this in turn will give 403 watts to the steam plant free of cost. The steam plant will then have only to furnish 1,000 — 403, or 597 watts per kilowatt at a thermal efficiency of 15 per cent.; in other words, the economy of the steam part of the plant will be raised to $\frac{15}{0.597} = 25$ per cent.

The average total thermal efficiency of such a combination plant would then be $\frac{24 + 25}{2} = 24.5$ per cent.

Load Factor and Investment.

In Fig. 12 the interest depreciation and taxes on a plant costing $130 per kilowatt, which may be taken to represent a first-class steam or internal-combustion plant, is shown plotted in conjunction with various load factors.

Another curve is plotted showing the minimum investment with a plant in which the prime mover would be steam turbines and designed otherwise without regard to efficiency, leaving out economizers, feed-water heaters, etc., and thus reducing the investment to $90 a kilowatt. This cheap and relatively inefficient part of the plant would only be operated on peak loads of two or three hours' duration, corresponding to a load factor of 0.1 or less found in possibly 40 per cent. of the output of our lighting plants.

Table II.

Distribution of Maintenance and Operation Charges Per Kilowatt-hour.

Maintenance.	Reciprocating Engines.	Steam Turbines.	Reciprocating Engines and Steam Turbines.	Gas Engine Plant.	Gas Engines and Steam Turbines.
1. Engine room mechanical	2.57	0.51	1.54	2.57	1.54
2. Boiler room or producer room	4.61	4.30	3.52	1.15	1.95
3. Coal and ash-handling apparatus	0.58	0.54	0.44	0.29	0.29
4. Electrical appartus.	1.12	1.12	1.12	1.12	1.12
Operation.					
5. Coal and ash-handling labor	2.26	2.11	1.74	1.13	1.13
6. Removal of ashes	1.06	0.94	0.80	0.53	0.53
7. Dock rental	0.74	0.74	0.74	0.74	0.74
8. Boiler-room labor	7.15	6.68	5.46	1.70	3.03
9. Boiler-room oil, waste, etc	0.17	0.17	0.17	0.17	0.17
10. Coal	61.30	57.30	46.87	26.31	25.77
11. Water	7.14	0.71	5.46	3.57	2.14
12. Engine-room mechanical labor	6.71	1.35	4.03	6.71	4.03
13. Lubrication	1.77	0.35	1.01	1.77	1.06
14. Waste, etc	0.30	0.30	0.30	0.30	0.30
15. Electrical labor	2.52	2.52	2.52	2.52	2.52
Relative cost of maintenance and operation	100.00	79.64	75.72	50.67	46.32
Relative investment in per cent	100.00	82.50	77.00	100.00	91.20

In Table II. will be found a tabulation of the relative values of the various items necessary in the maintenance and operation of a power plant. The first column covers a plant with compound condensing reciprocating engines without superheat,

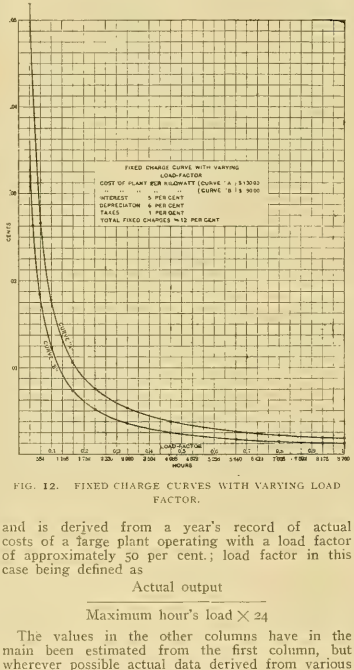


Fig. 12. Fixed Charge Curves with Varying Load Factor.

and is derived from a year's record of actual costs of a large plant operating with a load factor of approximately 50 per cent.; load factor in this case being defined as

$$\frac{\text{Actual output}}{\text{Maximum hour's load} \times 24}$$

The values in the other columns have in the main been estimated from the first column, but wherever possible actual data derived from various sources, both domestic and foreign, have been used; but in all cases all values have been reduced so as to make them directly comparable with the first column and with one another. The values in maintenance and operation of steam turbines are derived from actual costs.

Summary.

1. The present type of steampower plant can be improved in efficiency about 25 per cent. by the use of more scientific methods in the boiler room, by the use of superheat and by running the present types of reciprocating engines high pressure and adding a steam turbine in the exhaust between the engine and the condenser. At the same time the output of the plant can be increased to double its present capacity at a comparatively small cost for turbines and boilers.

2. The steam-turbine plant has an inherent economy 20 per cent. better than the best type of reciprocating-engine plant, not so much due to its higher thermal efficiency as to a variety of causes shown in Table II.

3. An internal combustion-engine plant in combination with a steam-turbine plant offers the most attractive proposition for efficiency and reliability today, with the possibility of producing the kilowatt-hour for less than one-half its present cost.

In conclusion, the author wishes to acknowledge the kindness of the Westinghouse Machine Company, the General Electric Company and the Allis-Chalmers Company in furnishing data on steam turbines and gas engines, and also the work of his assistant, Mr. W. S. Finlay, on data and in preparation of curves.

Discussion (in Abstract).

F. E. Junge, New York: In contributing to the discussion of the highly instructive paper presented by Mr. Stott a few remarks on the prime-mover end of the problem, with reference to German practice. I want you to bear in mind that inequalities and conditions, whether they be geographical, economical or governmental, must always largely affect the point of view and the judgment on questions that are of common interest in engineering matters, and especially so when the comparison concerns the practice of two countries, as the United States and Germany, wherein the specific circumstances governing the problem in question are so utterly divergent.

Beginning with the geographical conditions prevailing on the Continent, I want to say that in a small country with limited natural resources, but which are more closely located and more evenly distributed, and which have to supply a largely concentrated sphere of industrial activity, industries will naturally be attracted to locate within the coal-mining and iron-producing districts, and for the employment of high-tension electricity will easily extend the commercial radius of power distribution over the whole area of the country.

The possibility of utilizing the surplus power generated from waste gases by distributing and selling is in the neighboring industrial districts or cities for light and other purposes, forces the German engineer to place, in the determination of the commercial economic coefficient for a heat power plant, a more pronounced value on the factor of heat cost than can be imparted to it under the conditions prevailing in this country. How seriously the difference in the valuation of this factor effects the prime-mover problem in central stations can best be seen by comparing the results of an estimative calculation made by Iffland to determine the respective merits of various engine drives for a combined coke, iron and steel-melting plant, where the coal mines are so closely located as to fall into the commercial distribution radius of the electrical central station and are operated from such. The normal power required by all engines together is 42,200 horsepower; therefore the maximum simultaneous capacity which the plant must be able to carry permanently is 21,000 horsepower, which is produced from the waste blast furnace and coke oven gases.

We shall only consider two cases. First, the gas-engine-driven central station, and second, a steam-turbine-driven central station. The auxiliary machines are all operated from the central station. On account of the difference in consumption of the reversible and non-reversible machines the total capacity of the central station required is found to be 25,000 kilowatts, it being advisable with complete centralization to provide for an ample reserve. The power equipment in case 1 consists of eight gas engines, having each 6,000 horsepower normal capacity and 4,000 effective kilowatts ($\cos \rho = 0.8$).

In case 2, of five steam turbines, each having 10,000 horsepower normal capacity and direct connected to alternating-current generators of 6,800 effective kilowatt capacity ($\cos \rho = 0.8$). The normal capacity of the gas-engine-driven central station is therefore 32,000 kilowatts total; of the steam-turbine-driven station, 34,000 kilowatts. Most of the machines used on the plant are in constant operation all the year round.

Now, assuming that the waste gases had no commercial value whatsoever, then the actual cost, including initial capital outlay and operating expenses for generating one brake horsepower-hour, comes out as follows:

For gas-engine-driven central station.....0.44 cents
For steam-turbine-driven central station.....0.42 cents

For purposes of comparison I give the figure that would be obtained with pure steam-engine drive throughout. One brake horsepower-hour would then cost 0.75 cents. In this case, then, the steam turbine would be the most economical prime mover that could be selected. However, the assumption that the blast furnace and coke-oven gases are given for nothing is erroneous. The gases must first be cleaned, because this increases their heating capacity and makes them applicable for use in gas engines, but this process requires an expenditure of one cent per 30,000 cubic feet; moreover, they actually have a value as fuel for steam raising. In the plant under consideration we shall therefore compare the power value of the waste gases when used in gas engines to what obtains when burned under boilers, and so we must appraise the gas at a rate corresponding to the reduction of the coal bill. If power can be distributed abroad the appraising of the gas depends on the salability of the surplus power and varies with the localities. Now, if we figure $2.50 per ton for coal and assume that seven kilogrammes of steam are raised from one kilogram of coal, then the value of the blast-furnace gases which are

to be used in gas engines is $150,000. The value of the blast furnace and coke-oven gas available for raising steam is $325,000. With this valuation the former results are modified as follows:

	Per Brake Horse-power Hour
Gas engine-driven central station	[illegible]
Steam turbine-driven central station	[illegible] cent

With pure steam-engine drive the cost would be 0.98 cents. The correct valuation of the fuel upsets the former results entirely in favor of the gas-engine-driven central station. Basing the results on the cost of production per ton of marketable goods, of which the plant sells 300,000 tons a year, the following is arrived at: Gas-engine-driven central station, $2 without, and $2.48 with appraising the gas; steam-turbine-driven central station, $1.93, and $3.02, respectively. With pure steam-engine drive the cost would be $3.35 and $4.42, respectively. It is seen that the gain effected by the selection of gas engines instead of steam turbines for the central station amounts to 50 cents per ton of annual capacity. The figures are of special significance, as they show how much the whole prime-mover question hinges on the valuation of the factor of heat cost. The conditions change, of course, if a plant possesses only capacity for iron and steel smelting and has rolling mills but no coal mines attached to it, and they are again different when we consider a steel plant with rolling mills but without coal mines, blast furnaces and coke ovens. It is only in the last-named cases that pure gas-engine drive—that is, gas-engine central station and scattered gas-engine auxiliaries—is the most economical method, but it is only by a combination of coal mines, blast furnaces, steel-smelting plants and rolling mills that an efficient production is possible, as we can hereby avoid paying the duty imposed by the protective tariff on raw materials, pig-iron and half-finished goods.

Mr. Rice: If the steam engineer only had the equivalent of the ammeter and voltmeter, I feel confident that the efficiency of the steam engine plant could be greatly increased at the present time. In connection with this point it is interesting to note the large saving which may be effected in item 3, losses through stack, in Table I. [Part I], by intelligently following out of the indications given by the CO_2 recorder, a most admirable instrument. The author shows quite conclusively the high efficiency of steam auxiliaries. This naturally follows from the fact that the latent heat can be usefully employed to raise the temperature of the feed water. It is evident in a case where the heat of exhaust can be usefully employed the mechanical power can be obtained at high efficiency by using steam in a steam engine between boiler pressure and atmospheric exhaust. Familiar illustrations of this are to be found in the use of exhaust steam from high-pressure engines in the heating of factory buildings. During the period and to the extent that such exhaust steam can be utilized in the heating of factory buildings, or for other manufacturing purposes, mechanical power may be obtained at high efficiency by the use of simple or compound engines operating from boiler pressure down to the pressure of the exhaust. The engine in this case may be considered as a simple reducing valve, reducing the pressure.

No doubt there is much to be said in favor of electrically driven auxiliaries from the standpoint of convenience, simplicity, reliability, avoidance of unnecessary steam pipes, but they cannot compare in heat efficiency with steam-driven auxiliaries. It is unfortunate that no way is known at present of eliminating the enormous losses, some 60 per cent. of heat units rejected to the condenser. It emphasizes the importance of working with the highest possible vacuum.

I am not quite sure Mr. Stott recommends the combination of reciprocating engine and steam turbine in the exhaust as a type to be considered in laying out a new station. If so, it does not seem to me that the advantages gained by such a combination would offset the added complexity. I believe, however, it is a most excellent means of increasing the economy, and particularly to add to the output, of existing reciprocating engine stations.

Charles E. Lucke, New York: Mr. Stott has mentioned as one of the strong points in his paper a sort of wonder as to why the gas engine had not developed faster than other units—for instance, the turbine. I think that if there were more men of Mr. Stott's fairmindedness and judiciousness this would have happened. The gas engine has had a hard road to travel. It has had, undoubtedly, from the very first a high thermal efficiency, but by reason of the ignorance of operators or the superstition of operators and by reason of their love for their old friend, the steam engine, the gas engine has been called a tricky machine and has not had a fair chance. I think also, in fairness, I ought to point out in this connection that the gas-engine builders in the past have probably been as great enemies to the development of their own machinery as some of these so-called superstitious and ignorant persons who handled them. They have claimed everything on earth for the gas engine; that it required only a child to run it; that it ran on so little coal that shortly it would be making coal, and people bought these machines and were inevitably disappointed and complained [illegible] could not [illegible] kilowatt hour, including [illegible] the gas-engine plant [illegible] plant, and that, with the [illegible] generator with [illegible] still greater economical advantages. I think it is necessary, however, in this [illegible] to remember that of all the power used [illegible] throughout the United States [illegible] our attention to the [illegible] horsepower generated in such high-efficiency central stations is but a very small percentage of all the power generated in the country, taking together all our mills and factories, and that the arguments which apply to such a concentrated low power-cost station as this would not necessarily apply to some of these other cases. There are conditions for every installation which will undoubtedly determine its type, and these are, not always, and I might almost say very seldom, considerations of high economy or thermal efficiency.

Mr. Stott points out for our consideration a load curve, rather a load-economy curve, for a gas engine, and draws the conclusion that a gas engine having this load economy curve should not be used at anything less than half load, because its efficiency falls off so very much toward no load. The conclusion is entirely justified with respect to this particular engine that produced this particular curve, or the particular type of engine which produced that curve, but it is not justified with respect to all gas engines. The only reason why the economy of a gas engine should vary very much with load is to be found in the governing mechanism. This is caused when the governor of the gas engine acts as a throttle on the mixture, which is the case with the engine quoted, although the name is not given. In that case, for the entire suction stroke of the engine, which is the charging stroke, the piston must work against the constantly increasing vacuum clear to the end, and that means there will be a loss, working away below the atmosphere line. Now it does not necessarily follow all gas engines will have this type of governor, or that any gas engine will have this type of governor some time in the future when the design has been refined. If the lowest working of the engine, as effected by the position of the governor, or governor action, is eliminated or reduced to a minimum, or kept standing, the economy load curve will be perfectly flat, and this curve becomes then, not a criticism of the gas-engine economy, but a criticism of that particular type of governor which I am confident will disappear in time.

W. L. R. Emmet, Schenectady, N. Y.: One of the great things which this paper of Mr. Stott makes clear is the great saving in investment incident to the use of steam turbines. He shows a curve of performance of a steam engine which shows a very abrupt rise in the rate of steam consumption with increase of load. We all know that what a man pays for when he equips a steam plant is capacity to carry his peak load. The reciprocating steam engine, particularly in the case of large units, is undesirable from this standpoint, for the reason that the problem in building very large steam engines is to take care of the great weights involved in the low-pressure cylinders and valves. Consequently, these very large steam engines have a tendency to be uneconomical at overload, because the temptation to the engine builder is always to make the low-pressure cylinder small, in order that he can get good economy at certain loads and can just barely get through without mechanical difficulties. Now this curve of Mr. Stott's, instead of turning up at 4,000 kilowatts, if this was a turbine of the good quality shown by another curve, it would keep along straight from that overload point, or there would be a very small rise. The result would be, at some maximum output of the boilers the turbine would have anywhere from 20 to 25 per cent. more capacity, more maximum capacity than the engine. Now, the meaning of that is that you are buying for so much money 20 per cent. more power. The power is costing you possibly in the case of this station $150 a kilowatt, 20 per cent. of that is $30 a kilowatt; that is, the increased value which is represented by the turbine in overload capacity is more than the total cost of the turbine.

One of the important things in turbines is obviously, the use of high vacuum. A great deal of attention is devoted to this, and it is astonishing how successful high vacuum has been in connection with steam turbines. There is practically no air leakage, and you get almost theoretical conditions, and if one investigates the theory, it is easy [illegible]

Electrical Exports for the Year 1905.

[illegible] $840,202.

The total value of electrical exports from the United States for the year 1905 was $1[illegible],677. [illegible] following table shows the total value of electrical exports for the last three years:

	[illegible]	[illegible]	[illegible]
Electrical apparatus	[illegible]	[illegible]	[illegible]
Electrical machinery	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]

Details as to the destination of electrical exports from the United States can only be given for goods classed as electrical machinery. Considering, therefore, electrical machinery only, British North America was the largest purchaser from the United States in 1905, having held that position also in 1904. Previous to 1904 the United Kingdom had always held first place, but the amount of its imports from this country has gradually fallen off from $2,024,080 in 1902 to $885,005 in 1905. Japan was the second largest purchaser during the year 1905, and Mexico was third. In 1904 Japan suddenly jumped from a minor importer of our electrical machinery to the third from the top, and the 1905 figures show a considerable increase over 1904. It is also interesting to note that the exports to Cuba show an increase from $35,105 in 1904 to $100,337 in 1905.

Classified according to destination the following figures show the value of electrical machinery exported from the United States in the years 1904 and 1905, respectively:

	1904	1905
United Kingdom	$1,22[illegible]	$[illegible]
France	12[illegible]	2[illegible]
Germany	[illegible]	[illegible]
Other European	22[illegible]	[illegible]
British North America	[illegible]	[illegible]
Central American states and British Honduras	[illegible]	[illegible]
Mexico	6[illegible]	[illegible]
Cuba	[illegible]	[illegible]
Other West Indies and Bermuda	[illegible]	[illegible]
Argentina	[illegible]	[illegible]
Brazil	122,[illegible]	[illegible]
Columbia	[illegible]	[illegible]
Other South America	[illegible]	[illegible]
Chinese Empire	[illegible]	[illegible]
British East Indies	[illegible]	[illegible]
Hongkong	[illegible]	[illegible]
Japan	[illegible]	[illegible]
British Australasia	[illegible]	[illegible]
Philippine Islands	[illegible]	[illegible]
Other Asia and Oceania	[illegible]	[illegible]
British Africa	[illegible]	[illegible]
All other Africa	[illegible]	[illegible]
Total	$6,6[illegible]	$[illegible]

Electrical Exports for December, 1905

Electrical exports from the United States for the month of December, 1905, amounted to a total value of $1,525,717. This was the largest figure for any single month in the year, and was greater by $488,190 than the figures for the corresponding month in 1904. The exports for December in both classes of goods—electrical appliances (including telephone and telegraph apparatus) and electrical machinery—were more than for any other month in the year. Both classes also show a large gain over December, 1904, as follows: Electrical appliances—December, 1904, $433,081; December, 1905, $685,425; electrical machinery—December, 1904, $603,846; December, 1905, $840,202.

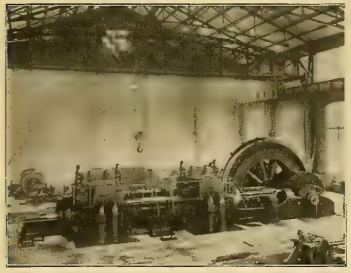
Considering now electrical machinery only, the following countries, with the amount of their purchases, were the principal buyers of electrical machinery from the United States in December, 1905: British North America, $240,0[illegible]; United Kingdom, $144,499; Cuba, $111,735; Mexico, $100,700; Japan, $59,845; British Africa, $42,099; Brazil, $24,829; France, $22,240; Germany, $10,300; British Australasia, $10,153; Philippine Islands, $4,88[illegible]; Argentina, $4,141; British East Indies, $2,805; Central American states and British Honduras, $1,361.

1,800-horsepower Gas Engine Direct-connected to Alternator.

The new Crystal City Works of the Pittsburg Plate Glass Company now under construction at Crystal City, Mo., will, when completed, occupy a unique position among industrial plants from the remarkable size of the lighting and power units installed there. This plant will be the largest of its kind in the United States driven by electrically transmitted power, its design embodying many new features specially devised to meet production conditions.

A notable feature of the power equipment for the new plant is the installation of an 1,800-brake-horsepower Allis-Chalmers gas-engine unit, direct-connected to a 1,000-kilowatt generator. This engine is of the well-known four-cycle double-acting Nuremberg type. It is a horizontal four-cylinder twin-tandem engine, with a 42-inch stroke and a speed of 107 revolutions a minute. The unit is designed to operate from producer gas, generated from "Big Muddy" (Ill.) bituminous coal. All moving parts are arranged for automatic and continuous lubrication under pressure. The gas engine and alternator will be arranged to run in parallel with other units.

The alternator is of the Allis-Chalmers revolving-field engine-type three-phase 25 cycles, and mounted directly on the crank shaft between the twin gas engines. This unit will be installed in the same power house with the 5,000-horsepower Allis-Chalmers engine recently purchased, and which will be recalled by visitors at the St. Louis Exposition, where it carried the entire lighting load for the illumination of buildings and grounds, and where, because of continued good service, it was named the "Big Reliable" by the exposition attendants.



1,800-HORSEPOWER GAS ENGINE DRIVING ALTERNATOR.

Advertising Exhibit for Atlantic City.

In connection with the twenty-ninth convention of the National Electric Light Association, to be held at Atlantic City, June 5th, 6th, 7th and 8th next, it is proposed to repeat, on a more extensive scale, the exhibit of central-station advertising that was given with so much success last year at Denver for the first time. Steps are now being taken to carry out this purpose, and it is believed that the exhibit will prove attractive and instructive to central-station managers. It is proposed to divide the exhibit into two sections, one showing the work done by the larger companies, which maintain their own force for such work, and issue and prepare their own bulletins, and the other showing bulletins and material furnished by the new concerns that have sprung up lately to supply the smaller stations with this class of matter, many of which have already done very effective work. In addition to this, a display will be made of posters, large newspaper advertising and the original drawings and sketches employed in the bulletins.

Electric Hoisting Machinery.

Electrical hoists have demonstrated their superiority over steam-driven apparatus for raising building materials, quarrying stones, erecting steel work, etc., a convenient source of electrical power being, of course, necessary. The fact that the power is brought to the motors through two small cables makes the erection of the hoisting apparatus a matter of small moment. On board ship, for handling cargos, sails and boats, or for warping the ship into dock or changing its position along the wharf, drum hoists provided with a winch head are of special service. Apparatus of this nature is manufactured extensively by the Crocker-Wheeler Company of Ampere, N. J., and the two illustrations herewith show examples of its product.

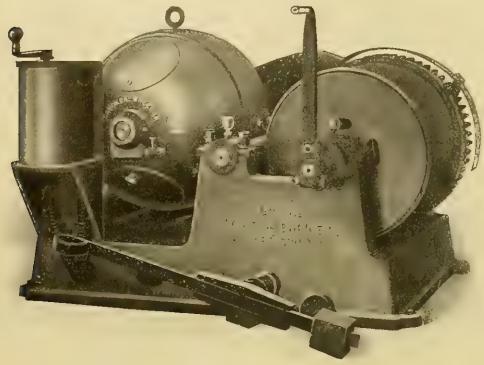


FIG. 1. ELECTRICALLY OPERATED HOIST WITH REVERSIBLE DRUM CONTROLLER.

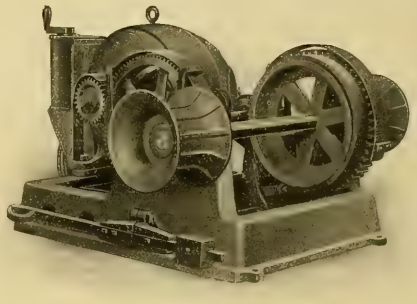


FIG. 2. ELECTRIC WINCH WITH DOUBLE WINCH HEAD.

Fig. 1 is a standard electric hoist provided with a winding drum driven by the motor through a double run of spur gearing. This drum is free to revolve on the shaft, but is thrown into engagement with the gearing by means of a friction clutch operated by a hand lever. When the drum is disengaged from the clutch its motion may be regulated or stopped by means of a band brake operated by a foot lever. This lever is counterbalanced so that the brake is instantly released as soon as the foot is removed from the lever.

The motor is operated by a reversible drum controller, providing 12 or more speeds in either direction, and the location of the controller handle, foot lever and friction lever is such as to place them all within convenient reach of the operator. The motor is of the fully enclosed I type, having a compound winding especially suited to this class of work. In operation the motor may be run continuously and the motion of the drum controlled by means of the friction clutch and band brake, or, when the class of service demands, the friction clutch may be engaged and the motion of the drum regulated by the controller.

The electric winch illustrated in Fig. 2 is designed to carry two winch heads, one being mounted on either end of the main shaft. The heads are keyed to this shaft, and the drive from the motor is through a double run of spur gearing. The winch heads are ribbed so as to provide a secure hold on the rope, and a friction band brake is applied to the side of the gear upon the main shaft. This brake is controlled by two levers, so that it may be operated from either side of the winch.

The motor equipment and controller are the same as are furnished with the standard hoists, but the controller is in this case placed at the rear so that the operator when he stands at the controller is able to handle a rope coming from either winch head. In operation the motor may be run continuously or its speed may be regulated as desired by means of the drum controller.

Searchlights to Aid Firemen.

At the time of the recent collapse of a London railway-station roof the electric searchlights lent by the Electrical Engineers Volunteers were a great aid in helping to clear away the debris. This fact has brought into prominence the great possibilities that lie in this direction. Consequently the London County Council is giving attention to a proposition that its fire engines shall be equipped with portable searchlights, which could be supplied with electricity from street boxes, much in the same way that water is now provided. The London correspondent of the Western Electrician says that the electric-supply companies are taking the matter up, and he thinks something should certainly come of it, for in the center of London electricity is available in every street.

Not How Flat but How Steep.

The following paragraph from an article in a daily newspaper in a western city is rather amusing. It is so laboriously sarcastic that no doubt most readers will regard it as a mere burlesque and attach no serious importance to it. But such publications as these can have no good effect on the business of the central-station company, and may have some bad effect. It should be part of the business of the electric-light company to cultivate good relations with the daily newspapers, which, with all their shortcomings, wield a tremendous influence. These jibes, then, are cited to show what an ill-natured newspaper can do:

"It is really too bad that the electric company decided a few months ago to install new meters all over town. The old meters were doing all that could reasonably be expected of them in the way of piling up monthly light and power bills, and even the flat rate was not quite so flat as it was steep. But all at once the company learned that somebody had invented a new kind of meter, a cunning little device, which not only registered the current that passed through it, but a good deal more. Just for the sake of giving the people a change, and confident of its ability to hold the things down within the limit of the speed ordinance, the company put them in the homes and business houses of the dear public, and now there is no end of trouble. For, as we have just remarked, people are so unreasonable. They seem incapable of appreciating the altruistic motives of those public-utility corporations which have no competition. Hence, the intimation that the company willfully speeds up the meters, merely to gratify a vulgar desire to increase its profits."

The Arc Light on Candlemas Day.

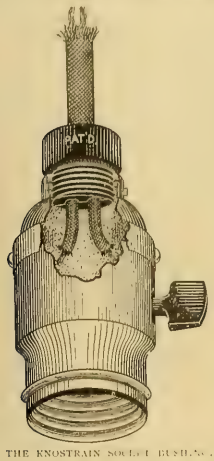
The accompanying illustration is a reduced reproduction of a cartoon by McCutcheon which appeared in the Chicago Daily Tribune of February 2d. Tradition says that if the groundhog sees his shadow when he emerges from his subterranean abode on February 2d he will go back and there will be six weeks more of winter weather. It will be noticed in the cartoon that the coal man has a large pile of coal left, and so determined is he to get rid of it that he has prepared for the occasion. If the sun fails to shine the arc lamp will furnish the necessary light to send the groundhog back for six weeks of cold weather.

THE ARC LIGHT ON CANDLEMAS DAY.

The Knostrain Socket Bushing.

The National Board of Fire Underwriters now demands (rule 28, section G) that the weight of a suspended socket and lamp shall be borne by some approved device which will take the strain from the connections or binding screw both in the socket and rosette and at the same time form an insulator or bushing. To accomplish this with new code reinforced window or new code tan cord it is necessary to use three-eighth-inch socket and a rosette with a large size hole in the cap.

To fulfill these requirements the Frank H. Stewart Electric Company of 45 North Seventh



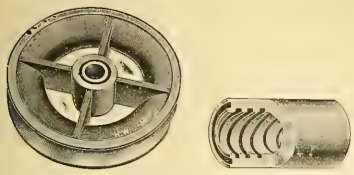
THE KNOSTRAIN SOCKET BUSHING.

Street, Philadelphia, is placing on the market a new device known as the Knostrain socket bushing, designed to take the strain off electrical connections in three-eighth-inch sockets and ceiling rosettes. One type can also be used as a handle bushing.

The bushings, as seen by the accompanying cut, are made in two pieces with corrugated grooves, so arranged that they firmly grip ordinary lamp and show-window cord and act as an insulator at the same time. The type known as the Knostrain rosette or handle bushing, not here illustrated, is much similar in construction and securely grips No. 16 or 18 new cord.

A Trolley Wheel of Pure Copper.

In the manufacture of trolley wheels such materials as arsenic, antimony, bismuth, tin, lead and spelter are sometimes combined with copper, and these elements (even if used only in very small quantities) seriously affect copper as a conductor of electricity, and hence shorten the life of the wheel. Alloying copper with these metals also renders the metal harder and greatly diminishes its ductility. As a result the trolley wheels cut the wire and both the wheels and the overhead construction require frequent replacement. To obviate these difficulties the H. W. Johns-Manville Company has recently placed on the market a new wheel made of absolutely pure copper, which is purified, hardened and made tough by a special treatment known and used only by itself. These wheels have been subjected to severe tests in actual service. The salient feature of the J-M pure copper wheel that



PURE-COPPER TROLLEY WHEEL AND BUSHING.

appeals to the operating railroad man is economy. The mileage is said to be far greater than heretofore obtainable by the use of any known metal or combination of metals. The wheels also wear smooth and even and will not pit, arc or burn.

In the manufacture of these wheels only the best grade of pure Lake copper is used, and this material is treated chemically so as to reduce to a minimum any ingredients there may be in the copper in its crude state. By a further chemical process the action of the atmosphere is excluded. Subjecting the copper to the action of carbon removes the oxygen and renders the copper solid when cast, thus increasing its malleability and durability. A still further process toughens the metal without hardening it, and the result is that the wear is reduced to a minimum and the con-

[illegible]

Interborough Rapid Transit Company's Test of Subway Engines.

An interesting official 15 hour test of one of the tandem vertical horizontal Reynolds Corliss engine cylinders 42 and 86 by 60 inches, which have been in operation at the Fifty-ninth Street station of the Interborough Rapid Transit Company, New York city, since 1902, was concluded December 13th. The tests were conducted by the Interborough Rapid Transit Company and representatives of the Allis Chalmers Company as a final determination of the fulfillment of the builder's guarantee and formally provided for in the original contract. How well the tests of engine No. 8, which was selected as representing all the engines installed, fulfilled the claims made for it, may be readily ascertained from the following data, giving a synopsis of the completed tests.

As per agreement, on account of the impossibility of keeping a constant load, the power was determined by the readings of tested integrating wattmeters. These readings were reduced to indicated horsepower by running the generator as a synchronous motor, and adding the electrical input to the switchboard readings when developing power, to obtain the power exerted by the engine. The result of the test so made, under conditions approximating the contract requirements of 7,500 horsepower, 75 revolutions per minute, 175 pounds steam pressure and 26-inch vacuum, was a consumption of 11.96 pounds of dry saturated steam per indicated horsepower-hour, or well within the guarantee of 12.25 pounds. The steam consumption per kilowatt-hour at the switchboard was 17.34 pounds. Following is the general data of the test.

Duration	15	hours
Load	5,079.2	kilowatts
Friction and generator losses	417.3	Kw.=559.41 H. P.
Total load	5,496.5	kilowatts
I. H. P.	7,365.3	horsepower
R. P. M.	75.02	
Steam pressure	175.18	pounds
R. H. Receiver	19.1	pounds
L. H. Receiver	10.27	pounds
Vacuum	26.02	pounds (actual)
Temperature Injection Water	42.36	degrees
Temperature R. H. Discharge	74.58	degrees
Temperature L. H. Discharge	77.38	degrees
Barometer	30.50	pounds
Water per hour	89,906	pounds
Drips per hour	512	pounds
Leakage per hour boiler	1.4	pounds
Boiler level correction	60	pounds
Net water per hour	88,564	pounds
Quality of steam	1.0038	per cent
Dry steam per hour	88,120	pounds
Dry steam per kilowatt hour	17.34	pounds
Dry steam per indicated horsepower	11.96	pounds

The final results allow for boiler leakage, which was determined by a separate test of 24 hours' duration. The steam was very slightly superheated during the test, as being easier to make allowance

[illegible]

Convention of Crocker-Wheeler Officials.

Branch managers, officers and department heads of the Crocker-Wheeler Company met at their annual convention at the home office in Ampere

BRANCH MANAGERS AND OFFICERS OF CROCKER-WHEELER COMPANY IN CONVENTION AT AMPERE, N. J.

N. J., January 24th to 27th. Mr. Julian Roe, manager of the Chicago office territory of the company, attended the convention and reported that the company had done more business through his office during 1905 than in any former year since the office was opened. He also declared that the reputation of the Crocker-Wheeler Company motors, small and large, and both direct and alternating-current generators, was unsurpassed.

The Crocker-Wheeler Company has made during the last year a great record in alternating-current manufacture and has built and marketed a line of core-type transformers that are new to the American market and have already earned a satisfactory popularity. The branch managers expressed their enthusiasm for this line of machine and for two other new lines of electrical apparatus the company is about to place upon the market.

On Thursday evening, January 25th, the branch managers and department heads were the guests of Dr. Schuyler Skaats Wheeler, president of the company, at dinner at the University Club, New York.

A photograph was taken of those in attendance at the convention which is reproduced herewith. From left to right the names of those in the top row are as follows: F. W. Kreps, W. C. Appleton, H. M. Gassmann, H. Fuller, B. A. Schroder, S. Russell, Jr., C. W. Startsman, J. R. Wilson, H. A. Brown, H. J. Sage, H. C. Petty, H. C. Baker, Harold Lomas, R. N. C. Barnes, H. B. Hussey, Julian Roe, L. M. Ward, C. N. Wheeler, M. E. Weissblatt, L. S. Horner, E. Heitmann, A. Hartmann, W. E. Sullivan, H. Pikler. In the second row from left to right the gentlemen are J. B. Milliken, H. B. Patteson, W. L. Brownell, A. L. Doremus, S. S. Wheeler, G. S. Dunn, W. A. Doble, F. B. DeGress and G. W. Bower.

Electrification of Victorian Railways in Australia.

According to information from Melbourne, Australia, as reported in the London Times Engineering Supplement, work of a considerable magnitude has been planned in connection with the electrification of the Victorian railways which include sidings and all, 4,264 miles, and are owned and operated by the state. Mr. Thomas Tait, chairman of the railway committee, has just submitted to the government a statement in which he says that, notwithstanding the serious increase in maintenance which would follow such a course, the board was not averse to the electrification of the railways, which are now being worked by steam, provided it could be shown that the new system would produce an additional revenue equivalent to the interest on the capital involved for conversion of lines and rolling stock. The proposals immediately under consideration deal with the conversion of the railway from Melbourne to St. Kilda, 12 miles, and provide also for six electric street-railway lines. A general power house, with the necessary plant, rolling stock and conversion of tracks are estimated to cost £256,559. The commissioners do not think that existing railways, or railways which may be built in the future, would injure the financial success of their lines, even if running parallel with them. Their suburban lines, which have a length of 147 miles, with 293 miles of single track, during the year ended June 30th carried the extraordinary number of 54,470,000 suburban passengers. The popular feeling appears to be greatly in favor of the electrification of these lines, for Melbourne is very poorly provided with other means of transit.

The Melbourne street railways, which are on the underground cable system, extend over 150 miles. During the first nine months of 1905 they carried 42,177,744 passengers over 7,666,081 car-miles for a revenue of £375,887, both mileage and receipts being on the decrease.

Pabst Brewery Power Plant.

In response to a demand for more power in its large brewing plant at Milwaukee, the Pabst Brewing Company has recently placed an order with the Allis-Chalmers Company for additional steam and electrical units. There are three engines in all—one of the single-cylinder non-condensing type, cylinders 20 by 36 inches, and two of the cross-compound non-condensing type, 18 and 30 by 36 inches, all vertical and of the heavy duty pattern for direct connection to electrical machines. The electrical equipment will consist of three revolving-field type alternating-current generators, 25 cycles—one for 300-kilowatt and two for 400-kilowatt capacity. Two exciter sets, consisting of direct-current constant-potential compound-wound generators, coupled direct to three-phase synchronous motors and fitted with induction type of starting motors, will be installed; also one exciter set, consisting of a direct-current generator of the same type as above, for steam drive.

A feature of the new installation will be a special governing device consisting of an electrical adjusting or synchronizing attachment by which the speed of the engines may be varied within certain limits while they are in operation, the device being under control of the operator at the switchboard. It is expected that the first of the new units will be in operation by the first of May.

Mr. C. A. Chapman of Chicago acted as consulting engineer for the Pabst Brewing Company.

Niagara Power for Cleveland Proposed.

The Ohio correspondent of the Western Electrician says that it is rumored in Cleveland that the Niagara, Lockport and Ontario Power Company is considering the possibility of building a transmission line from Niagara Falls to that city. He continues: "Cleveland is but 40 miles farther from the source of power than Syracuse, where a contract has already been made. The trolley men believe that it would be entirely feasible to transmit power that distance to advantage. Nothing has been done, so far as known, but the matter has been under discussion in electrical circles." Cleveland, it may be added, is about 190 miles from Niagara Falls.

The Erie Railroad Electrification.

It has been announced by the Erie Railroad Company that, in all probability the 250 miles of suburban tracks of the company entering New York city will be equipped with electric traction within two years. The electrical commission authorized by the directors and formed by Vice-president Graham is examining the details of the different electric-traction systems, and will soon decide what branch shall be used for experimental purposes. The proposition involves not only the electrifying of the lines, but the purchase of entire new equipment to conform to the necessities of electrical power, and the cutting of a way for four tracks through Bergen Hill, near the present tunnel and, possibly, the rearrangement of the present Jersey City terminal.

Searchlight "Morse" for Announcing Election Returns.

During the recent general election in Great Britain many and diverse were the schemes devised by the London and other daily newspapers to make the public early acquainted with the polling results. "The majority of these efforts," says the London correspondent of the Western Electrician, writing under date of January 24th, "have been witnessed in London. In most cases the organizers were satisfied with the commonplace cinematograph result thrown upon a white screen, but the Daily Mail devised a scheme by which the results were thrown into the dark night atmosphere in the Morse telegraphic code by means of searchlights of the army type. The modus operandi was to select three or four of the highest parts of London, at the various points of the compass, and there install a powerful searchlight. From a point in the center of London, the results, as they were received from the various parts of the country, were signaled out, and were taken up by the watchers in the outskirts and repeated. The dots and dashes were produced by working a shutter in front of the carbons. The unfamiliarity of the general public with the Morse code necessitated an elaborate coaching in the pages of the journal in question."

Engineers' Club of Chicago.

One of the newer organizations of technical men in Chicago is the Engineers' Club, which has as its object the promotion of social intercourse and goodfellowship among the engineering profession in Chicago. The club has seven simple rules and is managed by an executive committee, of which Onward Bates is chairman. It has no permanent quarters now, but may have before long, as it has accumulated a fund for the purpose. The resident membership is limited to 100, and the list is about full. Any engineer or person interested in the advancement of engineering is eligible, but a negative vote of three per cent. of the resident members, by secret-letter ballot, will exclude any candidate. Among the members are the following-named gentlemen:

John B. Allen, B. J. Arnold, Onward Bates, George M. Brill, William H. Finley, Charles H. Fry, E. M. Hagar, Robert W. Hunt, William S. Love, Arthur F. MacArthur, Ralph Modjeski, W. Morava, E. S. Nethercut, George P. Nichols, A. T. Perkins, Isham Randolph, E. C. Shankland, Theodore W. Snow, Adolph Sorge, Jr., Charles L. Strobel, J. W. Walsh, Chicago; A. S. Crane, New York; Prof. D. C. Jackson, Madison, Wis.; Alfred Noble, New York; H. U. Wallace, New York, and John F. Wallace, Flossmoor, Ill.

Large Induction Motors for Anaconda.

What are said to be four of the largest induction motors ever installed in the West, and some of the largest in the country, with the exception of those installed at Niagara, will be used to furnish power at the $9,000,000 reduction plant of the Anaconda Copper Mining Company, Anaconda, Mont. Each of the big induction motors will weigh over 40 tons, the weight of the entire equipment when ready for shipment being approximately 259 tons. The motors will be used in the concentration building, which is 600 feet long, through which a main line shaft extends the entire length. The motors will be rope-connected to this shaft and will carry the entire power load.

The Allis-Chalmers Company of Milwaukee will furnish the electrical equipment for the 8,000-ton concentrator and the street-railway company at Anaconda. The concentrator equipment will consist of the four 1,200-horsepower induction motors under consideration, three 300-kilowatt motor-generator sets, together with the usual auxiliary accessories. This order is one of several which will follow the determination of the Anaconda company to substitute Missouri River power, transmitted 90 miles at 70,000 volts, in place of the present power system installed.

Cheaper to Buy Current.

The Grand Rapids (Mich.) Press of recent date says: "The action of the Grand Rapids Railway Company, following that of the Grand Rapids-Grand Haven and Muskegon interurban, in deciding to purchase power from an electrical company, adds force to the suggestion of General Manager Freshney that the municipality seriously consider the matter of buying electricity, instead of making it at the lighting plant. When private corporations managed as shrewdly as the street railway and the Muskegon interurban can see that it is to their advantage to buy electricity generated by water-power in preference to transforming coal into electricity at their own plants, the city can afford to turn its attention in the same direction."

Step-by-step Party-line Selective Telephone System.

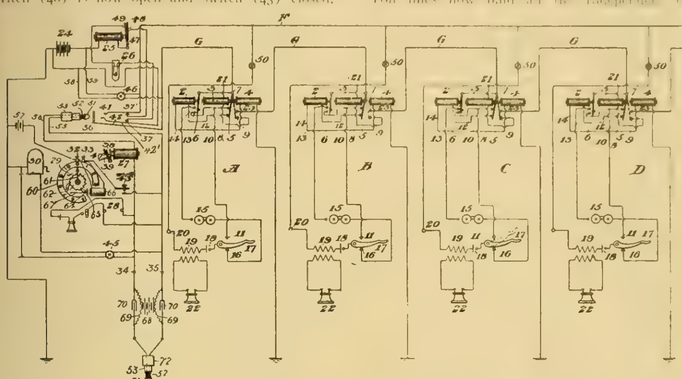
Party-line selective systems may be divided roughly into two classes, one of which makes use of different degrees of current strength or different polarities sent out from the central station and the other employing selective apparatus at the subscriber's station, which may be operated from the central exchange. This latter class of mechanism makes use of some form of step-by-step apparatus to select the subscriber desired, and usually strong current is necessary to operate all the mechanisms that are on the line at once. A party-line selective system of the latter class, but which is said not to have the disadvantage of requiring a heavy current to operate, is the basis of a patent recently issued to Frank B. Hall and Arthur F. Poole of Wheeling, W. Va. The system may be adapted to any party line, and the mechanism at each station is a duplicate of that of all other stations.

The invention consists of connecting each station with a continuous line on one side and with a normally broken line on the other side. The mechanism is so arranged that it is possible for the operator to build up or complete the broken line to any station desired and thus complete the circuit through that station. Each station is normally connected to ground, and an automatic switch at each mechanism, when actuated by current sent over the broken line to ground, will open the ground circuit and connect the broken-circuit sections between the several stations to form a continuous metallic line to the station desired.

By reference to the diagram on the opposite page the operation of the system will be apparent. Starting with the line and apparatus in their normal condition, as shown in full lines, suppose that central wishes to call station (C). She inserts her plug in the jack and presses the key (43) to establish the circuit from the negative side of battery (57) to binding post (32) of the indicator, through the indicating electromagnet (66) to binding post (33), through switch (43), to cord strand (55), to the sleeve of the plug, to the test thimble, jack conductor (42), to line (G), to armature pivot (7), to armature (5), to contact (8), through electromagnets (2) and (4), to ground, and through the ground conductor at central to the positive side of battery (57). Current flowing in this direction will not operate the polarized electromagnet (2), but will energize magnet (4), causing armature (5) to be moved to its alternate position to engage the alternate contacts (23) and (9). As the circuit is momentarily broken as the armature passes to its alternate position, the indicator electromagnet (66) at the central station becomes momentarily de-energized to allow its armature to be attracted to revolve the ratchet wheel (63) one division—that is, to bring the pointer to position (1) on the indicator to show the operator that the connections at the first station have been successfully completed.

Upon attraction of armature (5) at substation (A) the circuit through electromagnets (2) and (4) is broken, as also the ground connection, the current from the line wire (G) passing directly into the next section of the line wire (G), connecting station (A) with station (B), the same operation taking place at station (B) as has taken place at station (A), and so on. Central now opens the key (43) and closes switch (45), whereby current from the signaling generator (30) passes through substation (C) to generator (30) at central. The current from generator is alternating, and polarized electromagnet (2) will now be operated to attract armature (6), and armature (5) will also be attracted to its alternate position by electromagnet (4). The operator now opens switch (45) and again closes switch (43) to bring the remaining armatures (5) on the line to their alternate position, whereupon switch (43) is again opened. It will be seen that there is now a complete metallic continuous line between central and the subscriber's signaling apparatus at sub-station (C). Upon closure of switch (45) subscriber (C) may now be signaled. This circuit is entirely metallic, the grounds at all these sub-stations having been removed by the attraction of armatures (5) to their alternate position. Upon being thus signaled subscriber (C) removes the receiver from the hook and central connects her talking circuit to the line, the battery (68) supplying current for both the subscriber and the operator, the circuit from the battery to the subscriber after the removal of the receiver from the hook being traced as follows: From one side of the battery (68) through the clearing-out electromagnet (27), through cord strand (56), to jackspring (41), line wire (F), primary winding (19) of the induction coil at station (C), transmitter (18), switch hook (17), con-

tact (11), contact (13), armature (6), line wire (G), through contacts (23) and armature (7) at stations (B) and (A), to jack conductor (42), cord strand (55), and the other side of battery (58). All the other subscribers on the line are prevented from listening in on the line, as the armatures (6) at these other stations are out of engagement with the contacts (14) and (13), leading to the sub-station signaling and talking apparatus. Central having ascertained the person to whom the calling subscriber wishes to talk inserts the plug (72) in the jack of the called subscriber. Should the calling subscriber desire to talk to another subscriber who is party to the line to which he is connected, he is notified by central to press the button (50), thus causing the breaking of the circuit leading to sub-station (C) from the line wire (F). Central now closes the switch (46) to connect battery (24) across the line wires (F) and (G). Electromagnets (3) which are bridged across the sides of the line, are adapted to respond to current flowing from battery (24) to attract the armatures (5) to restore them to their normal position, breaking the continuity of the line wire (G) and to establish ground connections at each of the sub-stations with the exception of sub-station (C), which by pressure of button (50) has become disconnected from the line. Switch (46) is now open and switch (43) closed,



STEP-BY-STEP PARTY-LINE SELECTIVE SYSTEM.

whereby current from battery (57) is led into the ground and to line wire (G) to select the person desired to be talked to by sub-station (C), the circuits being the same as before traced. After the subscribers have finished their conversation the hanging up of the receivers momentarily breaks the talking circuit as the switch hook passes from contact (16) to contact (11), and the clearing-out magnet (27), included in the talking circuit, momentarily becomes de-energized, allowing the retractile spring to restore the armature (38) to its normal position, thus indicating to the operator that conversation is ended, the operator upon such signal removing the plug from the jack. The operator now closes the switch (46) to again apply current from battery (24) to the line, and electromagnets (3), responsive to the current from the battery, attract the armatures (6) and (5) at the sub-stations to return them to their normal position, and the line is now ready for further connections.

To Test Telephone-rate Law in Wisconsin.

Attorney-general L. M. Sturdevant of Wisconsin has filed a suit against the Wisconsin Telephone Company for $500 for alleged violation of the law of 1905 forbidding telephone companies charging higher rates in one city in the state than in another of the state of the same class. The complaint comes from Beloit, it being charged that the defendant unlawfully charged a greater rental in that city for its usual service than it charged in Janesville, a near-by city of the same class. The Independent telephone companies of the state secured the passage of this law.

President Alonzo Burt of the Wisconsin Telephone Company is quoted as follows on the suit: "The suit brought against this company to enforce compliance with the new law, in Beloit, is a scheme upon the part of the opposition at Madison and Janesville to make this company base its rates for service entirely upon the population of a town or city. We have not obeyed it because we believe it unconstitutional."

Indiana Telephone Items.

[illegible] incorporated.

[illegible]

The stockholders of the [illegible] Telephone Company at [illegible] merge the various telephone [illegible] county into one system [illegible] at the [illegible] exchange [illegible] part of the county [illegible].

Indiana is to be represented [illegible] bama and the southern [illegible] Telephone Company [illegible] Del., with a capital stock of [illegible] pany will operate in western Kentucky [illegible] J. D. Powers of [illegible] Monteleith of Bloomington, Ind., are among the incorporators. The proposed [illegible] in connection with [illegible] Kentucky.

Toll lines now band all the Independent telephone companies of Indiana into one large system, and this has increased the demand for telephones and toll lines to the extent that the leading companies of the state are perfecting plans for an expenditure of money in adding to and extending present systems. Over their own lines the Independent telephone companies are furnishing service out of Indiana to points in Illinois, Missouri, Kansas, Kentucky, Ohio, West Virginia and Michigan.

Supply men say that present prospects indicate that Indiana will spend more money in telephone equipment this year than last, when over $4,000,000 was invested, and that their sales thus far have exceeded that of any corresponding period during their canvass of the Indiana field.

The co-operating telephone lines entering at Judson have reorganized into an association known as the Judson Switchboard Association. The necessity of the plan grew out of the new contract made with the Parke County Telephone Company. By the terms of the new agreement the patrons of the Parke County Telephone Company will pay a line charge of five cents per call for the use of the Judson line, which will be collected by the Parke County Telephone Company and paid to the Judson company.

The Harrison County Telephone Company, with home office in Corydon, is extending its lines to the Floyd County line, near Georgetown, where connection will be made with the line of the Home Telephone Company of New Albany and Louisville. S.

Southeastern Telephone Developments.

The Southern Bell Telephone Company has purchased a site in Columbia, S. C., for $8,500, and it is reported that a modern exchange building will be erected on the site thus secured.

The stockholders of the Cumberland Telephone and Telegraph Company at a meeting at Hopkinsville, Ky., authorized an issue of $3,500,000 additional stock, making a total of $17,000,000.

The heavy sleet in the Carolinas last month worked about $50,000 damage to the wires and lines of the Southern Bell Telephone Company. In nearly every town and city in the western portion of the Carolinas many telephones were put out of business temporarily and hundreds of poles were down. Scores of linemen and assistants were

[illegible]

Ohio Telephone Notes.

[illegible] built to [illegible] lines.

[illegible] Akron and Columbus Railway Company [illegible] will be used for both telephone and [illegible] purposes.

The annual statement of the Newark [illegible] Company of Newark [illegible] been $60,772. After paying all expenses [illegible] on bonds and dividends [illegible] preferred stock an addition of [illegible] $7,000 [illegible] surplus.

By the merging of the [illegible] Independent Telephone Company, the Farmers Independent Telephone Company and the [illegible] Independent Telephone Company, the Noble County [illegible] Company of Caldwell has been formed [illegible] 1,000 telephones and over 2000 miles of wire. The new company will be Independent [illegible] with the other systems of the state. The capital stock is $100,000. H. W. Kuntz heads the incorporators.

The Citizens' Independent Telephone Company of New Lexington has been incorporated with a capital of $50,000 by J. B. Rhoads, [illegible], C. H. Bell, J. W. Fry and J. G. Morris. C.

The Telephone on the Pacific Slope.

The Northwestern Long-distance Telephone Company of Los Angeles, Cal., has filed articles of incorporation at Olympia, Wash., preparatory to going into business in that state. The company is arranging to build lines extensively in both Oregon and Washington. Lines will be built connecting Ashland, Portland, Baker City, [illegible], Albany, Seattle, Aberdeen, Pendleton, Bellingham, and Vancouver, B. C.

The Pacific States Telephone and Telegraph Company is continuing its extensive reconstruction work at various points on the coast. At Portland, Ore., preparations are under way to build three new stations at a cost of $150,000 in the east side district. The entire system of Portland is also to be remodeled and brought up to date. In Baker City, Ore., the company is arranging to put up a new office building and station at a cost of approximately $20,000. In Baker City all the company's lines are to be put underground. In San Francisco preparations are under way for installing what is claimed to be the largest multiple [illegible] switchboard in the United States outside of New York and Chicago. It is capable of accommodating 22,300 telephones. The company hopes to get its improved service in San Francisco in operation by the end of March. A.

Telephone News from the Northwest.

The Sharon (N. D.) Rural Telephone Company has been incorporated with a capital of [illegible]. K. Bakken heads the list of incorporators.

The Edmunds County Mutual Telephone Company will establish an exchange at [illegible], S. D.

The Langford (S. D.) Telephone Company has been incorporated with a capital stock of $22,50[illegible].

The Hokah Telephone Company of Hokah, Minn., has been granted a 20-year exclusive franchise in that village.

The Gregory County Telephone Company of Bonesteel, S. D., has been incorporated with $10,000 capital.

The District Court at Albert Lea, Minn., has held that portion of the city ordinance which required telephone companies to connect with each other and to grant connections to all comers, to be

unconstitutional. Also the clause permitting the ordering out of pole lines. The court suggests that, under proper safeguards, the provision for only one pole line on any street might be valid, although, as found in the ordinance, it was invalid. The Northwestern Telephone Exchange Company secured an injunction to restrain the city from interfering with its construction of an exchange and has rushed the work through, so that it is about completed.

The Fall River Rural Telephone Company of Hot Springs, S. D., has been incorporated with $30,000 capital. D. O. Kimball and others are interested.

The Zenith Telephone Company of Duluth shows a profit of nearly $20,000 for the last year. The cost of the plant is given at $379,597. The revenue was $62,437 and the expense $43,008. The company expended $13,887 for overhead and $823 for underground material.

The City Council of Wymore, Neb., has granted a franchise for an Independent telephone system to Frank M. Smith.

The Western Electric Telephone Company will expend about $200,000 on its lines in Iowa this year, it is said.

The Fort Dodge (Iowa) Telephone Company has purchased the lines formerly controlled by Ware & Leland, and will install a new switchboard.

R.

NEW COMPANIES.

The Bernice (La.) Telephone Company has been incorporated with a capital stock of $5,000.

The South Side Rural Telephone Company of Oklahoma City, Okla., has been incorporated with a capital of $3,000 by A. Spencer and others.

The Klein Rural Telephone Company of Rick Valley, Iowa, has been incorporated with a capital stock of $2,000 by J. E. Quintan and others.

The Clarksfield Telephone Company of Clarksfield, Ohio, has been incorporated with a capital stock of $9,500. E. E. Rowland, Dennis Ross, F. E. Weeks are among the incorporators.

The Navajo Telephone Company of Headrick, Okla., has been incorporated to build a telephone line from Headrick to Warner. The capital stock is $1,000, and the incorporators are W. J. Hastings, Jonathan F. Knox and others.

The New State Telephone Company has been organized under the laws of Iowa, with principal place of business in Sioux City. It is said the new company will build through Nebraska and into Omaha if possible. The articles state that it can do a general telephone business and establish lines in the states of Iowa, Minnesota, Nebraska, South Dakota, North Dakota, Kansas, Missouri and Illinois. The capital is $1,000,000 and the incorporators include Charles G. Cockerell and M. M. Hood of Jefferson, J. C. Hammond of Mapleton and Joseph Mattes of Odebolt.

TELEPHONE MEN.

Dudley E. Waters of Grand Rapids has been elected to the office of vice-president of the Michigan State Telephone Company.

H. B. Willard, superintendent of the Duluth (Minn.) Telephone Company, has been transferred to Minneapolis to a position with the Northwestern Telephone Exchange Company. He is succeeded at Duluth by George A. French, formerly with the Southern New England Telephone Company.

William B. Woodbury, assistant general manager of the Cuyahoga Telephone Company of Cleveland, has resigned his position, to take effect on February 15th, when he will go to Detroit to superintend the construction of a large telephone system that will be built by the Kaehler-Brailey syndicate, which also owns the Kansas City plant. It is said the syndicate will spend $5,000,000 on this system, which is expected to be one of the finest in the country. The property of the Co-operative Telephone Company has been purchased and this will be used as a nucleus. The wire construction will all be underground. Mr. Woodbury has been with the Cuyahoga Telephone Company since October, 1901.

Theodore Spencer, vice-president and general manager of the Bell Telephone Company of Philadelphia and of the Delaware and Atlantic Telephone and Telegraph Company, died at his home in Philadelphia on January 28th. He had been ill only a few days, the cause of death being acute Bright's disease. Mr. Spencer had been with the Bell company in Philadelphia since 1894, serving successively as superintendent of installation, engineer, general superintendent and general manager. Recently he had been elected a director and vice-president. To his ability largely is attributed the present development which the company has reached. Mr. Spencer was born in 1870 at Fort Snelling, Minn. He graduated from the Massachusetts Institute of Technology in 1891 as an electrical engineer and then entered the employment of the General Electric Company in Lynn, Mass. Soon after he went to the American Bell company in Boston and later to Philadelphia. He was an associate member of the American Institute of Electrical Engineers. A widow and two children survive him.

Southern Indiana Telephone Men Meet.

The third quarterly meeting of the ninth district of the Indiana Independent Telephone Association was held in Evansville on February 1st. W. D. Curl of Petersburg, vice-president of the state association from the ninth district, presided, and Philip Dilly of Huntingburg acted as secretary. There were 26 companies represented by the delegates present, and upward of 12,000 telephones were reported in operation at this time in the territory immediately surrounding Evansville.

The situation at Evansville was the principal subject before the meeting. Allen Gray of Evansville, president of the Pocket Long-distance Telephone Company, presented the difficulties in the way of the immediate securing of a foothold in that city. He stated that the Pocket Long-distance Telephone Company had not yet presented its application to the Board of Works for a franchise in Evansville. The discussion of Mr. Gray's analysis of the situation resulted in the adoption of a memorial to the mayor of Evansville that no franchise be granted to an Independent company except to one possessed with the financial ability to establish a modern telephone system and one able to make connection with the Independent system contributory to Evansville and throughout Indiana and the Central States.

An interesting and profitable discussion was brought out by the presentation of a paper on "Service Between Exchanges," by W. H. Moore, manager of the Knox County Home Telephone Company of Vincennes.

The Ninth District companies seem to be in good condition and on a paying basis. It was agreed that a foothold in Evansville was the key to a still greater development in the district, and this advantage is thought to be attainable in a short time.

Among those present were Henry Landgrebe of Huntingburg, C. F. Stevens of Plainville, W. A. McGregor of Mt. Vernon, W. D. Curl of Petersburg, R. N. Parrett of Princeton, W. G. Turpin of Palmyra, W. H. Moore of Vincennes, W. H. Wallace of Washington, H. G. O'Neal of Hazelton, Allen Gray of Evansville and C. S. Norton of Indianapolis.

GENERAL TELEPHONE NEWS

Miller Bros. have purchased the telephone business of the Colman Electric Company in Colman, S. D.

J. H. Fraley, city clerk of Morehead, Ky., is receiving bids for the construction of a telephone system. The franchise will be awarded to the highest bidder.

Following the sleetstorm of January 21st and 22d, when communication by wire out of Chicago to the east, west and south was practically prostrated, the American Telephone and Telegraph Company was able to communicate to New York from Chicago only by an unusually roundabout way. On January 22d and 23d direct communication east, south and west was impossible, but the company was able to maintain and operate two first-class Morse circuits from Chicago to New York via Milwaukee, Minneapolis, Waterloo, Des Moines, Omaha, St. Joseph, Kansas, St. Louis, Terre Haute, Indianapolis and Pittsburg.

MANUFACTURERS AND DEALERS.

H. S. Durant of Chicago has taken a partnership interest in the firm of George W. Conover & Co. of this city, who are purchasing and forwarding agents for Independent telephone companies. Mr. Durant has resigned his position with the Automatic Electric Company after having been identified with its sales department for the last three years.

The International Telephone Manufacturing Company of Chicago has recently built for the Illinois Traction Company what is asserted to be one of the most convenient dispatcher's telephone switchboards ever constructed. The board was installed in the offices of the St. Louis and Springfield Railway Company at Staunton, Ill. The International company also reports a heavy demand for its new permanently adjusted horseshoe magnet receiver, which it is furnishing in any quantity. This is a simple, neatly designed and durably constructed instrument.

Speaking of the Chicago Electrical Show, J. P. Cracraft, Chicago manager of the Stromberg-Carlson Telephone Manufacturing Company, says: "More worthy and interested people visited and examined critically our exhibt at the Electrical Show than have ever interested themselves in any of our former exhibits. Chicago people were greatly interested in Independent telephone equipments being made for other cities, and practically all of the telephone men from the middle western states were in at some time or other during the show to examine a section of the largest switchboard in the world that we are now building for the Kinloch Long-distance Telephone Company of Missouri for its St. Louis office. In fact, there were so many out-of-town telephone men in the city that it was necessary for us to telegraph for eight of our traveling salesmen to come in before the first week was over, and we were all busy from early morning until late at night. We consider the show a great success from every standpoint."

CORRESPONDENCE.

Great Britain.

London, January 24.—Those engaged in automatic signaling on railways will read with interest a report which has just been issued by the Board of Trade with regard to an accident which occurred upon a portion of the District Railway where automatic signaling was employed. The report certainly comes at an inopportune moment, for the District company is making great efforts to increase the use of such arrangements, in order to accelerate the service, and so meet the great outcry which is being made as to overcrowding. The system in use at the time of the accident was the Westinghouse electropneumatic system, and the trip gear on the train having become disarranged, the train passed a signal which stood at danger.

In a somewhat lengthy report the following recommendations are made: The trip gear should be directly attached to the axles of the cars, to prevent their movement by the swing of the frames; two triggers should be employed, in case one failed, both triggers might be attached to one car; at all terminals and other places where brakes are tested, car examiners as well as the motorman should actually test the movement of the striking triggers by moving them until the air valves are fully open. The report adds that the railway authorities are fully aware of the importance of the efficiency of the tripping arrangements, and either have been or are making improvements in the directions named.

The fire insurance offices have, after a long period, decided to recognize the various patent fire-alarm systems, and will reduce the premiums for buildings equipped with such systems. The May-Oatway, the Pearson and other systems, such as the auto-pyrophone, have made very rapid strides during the last few years, and one of them, at least, has been recognized by the fire offices abroad for a year or two. The Glasgow Corporation was instrumental in prevailing upon the offices to follow the line of action that they have done, although the actual rebate to be allowed has not yet transpired.

The Sheffield Corporation, which has been threatened with legal proceedings by the Electrical Contractors' Association if it does not abandon its electric wiring business, has made a reply to the charges against it. The argument of the corporation is that it purchased the electric wiring department some years ago when the Sheffield Electric Light and Power Company was absorbed, and that the work carried out is only for persons who are actually consumers or who are about to become such. The corporation further argues that all electrical contractors in Sheffield have come into being since the department in question was established, and that, in short, it refuses to abandon the branch. A full investigation, it states, of the complaints of the wiring contractors has failed entirely to substantiate them. In these days of increasing municipal competition, the case is an important one, and the result may be reflected throughout the country, for a large number of electric-light companies having the widest possible powers under their articles of association, have been acquired at various times.

With the enormous majority which the liberal and municipalist party now has in the House of Commons, some fears are being expressed as to the fate of the various electric power bills affecting London, which have been promoted by companies. The cry of the municipalist party against the late administration was that it was true to its friends, the trusts, and anything in the nature of a fairly large company was dubbed a trust. In the flush of victory, and in the possession of such a huge majority, it will need cool thinking on the part of the responsible leaders to curb the inclinations of a large number of the rank and file, and, from the companies' point of view, the presence of no less than 30 members of the London County Council (itself promoting an electric power bill) in the House of Commons is of itself a disturbing element, to say the least. All the bills are well forward, however, and there will be no delay consequent on the change of ministry, which must have been inevitable had the election taken place at any other time.

The various fruit and horticultural associations in the United Kingdom have for some time past been agitating for a better telephonic service to the many out-of-the-way places which are the centers of the fruit-growing industry in Great Britain. The Board of Agriculture has taken the matter up, and as a consequence the postmaster-general has promised to take the matter seriously in hand if he is informed of the localities where the needs of the telephone are most pressing for the purposes of the fruit industry. In 1904 the late Parliament granted special funds for this purpose.

A serious accident happened yesterday to one of the tram cars on the Liverpool Corporation service through the failure of the brakes to act, for some reason, on a very steep incline. The number of injured is large, which may be accounted for by the fact that the car, which overturned, was a double-deck one with covered-in top. I believe this is the first accident to a covered-in top-deck car in England.

G.

New York.

New York city, February 3.—The aftermath of the rapid-transit merger has been considerable. The Interborough Rapid Transit Company has intimated to the rapid transit commissioners that the downtown subway traffic is already so extensive that the original idea of bidding for a Lexington Avenue extension from the Grand Central Station would be impracticable and that an entirely new north and south subway route would be more serviceable. The Lexington Avenue route was originally laid out by the commissioners with a view to attract a competitive bid from the Metropolitan people. Generally speaking, and without attempting to record or analyze all the current talk and criticism, there seems to be a disposition on the part of the transit companies to outflank the municipal-ownership movement by offering fairly satisfactory terms to the city for the franchise of new routes. August Belmont, in a long letter addressed to the president of the commission, states that he would not have consented to the merger if he had not thought that its effect would be to hasten subway construction and result in a very substantial enlargement of the traveling facilities in the two boroughs.

Several bills have been introduced at Albany affecting the merger directly or indirectly. Some appear to be merely of the usual blackmailing sort and intended to be withdrawn or modified. Others are engineered by municipal-ownership interests and designed to hamper or restrain the merger; while others, introduced by transit representatives, are seeking to validate and strengthen various franchises. Meanwhile Theodore W. Meyers is waging a bitter contest against the Belmonts on behalf of the minority shareholders, and he points out that under the scheme of organizing the new holding company the minority stockholders are asked to part with their stocks at one-third the equivalent at which they could have been sold in the open market.

The outstanding legal suits to decide whether the Board of Estimate or the Board of Aldermen is empowered to have the last word in regard to new subway transit routes are advanced this week by the appointment by the appellate division of the Supreme Court of three special commissions to investigate and report upon the questions in dispute. The three commissions will deal respectively with the Third, Lexington and Eighth Avenue routes. As a contribution to the discussion, a bill has been introduced at Albany to create a New York City Railroad Commission to deal with local matters now within the province of the state commission.

The Chinese High Commissioners visited New York this week and took rides in the subway and on the elevated lines yesterday. The engineering features of the system were explained to one of the party.

The new bridge commissioner, James W. Stevens, has reached several points of agreement with the Brooklyn Rapid Transit, which if carried out will materially facilitate the rush-hour traffic on the Brooklyn and Williamsburg bridges. Mr. Stevens has been voted an appropriation of $750,000 to carry out improvements. The commissioner, who really seems to be wide-awake to present-day conditions, is also considering a scheme for a moving platform over the Williamsburg Bridge.

The Mohawk (N. Y.) Valley Company, having purchased the Rochester trolley lines, now controls a complete system of electric railways across the middle of the state, starting from Schenectady. The New York Central railroad has some interest in this amalgamation.

Lighting Commissioner Ellison, having examined the new bids for public lighting, announces that the need for proceeding with plans for a municipal lighting plant is not so obvious, for the Edison company has submitted a sliding scale and will supply arc lamps per annum at a maximum price of $80, as against $126 of former contracts. The original report of Consulting Engineer Cary T. Hutchison placed the cost of arc lamps at $64 per annum if operated by the city, but this estimate is affected by the eight-hour law and civil-service regulations.

The Secor Engine Company has an ingenious method of displaying the efficiency of its gas engine when coupled direct to a dynamo. A large electric meter, properly authenticated, is on view in the show room of the company on Liberty Street, and visitors can see how steady the index is when switched onto the dynamo circuit.

Scranton (Pa.) capitalists have organized the Northern Electric Railway Company of Millbrook, N. Y., with a capital of $600,000, for the purpose of constructing railways and rolling stock.

Henry Blank, R. C. Bennett and G. M. Treiber of Brooklyn have incorporated as the United States Electric Production and Construction Company with a capital of $30,000.

Applications are returnable at Albany on February 12th for the position of assistant electrical engineer for the state hospital department. The usual salary for this position is from $50 to $75 a month and maintenance. The examination will be held at various points on February 17th.

Plans for the terminal station of the Pennsylvania Railroad, to be built on the blocks bounded by Seventh and Eighth avenues and Thirty-first and Thirty-third [illegible] Building Department [illegible] S. White [illegible] building [illegible] and 771 feet [illegible]

The Municipal Art League [illegible] to submit designs [illegible] will be exhibited at the [illegible] judged by [illegible] the award will be made February [illegible]

[illegible]

New England.

Boston, February 3.—Another big [illegible] name of the "merger" [illegible] New Haven and Hartford Railroad Company [illegible] been carried to consummation [illegible] volves the acquisition of the [illegible] dicated electric railways [illegible] ter, in this state.

A large percentage of the street railways of Connecticut and Central Massachusetts [illegible] been acquired by the Consolidated Railway Company of Connecticut, which is the "holding" company for the big steam railroad corporation's electric system, which figure in the merger are the Hartford and Worcester, the Stafford Springs and the Hartford, Manchester and Rockville street railway companies. At the annual meeting, January 30th, Charles S. Mellen was chosen president.

Competition on a through line to New York, for which the Shaws were supposed to be gradually reaching out, is checked by this absorption of the steam road's interurban competitors. It is said now that the Boston and Worcester electric railway, a splendidly equipped high-speed interurban road, running for a large part of the distance over private way, is likely to pass also from the Shaw ownership and under the control of the steam road.

Incidentally, there come at this time rumors from Worcester of the transfer of control of the stock of the Marlboro and Worcester street railway. It is not disclosed as yet for what purpose or by whom the deal has been engineered. Rumor connected the Worcester Consolidated, which controls most of the roads centering in that city, with the transaction, but President Dewey quickly denied this report. The Boston Suburban Electric Company, which operates from Newton in the direction of Worcester, was also mentioned as the possible absorber. Nor was it considered wholly improbable that the New York, New Haven and Hartford had the coup up its sleeve.

The Massachusetts railroad commissioners made a ruling this week which served notice, so to speak, on all the electric railways which are calculating to do a freight and express business. It was to the effect that freight business on the interurban lines in the commonwealth must be subordinated to passenger business, and must not be permitted to crowd out or otherwise displace the passenger service to be rendered under the charter. The Old Colony Street Railway Company was the petitioner in this instance. The company has three special cars ready for service.

By a settlement just effected with the city of Boston, the Boston Electric Light Company will receive payment of $388,000 on judgments on land suits. The land involved was the site of the companys plant some time ago on Summer Street, absorbed by the city.

Recent new incorporations include the Frank Ridlon Company of Boston, electric-railway supplies; capital, $75,000; directors, Frank Ridlon, Oren S. Hussey, Edmund W Kellogg, Charles W. Whitney, Jr. B.

Southeastern States.

Charlotte, N. C., February 3.—Because of the fact that the city of Albany, Ga., owns its own electric-light plant, the municipality has rejected the applications of private persons for gas privileges, it not being desired that the city shall have competition in the lighting business.

A public-ownership plan presented in Baltimore, Md., by George Stewart Brown, who appeared before the Second Branch of the City Council, has been defeated, this in connection with the franchise ordinances of the United Railways and Electric Company and others that had been favorably reported by the committee on railways. Mr. Brown next offered amendments aimed to retain for the city the right to regulate and prevent future legal difficulties, all of which amendments were defeated. Amendments providing that new franchise rights to the United Railways Company on certain streets shall expire in 1919, when the old City Passenger Railways Company franchises expire, was also voted down. The council also went on record as opposed to the municipality building a terminal for the Washington, Baltimore and Annapolis Company.

At Norfolk, Va., R. B. Fentress is quoted as saying that he will not bid on the light and heating franchise as now amended, and that he will not accept the franchise. The matter has been in the hands of a special committee of the City Council.

The North American Company is an applicant for a franchise for lighting and heating privileges in Louisville, Ky.

An authorized capital of $5,000,000 is asked for [illegible]

[illegible]

Robert [illegible] president and J. [illegible] of the Birmingham [illegible] Light and Power Company [illegible] trip North, where [illegible] Birmingham [illegible] will be held to adopt [illegible] work.

It is understood that [illegible] for the [illegible] from Great Falls waterpower, being developed by the Southern Power Company [illegible] and that the current will be [illegible] city and many others. At the [illegible] sites with about 75,000 total horsepower. There will be a storage reservoir two miles long and a quarter of a mile wide parallel to the river. At the lower end will be a powerful retaining wall and six 5,200-horsepower twin hydraulic turbines will be placed here to operate at a speed of 225 revolutions per minute from a 72-foot head of water. There will also be two 700-horsepower twin horizontal hydraulic exciter turbines running at a speed of 450 revolutions per minute from the same head. The plant will be one of the largest single electric waterpower developments in the South. L.

Ohio.

Cleveland, February 3.—At the annual meeting of the directors of the Toledo and Western at Sylvania, Ohio, a few days ago Judge Carlos M. Stone of Cleveland was chosen president to succeed the late Luther Allen. J. R. Seagrave was elected vice-president, and C. F. Franklin, general manager. The total mileage, including sidings, is 83.40.

The City Council of Girard has contracted with the Youngstown Consolidated Gas and Electric Company to light the streets, with the understanding that at the end of the year the village may purchase the poles, wires and fixtures, which will be turned over to a local company that is preparing to operate a lighting and water plant.

The bid of the Union Light, Heat and Power Company for street lighting has been accepted by the council of Newport, Ky. The price for commercial lighting is 8½ cents per kilowatt, with very liberal discounts, according to the size of the bill, and five per cent. off that for cash. The same company is negotiating with the council of Covington with the idea of building a plant in that city.

A schedule of one hour and 45 minutes between Lima and Fort Wayne, a distance of 63 miles, has been arranged for the Fort Wayne, Van Wert and Lima electric railway. This is fast service, but the roadbed and tracks on this line have been pronounced of the highest grade. The time between Lima and Indianapolis, in connection with the Wabash Valley and Union Traction Company, will be six hours and five minutes, 10 minutes less than the fastest steam road makes it now. The time between Fort Wayne and Dayton by way of the Western Ohio will be four hours and 15 minutes. The Western Ohio has heretofore had the fastest service in this section, and as soon as the ballasting is completed it will put on trains between Lima and Findlay, 53 miles, to make schedule time of one hour flat.

Rumors are now afloat to the effect that the Lake Shore electric railway will be double-tracked between Cleveland and Lorain. The line between Lorain and Elyria is also to be similarly improved as soon as possible. The Cleveland and Southwestern has ordered new cars to strengthen its service, and it looks as if competition was getting rather sharp.

The House of Representatives will consider the Bassett bill next week. It provides than canal banks shall not be leased to electric-railway companies, and has been recommended for passage by the committee. This bill is for the purpose of blocking plans which have been made to secure the use of the canal banks at Toledo.

The Northern Ohio Traction and Light Company has closed a contract with the Cleveland Construction Company to build an extension to its line from Barberton to Seville, a distance of 16½ miles. It will pass through Wadsworth, Rittman and Ster-

ling, and at Seville will connect with the Cleveland and Southwestern.

A bill will be introduced in the present Legislature to enable cities to engage in commercial-lighting business.

It is probable that the Columbus City Council may be asked for a bond issue of $100,000 to purchase additional machinery for the municipal plant. A few days ago the plant broke down because of being crowded too hard. It is also said that councilmen believe that the Public Service Company is planning to give cheaper lights for the city, as well as for outside places.

The Reynolds bill, requiring heated vestibules for motormen, and the Lersch bill, requiring street-railway companies to sprinkle their rights-of-way in municipalities, have been passed by both houses of the General Assembly and await the signature of the governor.

The people of Georgetown have voted for a bond issue of $15,000 for the construction of an electric-light plant. O. M. C.

Indiana.

Indianapolis, February 3.—S. C. Dickey, president of the Winona Interurban Railroad Company of Warsaw, announces that the management will build the Peru-Warsaw division by letting the work out in small sections to contractors instead of letting a general contract to a construction company. Bids, however, will be in order for the equipment. It is proposed to build a substantial line with the best equipment for high-speed passenger and freight traffic.

The work of making the final survey and establishing the line for the extension of the Portland and Muncie traction line from Portland to Celina, Ohio, was begun last week.

The Northern Indiana Railway Company has filed a trust deed at Laporte in favor of G. M. Cummings, trustee, and the United States Mortgage and Trust Company to secure the issuance of $4,000,000 five-per cent. bonds. The instrument covers all rights, franchises, tracks, rolling stock and property of the company in Laporte, St. Joseph and Elkhart counties, including the interurban lines now in operation between Laporte, South Bend and Michigan City. The money derived will be expended in acquiring a few connecting lines and completing and equipping the lines now under construction, which will include a large central power plant and a number of sub-stations.

Frank D. Norvall, general freight agent for the Indiana electric railways which were merged recently, states that the interchange-freight service just inaugurated over the lines is producing highly gratifying results. Carload-lot shipments were offered at once and they were handled with such facility and promptness as to occasion the service to grow until the management finds the need of more freight cars, which were ordered at once.

Mayor Boehne of Evansville has issued a statement to the effect that any franchises granted to traction lines during his administration must guarantee the city a percentage of the gross earnings of the road.

The Northwestern Traction Company has made such inroads on the Big Four traffic at Zionsville, a prosperous town 20 miles north of Indianapolis, as to occasion the closing of the Big Four station agency. The Big Four will straighten its line in this vicinity and eliminate Zionsville altogether.

The Town Council of Fortville is negotiating with the Indiana Traction Company to furnish the town electric light and power. If this is not done a local company is ready to put in a plant.

The Alexandria Electric Light and Power Company has been placed in the hands of the Anderson Trust Company as receiver. The company is solvent, but there is a difference among stockholders relative to improvements. It is thought the court will order the receiver to make necessary improvements and install some new machinery.

S. S.

Mexico.

City of Mexico, February 1.—Henkel Bros. of Toluca, railroad, mining and lumber men, have obtained a concession from the federal government for the construction of an electric railway from Toluca to Zihuatanejo, situated on the Pacific coast of Mexico. The proposed line has already been surveyed and all preliminary arrangements are made for its early construction. The power to operate the line will be obtained from the Nevado de Toluca River. The Maninaltenango Falls, where the generating plant will be located, is said to be capable of furnishing 20,000 horsepower, and at other places on that stream almost equal energy can be obtained.

Governor Miguel Ahumada has approved the plans of Compania Industrial de Guadalajara, the French light and power company of Guadalajara, for the construction of an electric street-railway system in the city.

The Mexican Light and Power Company is constructing a new transmission line from its power plant at Necaxa to Apizaco and Puebla. The line, including the receiving and distributing stations at Puebla, will necessitate an expenditure of about $2,000,000 Mexican money. The construction of the line is in charge of Lewis W. Henry, superintendent of the transmission department, and the work of installation at Puebla will be under the direction of Melton Ulmer, assistant general manager of the company. It is expected that the line will be completed and electrical energy be furnished the city of Puebla in about six months.

The Mexican Light and Power Company will begin to supply the Mexican Tramways Company with electric power for the operation of its extensive street-railway system in the City of Mexico on October 1st. W. W. Wheatley, general manager of the tramway company, has selected the sites for the four proposed sub-stations.

The Mexican Light and Power Company of the City of Mexico is still having trouble with thieves who do not hesitate to cut and carry off sections of the transmission cable which runs from Necaxa to the city. Recently this cable was cut and portions of it which weigned 1,500 pounds were carried away by the thieves. The theft caused a serious interruption of the service of the company.

La Electra, S. A., the Spanish light, power and street-railway company of Guadalajara, has let the contract for the construction of a combined general office building and central car station to Manuel de la Mora. The buildling will cost about $300,000. W. D. H.

Northwestern States.

Minneapolis, February 3.—E. A. Lee of Afton, Iowa, will receive bids until February 12th for the construction of an electric-light system for that town. A gasoline engine may be used to furnish power.

F. A. Bonebright will erect a large brick building at Webster City, Iowa, for an electrical supply house.

The Belle Fourche (S. D.) Electric Light, Heat and Power Company has been incorporated with a capital stock of $25,000. A. A. Moody is president and J. S. Moody secretary and manager.

The Minnesota Light and Power Company of Winona, Minn., is planning extensive improvements and additions to its power plant at Minnesota City.

J. H. Coulter, president of the Wisconsin Power Company of Rice Lake, Wis., has sold his interests. W. C. Ribenack of Menomonie succeeds him as president.

The Wisconsin Rapid Transit Company of Milwaukee will begin work early in the spring on an interurban line from Milwaukee to Fond du Lac. A deed of trust for $2,000,000 has been filed, and the line is guaranteed to be in operation by December 1, 1906.

A franchise has been granted at Biwabik, Minn., to the Mesaba Range Traction Company. The estimated cost of the road, which will be about 40 miles long, is $800,000.

Articles of incorporation have been filed for the Beloit (Wis.) Gas and Electric Power Company, with a capital of $600,000. This brings the three public utilities under one management, Cincinnati capital being behind the merger.

The electric-light plant of the Creston (Iowa) Gas and Electric Company was recently destroyed by fire. The company may sell what is left of the system to the new Mutual company which is to put in a plant at Creston.

The Virginia (Minn.) Light and Water Company has purchased a new 300-kilowatt generator and will start a 24-hour service.

The Wester Gas and Investment Company has decided to build a new brick building at Stillwater, Minn., as a station for the electric-light system and for the Apple River power plant.

The Keokuk (Iowa) Electric Railway and Power Company is planning to extend its interurban system to Hamilton and to Carthage. R.

Pacific Slope.

San Francisco, February 2.—The Siskiyou Electric Power Company, which is operating in the vicinity of Yreka, Cal., has completed its branch transmission line to Hornbrook and is now supplying power to that town. A 1,000-kilowatt generator is to be installed.

The California Supreme Court has declared the bond issue of the city of Stockton, amounting to $160,000, authorized by popular vote some time ago for the construction of an electric-light plant, to be illegal. The mayor and City Council have been enjoined from selling the bonds. Immediately upon announcement of the decision the City Council met as a committee of the whole and decided to call an election to vote on the proposition of issuing bonds to the amount of $700,000, a portion of which is to be used for the construction of an electric-light plant and a portion for the construction of other public utilities.

The Rio Vista Light and Power Company of Rio Vista, Cal., has been granted a franchise to build and operate a lighting and power plant at that place.

The Mono Power Company, which was incorporated in San Francisco a few weeks ago by the persons controlling the Owens River Power Company, has begun work on Owens River, near Bishop, Cal. The company's plans are to generate electricity to furnish power and light to various districts in California, Nevada and Arizona. It has taken over the rights of the Owens River Power Company and several individual rights. H. W. Leffingwell is in charge of the engineering work.

A. Welch of Salem, Ore., has purchased the plant and property of the Corvalis Electric Light and Power Company of Corvalis, Ore., for $18,000.

M. R. Hanger and George Thompson of Columbia County, Wash., are organizing a company to build an electric railway from Covelo to Wallula on the Columbia River.

The Los Angeles Pacific Company has awarded a contract to Hunt, Mirk & Co. of San Francisco for a 2,750-kilowatt 50-cycle Westinghouse-Parsons turbo-generator which is to be installed as an addition to the electric-railway power plant in Los Angeles. A condenser with 9,000 square feet of surface, pumps, etc., were also ordered. A.

PERSONAL

Amos P. Mack has resigned as superintendent of the municipal lighting plant at Ashtabula, Ohio, and Chase Palmer has been chosen to succeed him.

Andres Horcasitas of the City of Mexico, Mexico, has resigned his position as government inspector of electric-light plants. His successor has not yet been appointed.

Thomas G. Grier of Chicago is about to leave for Cuba on a combined business and pleasure trip. He will be gone from six weeks to two months and will visit Mexico during his outing.

J. C. Hoffman, who has been chief engineer of the Northern Texas Traction Company's lines since July last, has resigned his position in Fort Worth, Texas, to accept a railroad position at Memphis, Tenn.

D. G. Edwards, traffic manager of the Schoepf electric roads in Ohio, has recently returned from a trip to Europe. He will have charge of the freight and passenger traffic on all the roads included in the Schoepf syndicate properties.

Frank C. Folsom, who recently resigned as superintendent of transportation of the Fort Wayne and Wabash Valley Traction Company, has accepted the position of superintendent of the Atlantic City and Suburban Traction Company, with headquarters in Atlantic City, N. J.

The death is reported of Jules Despecher of Paris, France. Mr. Despecher had been the representative in Paris of the Eastern Telegraph Company, and he was one of the first men in that country to take part in the promotion of cable communication between Europe and America. He was 83 years of age.

Brigadier-general A. W. Greely, chief signal officer of the United States Army, has been nominated by President Roosevelt to be major-general of the line, to succeed General Bates as major-general. Col. James Allen is to be brigadier-general and chief of the Signal Corps, to succeed General Greely. These changes are brought about by the retirement of Lieutenant-general Adna R. Chaffee, and the nomination of Major-general John C. Bates, chief of staff, to be lieutenant-general.

In pursuance of a resolve made many years ago to retire from active business at his present age Mr. E. H. Valentine, president of the Valentine-Clark Company of Chicago, has disposed of his interests in the company to Mr. E. L. Clark, formerly secretary and treasurer, and who now succeeds him as president, the corporate name of the company continuing as heretofore. Mr. Clark has been identified with the company since its formation and enjoys an extensive acquaintance with producers and consumers of cedar poles, in which the company deals.

Mr. William J. Ferris, one of the best known and most popular salesmen connected with the Chicago office of the General Electric Company, has resigned his position with that company to accept the important position of assistant manager of the Illinois Traction System, with headquarters at Champaign, Ill. This system is controlled by the McKinley syndicate and operates some 300 miles of electric railway in Central Illinois, connecting Danville and Champaign, Bloomington and Decatur, Springfield and East St. Louis and a number of other cities and villages. On the evening of February 2d Mr. Harry L. Monroe, manager of the railway department of the Chicago office of the General Electric Company, gave a dinner at the Hotel Vendome in honor of Mr. Ferris. Those present at the dinner were old-time friends of the guest of honor and included Messrs. B. E. Sunny, F. M. Boyer, J. Scribner, J. W. Johnson, George P. Townsend, J. W. Buell, W. A. Colman, S. F. Dibble and L. G. Crawford. After the dinner there were a number of heartfelt speeches, the theme being "The Tie that Binds," and they showed clearly the genuine regard in which Mr. Ferris is held by his former associates. At the close that gentleman was presented a handsome silver loving-cup as a token of esteem and friendship. Mr. Ferris is a native of Scotland, but came to the United States at the age of 18. He entered the service of the Western Union Telegraph Company in Boston in 1883. He gradually became interested in other branches of the electrical industry and in 1891 joined the forces of the Edison

General Electric Company in the supply department at Chicago under John I. Beggs, and he has remained with that company and its successor, the General Electric Company, until the present time. Mr. Ferris has won the liking of associates, customers, competitors and acquaintances alike by his integrity and courtesy.

ELECTRIC LIGHTING

William Busby has been granted a 50-year franchise for an electric-light system in Hugo, I. T.

The Mill Creek Electric Light and Power Company is to put in a lighting plant at Mill Creek, I. T.

Mr. Dooley is sarcastic. In a recent dissertation he refers to "th' electhric light that ebbs an' flows."

The Winnfield Electric Light and Power Company has been granted a franchise to erect and operate an electric light and power plant in Winnfield, La.

Suit of the Mt. Sterling Water and Light Company against the city of Mt. Sterling, Ky., has been compromised. The company will pay all costs and will install a new plant and put in new street lights.

The election to vote bonds for the construction of waterworks and electric-light plant in Stroud, Okla., resulted in an almost unanimous vote for the bonds. The water and light plant will be operated by the city.

The property of the Mobile Electric Company, which does the electric lighting in Mobile, Ala., is said to have been bought by Charles H. Daws and associates of Chicago. The consideration is given as $1,500,000.

The Holton Electric Company of El Centro, Cal., recently concluded the purchase of new electrical equipment consisting of Allis-Chalmers induction motors, transformers of the oil-filled water-cooled type and transformers of the self-cooled type.

A franchise for an electric street-railway and lighting plant in Hopkinsville, Ky., has been sold to H. M. Dalton. Work is to begin on the system within 90 days, and five miles of track must be completed and in actual operation within one year.

The Memphis Electric Company of Memphis, Tenn., has been incorporated with a capital stock of $5,000 for the purpose of erecting and operating an electric-light plant. The incorporators are W. S. Counsell, Fred Clayton, T. O. Isele and H. H. Bonner.

Ed L. Healy of Red Lake Falls, Minn., is about to install an electric-light plant at Red Lake Falls, where he has a waterpower site capable of developing 3,000 horsepower. Current will be transmitted to Grand Forks, N. D., for light and power purposes.

A company has been incorporated for the purpose of supplying an efficient electric-light and power system for Murray, Utah, and adjacent suburbs, and also to supply consumers in Salt Lake City. M. M. Murray is president and F. M. Lyman, Jr., secretary.

Bids will be received until February 21st for the construction of a complete water system and an electric-light plant in Gunnison, Colo., including all necessary buildings. Plans are on file at the office of John Huddart of Gunnison and at 41 Bank Block, Denver, Colo.

Sealed bids will be received until February 19th for furnishing all materials, tools and labor necessary to install a complete water and light plant in Jackson, Mo. Plans and specifications are on file with the city clerk of Jackson, Mo., and Hiram Phillips, consulting engineer, 615 Frisco Building, St. Louis.

At Decatur, Ill., a new city electrician has been appointed and the change, it is reported, has resulted in considerably raising the standard for wiring. The local inspector desires that National Code requirements be complied with in every particular. The newly appointed superintendent of the lighting company is co-operating with the inspector.

The Merchants' Electric Heat and Light Company of York, Pa., has been awarded the contract for lighting the borough of North York for the ensuing year. The cost of each light will be 11 cents per night, or three cents less on each light than the borough is at present paying. There were only two bids for the contract considered, the other being from the Edison Electric Light Company.

The Belle Fourche Electric Light, Heat and Power Company of Belle Fourche, S. D., recently placed orders for extensive new equipment for its plant. The new machinery, to be furnished by the Allis-Chalmers Company, will consist of a 16 by 42-inch heavy duty Reynolds Corliss engine, adapted for right-hand drive, two new 66 by 16-foot Chandler & Taylor boilers, duplex feed pumps, feed-water heater, etc. The new engine will be belted to a counter shaft to drive a 150-kilowatt alternator, the load being practically all lighting. Mr. A. A. [illegible] Moody, president [illegible] Power and [illegible]

With [illegible] the city of [illegible] of that city [illegible] municipal electric [illegible] $10,000. [illegible] owner of the plant, tendered [illegible] fulfillment of a [illegible] ter was [illegible] were cast against [illegible] the utility.

Changing from [illegible] (Minn.) General Electric Company [illegible] and became the [illegible] with a capital stock of [illegible] change in the management [illegible] officers according to their [illegible] company. The new company [illegible] debt from $1,218,000 to [illegible] $150,000 for labor and [illegible] waterpower.

A peculiar method of furnishing light [illegible] intended for Arctic exploration has been proposed for Captain Bernier's [illegible] Arctic. The method, as described in Cosmos, embodies an odd combination. A windmill operating when the wind permits compresses air in a receiver. The compressed air runs a motor, which in turn operates a dynamo. Electricity generated by the dynamo charges an accumulator. Finally the accumulator furnishes current for the lamps.

The Empire Electric Power and Supply Company of Carthage, Mo., has increased its capital stock from $10,000 to $25,000, and will enlarge its business accordingly. The company will equip to generate its own electric power and will sever connection with the Southwest Missouri Electric Railway Company, from which it now secures its current. Eight thousand dollars' worth of new machinery is to be installed, including a 150-horsepower natural gas engine. With the new equipment the company will be able to handle all the business that Carthage and vicinity can afford.

The contract for lighting the courthouse in Seattle, Wash., has been let to the Seattle Electric Company for the ensuing year. The rate granted is said to be perhaps the lowest ever offered for similar lighting in the Northwest—2½ cents per kilowatt-hour. The Seattle-Tacoma Power Company also bid on the lighting. The lowest figures of this company were three cents a kilowatt-hour, or a minimum of $130 per month, or a flat rate of $144.50. The flat rate offered by the Seattle Electric Company, which was not accepted, was $1,200 a year, based on a maximum demand for 30 horsepower, and $40 per additional horsepower. The courthouse has been lighted for several years with gas. Some time ago the old electric wiring was condemned, and the commissioners had the building rewired. This work was done by the Seattle Electric Company for $1,900. P. J. Smith, chairman of the board, said that the gas has been costing $250 a month, besides eight to 10 cents a kilowatt for electric lights in the vaults. He expects to save the cost of wiring the building in one year. About 300 lights will be used.

ELECTRIC RAILWAYS

The charter for the Corinth and Shiloh Electric Railway Company has been issued. This company proposes to construct and operate an electric railway through the streets at Corinth, Miss., and on to the Tennessee River, touching at a point near the Shiloh National Park, at or near Pittsburg Landing.

The big new car barns of the Canton-New Philadelphia electric road, located at Canal Dover, Ohio, were completely destroyed by fire a few days ago. The loss is estimated at $100,000, with about $60,000 insurance. Ten of the 70-foot interurban cars were in the building and were destroyed. The sub-station was also damaged.

The Central Pennsylvania Traction Company of Harrisburg, Pa., recently contracted for three Reynolds horizontal heavy duty cross-compound engines, with cylinders 22 by 48 inches in diameter and 42-inch stroke, for direct connection to three 650-kilowatt railway-type generators, 600 volts. Both engines and generators will be furnished by the Allis-Chalmers Company of Milwaukee.

It is reported in Austin, Texas, that an organization has been formed among Texas men with a large capital for the purpose of controlling most of the street railways in the state and for the further purpose of constructing something like 700 miles of electric interurban lines connecting Dallas, Sherman, Denison, Fort Worth, Cleburne, Waco and Austin and many other smaller Texas towns. It is also rumored that the syndicate will undertake the construction of the interurban connecting Austin and Lockhart. The syndicate at the present time is said to control something like 2,500 miles of electric lines in the different cities of the state, and now the plans are to connect these [illegible]

[illegible] earning [illegible]

[illegible] electric [illegible] developed [illegible] by [illegible] line will be [illegible] with 60 per cent [illegible] trical apparatus [illegible] tured in Paris [illegible] Further information [illegible] Albanese [illegible]

Electric cars [illegible] Twelfth Street in Kansas City, Mo. [illegible] of the Twelfth Street line [illegible] cable as the motive power for [illegible] in Kansas City, with the exception of [illegible] stretch down the incline and [illegible] Within the comparatively short [illegible] electricity as a motive power [illegible] of the cable, which at that time [illegible] every street car in Kansas City [illegible]

The City Council of Atlantic City, in granting an entrance into the city of the Atlantic City and [illegible] Railroad, which is to electrify and operate the [illegible] ers Point division of the West Jersey R[illegible] stipulated that the franchise should be limited to 30 years. At the end of the term the [illegible] to pay a fixed tax for each foot of the [illegible] way used, to abolish grade crossings when [illegible] cil so directs, to heat the cars and pay for street lighting and pave and maintain the street where used.

The Merchants' and Business Men's Association of West Chester, Pa., believes that the regular transportation of freight over trolley lines [illegible] prove beneficial to the commercial and agricultural interests of the community, as well as the [illegible] state, and declares itself to be desirous of legislation which will grant to trolley companies the right to conduct such business. The association urges the governor and representatives to use every endeavor to secure the prompt enactment of such legislation.

From many localities come expressions that the continued mild weather has been something of a bonanza for electric railways. Operating expenses are kept down to almost the summer basis. There has been no call for the snow plows, and tracks have been clear without interruption in many cities. The mild weather has stimulated traffic [illegible] of January in many quarters has witnessed [illegible] of the difficulties of operation usual at this time of the year, and it is estimated that the earnings for January will prove a surprise.

The Manila (P. I.) Electric Railway Company, which obtained its franchise in 1903, and opened its line in April, 1905, has now 40 miles of track in operation and some additional mileage under construction. The earnings of the property have more than fulfilled expectations. When the Philippines passed to American control Manila, although about the same size as New Orleans or Washington, D. C., had a horse-car line only 13 miles long operating two dozen diminutive cars seating eight to 12 persons each. This inadequate service made necessary the use of the native cabs—"carromatas" and "calesas"—of which there were in Manila at the time of the building of the Manila street railway upward of 10,000.

A serious accident occurred to the plant of the Bloomington, Pontiac and Joliet (Ill.) single-phase interurban railway on January 25th, the flywheel of the engine bursting and completely wrecking the engine besides doing other damage. This plant, it will be remembered, was described in the Western Electrician of March 25, 1905. The railway gen-

erating apparatus was located in the plant of the Pontiac Light and Water Company and consisted of a 500-horsepower engine belted to the railway generator. Damage done, outside of that to the engine, was not great, and no one was hurt. There were four panels broken in the switchboard and two or three holes made in the building. A new engine is being installed, and, with no unforeseen delay, the plant will be in operation again by February 10th. The total loss was about $5,000.

POWER TRANSMISSION.

E. E. Carpenter of Beloit, Wis., has a proposition under consideration for the operation of an electric railway from Sioux City, Iowa, to Sioux Falls, S. D., and to furnish light to the various stations along the line. His proposition is to utilize the waters of the Big Sioux River for the generating of electricity. Mr. Carpenter has already secured control of the waterpower and mill at Canton, S. D..

J. E. Russell of San Francisco is said to have submitted a proposition to supply San Francisco with water and electrical energy, to be secured from the American River near Auburn. Mr. Russell's property has reservoir sites, which he says could be developed to solve San Francisco's water problem, and besides have enough for developing electrical energy for use in the city. A power plant and reservoir could be built for $500,000, he says.

A large and complete power equipment consisting of eight 3,000-kilowatt waterwheel-type alternators, with a complement of transformers, exciters and switchboards was recently ordered by the Southern Power Company of Charlotte, N. C. This is said to be the largest contract for electrical apparatus placed in the South for some years. The Southern Power Company's plant being situated in the midst of the cotton-mill district, will open up opportunities for the use of electric drive by the surrounding cotton mills and other industrial plants which have heretofore been impossible because of the lack of cheap electric power in that vicinity. The company has full assurance that the cotton mills and other industries in the adjoining territory will make liberal use of the cheap power thus placed at their disposal. The Westinghouse Electric and Manufacturing Company will furnish the equipment.

PUBLICATIONS.

The National X-ray Reflector Company of Chicago is sending out a folder which describes its "poke bonnet" reflectors and illustrates their use.

Machinery manufactured by the flour-mill department of the Allis-Chalmers Company of Milwaukee is fully described in a new bulletin entitled "Allis Roller Mills."

Bulletin No. 1409 of the Allis-Chalmers Company describes McDougall roasting furnaces and shows some very interesting illustrations of a plant in operation equipped with these furnaces.

Pass & Seymour of Solvay, N. Y., came to the front during the Electrical Show held in Chicago with a handsomely embossed calendar which they distributed. The calendar represents the beautiful painting "Determination," by Goldschrader, and is a work of art.

A page in the January issue of Wesel's Message to Printers, published by the F. Wesel Manufacturing Company of Brookyn, N. Y., is devoted to electric welded chases. It is asserted that these chases are always true, do not break at the corners, and will stand more strain without deterioration than any other kind.

The Pittsburg Transformer Company of Pittsburg, Pa., manufactures a line of annealing furnaces which are described in a leaflet now being distributed. Another welcome piece of advertising literature which it is sending out at the same time is the February number of its series of monthly calendars, the reputation of which was made many moons ago.

The A. D. Granger Company of New York city has issued a new bulletin descriptive, in a general way, of what the company is prepared to do in the way of the construction of complete power plants. A large part of the company's business is the execution of complete contracts under the specifications and supervision of consulting engineers, its field being entirely that of a contractor and not a consulting engineer.

The latest advertising novelty produced by W. H. Schott, engineer, Chicago, is an elaboration upon the handsome design printed on the back cover of the New Year's number of the Western Electrician. The space within the arch has been supplied with a woman of striking figure pointing to the inscriptions above which tell of the advantages claimed for the Schott system for central-station heating plants. The whole forms an attractive wall hanger.

Interesting descriptive and pictorial matter concerning the application of electricity to mining is characteristic of bulletin No. 11, issued by the Jeffrey Manufacturing Company of Columbus, Ohio. The application of electricity to the mining industry are many and varied, and the appliances which this company manufactures cover a large part of the field. Prominent among the things described in the bulletin are Jeffrey mining and gathering locomotives. There are also various types of coal-cutting and shearing apparatus, power-plant apparatus, drills, etc.

That the "Proof of the pudding is in the eating" everyone knows. The old adage is hit upon in a happy manner by James L. Robertson & Sons of New York in a folder they have just issued on "Provin' the Puddin'." The proof of Eureka packing lies in the enviable reputation which it has built up for itself since its introduction to the trade about "waist deep in the seventies." The folder says: "Play ignorance and ask any reliable engineer the name of the best soft piston-rod packing on the market—perhaps one in a thousand will give some other name than Eureka."

Electric fans are now considered necessary devices for all seasons of the year; therefore the fan-motor catalogue is apropos in summer or winter. Two admirable examples of catalogues of this class come from the Emerson Electric Manufacturing Company of St. Louis, one devoted to the Trojan fan motors for 1906 and the other to 1906 models in general. Desk, bracket, column and ceiling fans are included in the Trojan class, and there are also described in the catalogue devoted to this type some artistic combination ceiling fans and incandescent-lamp fixtures. The other catalogue is devoted to various types of alternating-current fan motors for high and low frequency; also a line of exhaust fans. Both catalogues are handsome in appearance, and the descriptive matter is well prepared.

SOCIETIES AND SCHOOLS.

The St. Louis Electrical Contractors' Association held its regular meeting recently. The following-named officers were elected: President, R. H. Robinson; vice-president, I. Elkas; secretary, Edward T. Cooke; treasurer, S. A. Van Noort; sergeant-at-arms, Emil Haas; directors, C. F. Smith, F. B. Adam, R. H. Robinson and S. A. Van Noort.

The National Electrical Contractors' Association of the United States will hold its next convention in Cleveland, Ohio, on July 18th. Special trains and rates from both the east and west will be arranged. Alex. Henderson, 26 Cortlandt Street, New York city, is master of transportation. Information concerning hotel accommodations, etc., can be obtained from him.

President James of the University of Illinois has announced the establishment at Urbana of a new school of railway engineering and administration. It will be opened for work in September of this year. The problems of construction and maintenance of way will be treated in one division. The subject of power and its application and all that is ordinarily included in mechanical and electrical engineering will be treated in another division. The problems of operation, of organization, of financiering, rate making, and everything which has to do with the actual formation and management of a railway company will be treated in a third division.

TELEGRAPH.

A bronze statuette of Samuel F. B. Morse, said to be an excellent likeness, the work of an unknown sculptor, has been presented by the Dutchess County Society to the Metropolitan Museum of Art, New York, through its director, Sir Caspar Purdon Clarke, to be placed among the collection of original Morse telegraphic instruments. The statuette, believed to be of French origin, was discovered by William F. Kanerberg in the cellar of a London art dealer, where it had lain for 20 years, having belonged to the estate of an English nobleman.

MISCELLANEOUS.

E. B. Miner owns a large farm near Oriskany Falls, N. Y. The Oriskany Creek passes through the property, and Mr. Miner utilizes the waterpower to generate electricity for light, heat and power purposes on the farm. Mr. Miner gets 15 to 18 horsepower from the creek, and the plant is said to be working well.

In Philadelphia the merchants of Chestnut Street have adopted a new means of advertising. Phonographs are placed beneath the sidewalk, and from the coal-hole gratings the records grind out in loud tones tempting bargain offers. Many pedestrians stop in wonderment and investigate the sounds coming from beneath their feet.

Reports that the new Central Heating Company of Milwaukee, which has secured a franchise from the council, will receive its steam from the Milwaukee Electric Railway and Light Company, have been confirmed both by President Beggs of the street-railway company and officials of the heating concern. This will obviate the necessity of the latter company building a plant.

The purchase of the Detroit (Mich.) City Gas Company for $5,500,000 by the American Light and Traction Company was announced a few days ago at the offices of the latter company in New York. The new acquisition will be paid for from the proceeds of the issue of $5,500,000 worth of stock of the American Light and Traction Company, which was recently authorized and offered to stockholders at par.

The newspapers have another of those marvelous "electrical" items that frequently appear. Harry Howse of Pittsburg, Pa., is said to have contrived a simple electrical device, which, applied to hens' roosts at night, so stimulates and strengthens the egg-bearing functions of hens that each one lays an egg a day regularly. Mr. Howse calls his invention the eggometer—admirable name!—and it is said to have accomplished the desired results in practical tests at Petoskey, Mich. The apparatus, with a battery, is attached to the roosts (not to the rooster), and an electric current is passed through the bodies of the hens at night.

Electrically driven mine haulage, electric light and the use of electric power tools for mining coal is every day becoming a more and more familiar sight throughout the coal-mining areas. The latest instance of this kind is the installation of a new equipment for the McKell Coal and Coke Company of Glen Jean, W. Va., at is properties at Kilsyth, W. Va. The new equipment will consist of a 26 by 42-inch heavy-duty Allis-Chalmers engine and generator unit, 500-kilowatt, 25 cycles, with switchboard, lightning arrester, rotary converter and transformer equipment complete. The plant at Kilsyth and the sub-stations are expected to be ready for operation in April.

A new transportation problem was recently presented to the Allis-Chalmers Company, Milwaukee, in the form of a large engine bed plate weighing approximately 80 tons and forming part of the blowing engine purchased some time ago for the Carnegie Steel Company's plant at Sharon, Pa. The weight of this casting alone is several thousand pounds greater than the maximum capacity of the heaviest cars available. To carry these heavy pieces orders have been placed for two 16-wheel flat cars with a capacity of 100 tons each, the first of their kind in existence. They will measure 41 feet in length, or more than 10 feet longer than the older standard, with bolsters not less than six feet from the ends. They will be built as low as practicable in order to furnish all the clearance room necessary.

TRADE NEWS.

The Ford Electric and Manufacturing Company of St. Louis has changed its name to the Ford-Oliver Electric and Manufacturing Company.

James R. Hemphill of the Colonial Sign and Insulator Company has left for Cuba to look after the company's growing interests there in porcelain-sign letters.

The Badger Electric Company of Green Bay, Wis., has been dissolved. J. P. Nugent has retired from the firm and the business will be continued by Len. A. LeClair.

The Cherokee Electric and Manufacturing Company of Cherokee, Okla., has been incorporated with a capital stock of $25,000. J. W. Howard, A. J. Henderson, W. R. Ross and E. J. Dixon are among the incorporators.

In manufacturing development Japan is making progress in production of iron, steel, electric-light appliances, wire, rails and cars, cotton goods, and in a great variety and diversity of lines. The development will be especially marked in all lines that require delicate and artistic handiwork.

The report of John I. Beggs, trustee of the National Electric Company of Milwaukee, dated December 31, 1905, places the total assets of the plant at $4,987,919.44 and the liabilities at $4,695,800.21, leaving a surplus of $292,149.23. This represents a gain over the surplus as reported October 1st of $1,543.66, although there has been a decrease in the amount of cash on hand of $8,467.86.

Under date of February 1st the Varley Duplex Magnet Company of Providence, R. I., issues a circular notice which reads as follows: "The American Electrical Works will discontinue the manufacture of our patented windings on Monday next, February 5th. The Acme Wire Company, New Haven, Conn., our new licensee, is prepared to promptly and properly take care of all business entrusted to it."

If paper can be made from wood, why not make wood from paper?—at least some product which will take the place of wood. This question the Vulcalose Company of Chicago believes that it has answered satisfactorily in the affirmative. This company expects to manufacture from waste paper by a special process a material which will be in every way the equal of wood for building purposes, and it owns the United States and foreign patents on the process. The artificial "wood," it is said, will not warp, split, crack or be affected by heat, cold or moisture.

Wilbur H. Traver, formerly connected with the Rand Drill Company for a period of 12 years, as manager of the Chicago territory until the consoli-

dation of the Ingersoll and Rand company, after which time he was manager of the railroad department, with headquarters in Chicago, has now severed his connection with the Ingersoll-Rand Company and accepted service with the Chicago Pneumatic Tool Company as manager of the mining and contract department. Mr. Traver will devote his time and attention principally to the sale of air compressors, rock drill and mining machinery.

The imports into the United States have practically doubled in value in the last seven years. The total value of imports, as drawn by the Department of Commerce and Labor, through its Bureau of Statistics, was in the calendar year 1905, $1,170,000,000, and in the calendar year 1898, seven years earlier, was but $635,000,000. The figures of 1898 included, of course, merchandise from Porto Rico and Hawaii, which are now customs districts of the United States. If the value of the merchandise brought from those islands in 1905 be added, the grand total would be $1,234,0000,000, or practically twice as great in value as that of 1898.

The Chicago Fuse Wire and Manufacturing Company of Chicago removed to its office on February 1st to 170 South Clinton Street, where it is now located with the new factory recently established. This was done in order to furnish more easily the western and southern trade with well-known specialties such as fuse wire, fuse strip, fuse links, Union enclosed fuses, Union switch-boxes, etc., and will insure prompt shipments. W. W. Merrill, who has been connected with the business for the last 12 years and in the capacity of western manager for a number of years, remains in charge. He is also interested in the company as stockholder and director.

A good plan has been adopted by some central stations which results in much benefit to themselves and to manufacturing concerns. It is to place on the companies' letterheads printed data concerning their plants, such, for instance, as the kind of current used, voltage, phase and cycles, whether there is a day circuit, kind of incandescent-lamp base used, etc. This information greatly helps the supply house to which a letter is written, as the writer may fail to state certain important facts concerning his plant which may be ascertained by consulting the letterhead. In many cases this printed letterhead would save the purchaser time and annoyance in making explanations by mail or telegraph. The idea is advocated by the Wesco Supply Company of St. Louis.

Important changes have been recently made by the Le Valley Vitæ Carbon Brush Company of New York city both in the factory and in the office organization. This company built up a large

[illegible]

Progress on the construction on the $3,000,000 extensions to the West Allis Works of the Allis-Chalmers Company, in spite of delays of various kinds, is steadily advancing. Some idea of the unusual size of the new structure, which will bring the total floor space for the entire plant to 1,513,000 square feet, may be gathered from the bill of material used in construction. Some of the largest individual orders ever placed by a Milwaukee concern have been given for material used in the building operations. Nineteen thousand barrels of Portland cement will be required for the concrete work; 785,000 feet of roof sheathing will help cover the works, and 850,000 feet of yellow pine and white oak will support the huge weight of structures and equipment. Even the scaffold lumber used only temporarily during construction will aggregate 10,800 pieces. Over 3½ acres of wire glass will be used in skylights and windows, while the weight of new equipment for the interior of machine shops will aggregate 3,080 tons.

Trade of the United States with Russia, including the Asiatic part, during the fiscal year 1905, as shown by the records of the Bureau of Statistics,

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BUSINESS

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The Electric Storage Battery Company has begun a suit against the Universal Storage Battery Company for damages to the amount of $[illegible] for alleged infringement of the Kennedy patent, owned by the Electric Storage Battery Company. Suit has been brought in Wilmington, Del., the Universal company being a Delaware corporation.

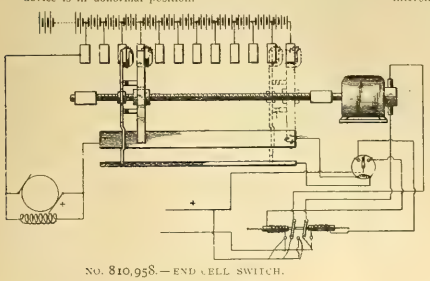
The Butterfield Construction Company of Chicago, well known as contractor for underground conduit and underground and aerial cable work, announces that it is continuing its business as in the past, with Mr. H. E. Butterfield as president, succeeding Mr. J. F. Butterfield, whose death was recorded in the Western Electrician last September. This company has a good reputation in the line of work which it makes its specialty, and it is its intention to keep up to the standard in every way.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 30, 1906.

810,912. Automatic Non-interfering Repeater for Fire-alarm Circuits. Frederick W. Cole, Newton, Mass. Application filed January 31, 1905.

Street circuits, each embracing a magnet and a moving device which controls means for repeating the signal over the circuits, contain mechanically controlled locking devices, the moving devices being normally unlocked. Means actuated by each impulse received lock out all of the moving devices in the normal position when a moving device is in abnormal position.



NO. 810,958.—END CELL SWITCH.

NO. 811,226.—LIGHTNING ARRESTER.

810,914. Protective Apparatus. Frank B. Cook, Chicago, Ill. Application filed December 4, 1903.

An electric protective device embodies a thimble adapted to grasp the device and normally hold it in a fixed position, means adapted to engage the device and tending to operate it, the operation of the device causing a circuit to be controlled, and means adapted to move the device within the thimble to operative position after operation.

810,915. Automatic Cut-out Mechanism for Electrically Operated Bulkhead Doors. William B. Cowles, Cleveland, Ohio, assignor to the "Long Arm" System Company, Cleveland, Ohio. Application filed July 11, 1904.

Gearing driven by a motor operates the door or hatch. Pivoted arms with a stop carry a spring under compression mounted between the arms, a lug or roller being connected to a member of the gearing and forcing one or other of the arms against the spring when the load on the gearing exceeds a predetermined limit. A cut-out switch controlled by the yielding of the arm against the spring cuts off the current from the motor.

810,929. Storage Battery. William Fennell and William P. Perry, Leytonstone, England. Application filed March 17, 1904.

In an electric accumulator are a honeycombed mass, an active material on the exposed surfaces of the mass and unobstructed passageways formed therein besides the interstices of the mass for the egress of gas.

810,930. Storage Battery. William Fennell and William P. Perry, Leytonstone, England. Application filed March 6, 1905.

An electrode comprised of a non-conducting mass insoluble in electrolyte is pierced in more than one direction with inter-communicating passages, the walls of the passages being lined with active material.

810,931. Alarm for Incubators. Willard S. Freeman, St. Cloud, Minn. Application filed May 6, 1905.

An electric alarm bell controlled by a thermostat is arranged to ring when the temperature in the incubator passes a predetermined point.

810,958. End-cell Switch. Lamar Lyndon, New York, N. Y., assignor to the General Storage Battery Company, New York, N. Y. Application filed October 17, 1904.

Combined with the end cells of a storage battery are reversible charging means having a switch brush, circuits and connections for automatically controlling the charging means in accordance with the electric condition of the end cells, whereby the brush is moved in either direction, and means for automatically determining the position of the brush in accordance with the electric condition of the end cells. (See cut.)

810,963. Electric Igniter. Homer N. Motsinger, Pendleton, Ind., assignor to the Motsinger Device Manufacturing Company, Pendleton, Ind. Application filed May 31, 1904.

Details are described.

811,020. Telephone for Ships, Mines, etc. Arthur F. Boardman, Somerville, Mass., assignor to the Electric Gas Lighting Company, Boston, Mass. Application filed April 10, 1905.

The device embodies a compact telephone set and is in a moisture-proof case.

811,037. Danger Signal. William C. Creveling, St. Louis, Mo. Application filed December 8, 1904.

A car provided with a lamp circuit carries also a storage battery. A storage-battery circuit, a signal in the circuit, a switch for throwing the storage-battery circuit into the lamp circuit and for including the signal circuit in the storage-battery circuit and a separate switch for breaking the storage-battery circuit when the switch is in position to include the storage-battery circuit in the lamp circuit are other essential features.

811,052. Telephone Call. Peter T. Geyerman, Brewster, Minn. Application filed March 14, 1905.

Selective ringing mechanism in a magneto-telephone set is described in the patent.

811,057. Electric Sign. Carl Haller, Chicago, Ill. Application filed April 29, 1905.

In an electric sign are a foundation plate, letter outline and shells consisting of strips of sheet metal bent to letter outline, the rear edge of each strip being bent to form a flange for attachment to the foundation plate and the front edge of the strip being beaded over for stiffness. Lamp sockets are secured to the foundation plate.

811,058. Electric Sign. Carl Haller, Chicago, Ill. Application filed April 29, 1905.

A sheet-metal shell forms the outline of a letter, and a diaphragm extends from wall to wall of the shell, the shell having a ridge formed therein between the front and back edges for supporting the diaphragm.

811,059. Electric Sign. Carl Haller, Chicago, Ill. Application filed April 29, 1905.

A sheet-metal shell forms the outline of a letter and has a ridge formed between its front and rear edges. A diaphragm is adapted to fit within the shell and lie against the ridge therein and carry lamp sockets.

811,064. Air Brake. Edwin T. Hughes, Gladstone, Colo., assignor of one-fourth to Vincent J. O'Brien, one-fourth to Willis Z. Kinney and one-fourth to James M. Rogers, Silverton, Colo. Application filed October 9, 1905.

Electromagnetic devices operate the valve of the exhaust passage leading to the triple valve in which the air pressure is sometimes reduced.

811,083. Annunciator. Halvor M. Olsen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed May 16, 1901.

An annunciator comprising an electromagnet has a frame secured to the forward end of the magnet. A target is pivoted upon the frame, and a convex cover is secured to the forward end of the frame in front of the target, the cover being provided with an opening adapted to expose the face of the target. The curvature of the cover corresponds to the arc described by the forward end or face of the target, and an armature is arranged to raise the forward end of the target.

811,088. Electric Drying and Ironing Apparatus. George W. Richardson, Wissahickon, Pa., assignor of one-half to Stephen T. Major, Norristown, Pa. Application filed March 28, 1905.

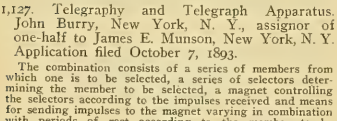
Drying and ironing mechanism comprises a number of rollers coacting to press and dry material passed therethrough, each of the rollers comprising a brass ironing cylinder, a resistance coil therein, bearings for the rollers, a conductor connected to and revolving with each of the rollers, means for insulating each of the conductors from the respective cylinders and bearings and a brush making contact with each of the conductors in combination with a casing having end walls disposed between the ironing cylinders and brushes. (See cut.)

811,098. Telephone Transmitter. Michael Setter, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed December 30, 1904.

A telephone transmitter comprises a front plate composed of two sheet-metal parts pressed into the desired shapes and rigidly secured together, one of the parts having an internally threaded boss. A mouthpiece is screwed into the boss, a diaphragm having its marginal portions resting against the other sheet-metal part. A bridge is suitably secured to the sheet-metal part on which the diaphragm rests, a casing being fitted upon the periphery of the sheet-metal part to which the bridge is secured and a microphone device connecting the diaphragm to the bridge.

811,105. Railway Signaling. Samuel D. Strohm, Philadelphia, Pa. Application filed August 29, 1891.

A railway having station electromagnetic devices is provided with contact plates and circuit connections, a semaphore, electromagnetic devices for setting the semaphore to one position, separate locking mechanism for holding the semaphore in position and electromagnetic devices for releasing the locking devices for returning the semaphore to normal position, the electromagnetic locking and releasing devices being included in the circuits of the station electromagnets.



NO. 811,088.—ELECTRIC IRONING APPARATUS.

811,127. Telegraphy and Telegraph Apparatus. John Burry, New York, N. Y., assignor of one-half to James E. Munson, New York, N. Y. Application filed October 7, 1893.

The combination consists of a series of members from which one is to be selected, a series of selectors determining the member to be selected, a magnet controlling the selectors according to the impulses received and means for sending impulses to the magnet varying in combination with periods of rest according to the member to be selected.

811,137. Electric Riveter. Samuel S. Eveland, Philadelphia, Pa. Application filed September 13, 1904.

An electric riveter is provided with an electrode, constituting a header, means for rotating the electrode to localize the heating effect at the end of a rivet, an electrode constituting a support for the rivet and devices for causing the electrodes to approach so as to head up the hot end of the rivet.

811,153. Trolley Pole. John E. Lagergren, New York, N. Y. Application filed May 25, 1905.

A base, a spring-pressed pole mounted thereon, an automatic friction lock or clutch mechanism whereby the pole is normally locked in relation to the base, a movable trolley head and means actuated by the trolley head whereby pressure on the head will release the lock or clutch are the patentable features.

811,154. Dynamo-electric Machine. Pierre A. J. Lapeyrade, Paris, France. Application filed February 8, 1904.

Details are described.

811,161. Incandescent-lamp Socket. Norman Marshall, Newton, Mass. Application filed March 31, 1904.

A casing for incandescent-lamp sockets consists of a telescoping shell and cap of sheet metal, one or more radially extending integral cylindrical lugs on one part internally screw threaded to receive body holding screws and a slot or slots in the other part co-operating with the lugs to hold the parts of the casing together.

811,186. Cleat and Socket. Charles M. Waite and Charles F. Fralick, New York, N. Y. Application filed April 14, 1905.

Combined with a two-part cleat are a socket carried by one side of the cleat, terminals arranged in the socket and a pair of weatherproof rings, one of which lies between one of the terminals and the wall of the socket, and the other of which encircles the socket.

811,200. Electric Lighter and Extinguisher for Gas Burners. Oreste Candi and Cesar Candi, Genoa, Italy. Application filed November 17, 1904.

A device operated by electromagnets operates to turn the gas of a gas burner on or off, a sparking mechanism lighting the gas.

811,226. Lightning Arrester. Walter C. Jones, Chicago, Ill., assignor to the Garton-Daniels Company, Keokuk, Iowa. Application filed December 7, 1901.

In a lightning arrester are two continuous paths for the current, non-inductive resistance arranged in one of the paths and an arrester coil and a resistance arranged in the other path. (See cut on preceding page.)

811,231. Alternating-current Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 30, 1904.

Combined with a source of multiphase electrical energy is a motor having a field-magnet winding supplied from the source with current of one phase and an armature winding supplied from the source with current of a different phase. Field-magnet pole pieces are provided with slots parallel to the armature axis, a neutralizing winding being located in the slots and connected in series with the armature winding. Plates of low-resistance conducting material are located in the interpolar spaces.

811,238. Signal. Karl Möller, Charlottenburg, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed June 12, 1905.

A solenoid is adapted to shift the signal and has two windings. A local circuit comprises one of the windings and a local source of current. A control circuit includes the other winding and a distant control station. Means controlled from the station close the local circuit, and means controlled by the movement of the signal open the local circuit.

811,247. Electrically Operated Typewriter. Willis J. Roussel, New Orleans, La., assignor of one-eighth to Alphonse King, Chicago, Ill. Application filed March 28, 1903. Renewed July 29, 1904.

Combined with a motor is a shaft operated by the motor. A type-wheel is loosely mounted upon the shaft with means for locking the wheel to the shaft. Teeth upon the wheel, a pawl normally engaging one of the teeth, a magnet and an armature for the magnet, the armature being connected to and adapted to operate the pawl and locking means complete the apparatus. (See cut.)

811,248. Magnetic Needle. George N. Saegmuller, Rochester, N. Y., assignor to Bausch, Lomb, Saegmuller Company, Rochester, N. Y. Application filed August 24, 1905.

A magnetic needle comprises an elongated substantially tubular body having a bearing, the walls of the body being magnetized. A post-receiving opening is alined with the bearing.

811,249. Governing Mechanism for Elastic-fluid Turbines. Frederick Samuelson, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed March 23, 1905.

In a governing mechanism for an elastic-fluid turbine are a number of discharge passages having different capacities, individual valves for controlling the passage of fluid therethrough and an electrical means for effecting different combinations of the valves to compensate for different loads on the turbines.

811,253. Socket for Incandescent Electric Lamps. Albert P. Seymour, Syracuse, N. Y., assignor to Pass & Seymour, Incorporated, Solvay, N. Y. Application filed January 30, 1905.

An inclosing shell of an incandescent-lamp socket is described.

811,265. Protection Against Reversal of Energy. Leonard Wilson, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed May 2, 1904.

In combination with a main alternating-current circuit are a local circuit in which the current varies in phase with variation of phase of the current in the main circuit, a commutator in the local circuit rotating synchronously with the cycles of the electromotive force of the main circuit, a device having relatively movable members, one of the members being energized by the commutated current in the local circuit and the other member being energized by a constant flux, and a switch in the main circuit controlled by the device.

811,277. Electromagnet. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 15, 1904.

Associated with a number of devices to be moved are a magnet winding, a lever arranged to be actuated thereby, dogs carried by the lever and adapted to engage the devices, means for holding the dogs normally out of engagement with the devices and selector magnets adapted and arranged to move the dogs selectively into engagement with the devices.

811,284. Electric Race Track. Thomas F. Gaynor, New York, N. Y., assignor to the Electric Amusement Company. Application filed March 14, 1905.

Electrical features of an amusement device are the basis of this patent.

811,304. Alternating-current Machine. Marius C. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed June 25, 1904.

In an alternating-current machine are a multipolar field magnet, a wave-armature winding, a commutator composed of alternate live and dead segments and brushes of each polarity distributed around the commutator, the width of a brush being not greater than that of a segment.

811,312. Dynamo-electric Machinery. John H. St. Hill Mawdsley, Taunton, England. Application filed November 30, 1903.

Dynamo-electric machines of the type described have magnetizing coils, each surrounding a pole piece placed with their sides in the neutral zones and close to their armatures and at or about the middle of the interpolar spaces of contiguous poles and spaced away from the pole cores.

811,323. Electric Meter. Edwin H. Porter and Burleigh Currier, Philadelphia, Pa. Application filed June 17, 1904.

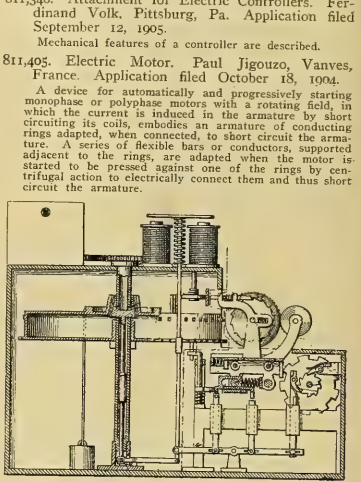
The electric meter has a crystalline-stone bearing, the meter spindle having an end of similar crystalline stone engaging the bearing.

811,340. Attachment for Electric Controllers. Ferdinand Volk, Pittsburg, Pa. Application filed September 12, 1905.

Mechanical features of a controller are described.

811,405. Electric Motor. Paul Jigouzo, Vanves, France. Application filed October 18, 1904.

A device for automatically and progressively starting monophase or polyphase motors with a rotating field, in which the current is induced in the armature by short circuiting its coils, embodies an armature of conducting rings adapted, when connected, to short circuit the armature. A series of flexible bars or conductors, supported adjacent to the rings, are adapted when the motor is started to be pressed against one of the rings by centrifugal action to electrically connect them and thus short circuit the armature.



NO. 811,247.—ELECTRICALLY OPERATED TYPEWRITER.

811,415. Regulation of Electric Motors. Johan G. V. Lang, London, England, assignor of one-half to Edward Hibberd Johnson, London, England. Application filed June 28, 1904.

Regenerative motor-controlling means employs the main controller cylinder and the field-change cylinder, and means whereby the field-change cylinder will automatically change the motor from its compound or shunt condition to its series condition, whenever the regenerated current of the motor, while in its compound or regenerative condition, falls below a predetermined value.

811,435. Telegraph or Telephone Pole. James M. Perdue, Matthews, Ga. Application filed July 11, 1905.

Mechanical features of a three-legged steel telephone or telegraph pole are set forth.

811,442. Dental and Surgical Lamp. Clarence F. Rodgers, Conneaut, Ohio. Application filed February 24, 1905.

A small incandescent lamp with special reflector for use in dental or surgical work is described.

811,519. Electric Switch for Street Railways. James A. Posey, Midlothian, Texas, assignor to the Posey Automatic Switching Company. Application filed March 14, 1905.

Electrical devices are so arranged in the apparatus that the motorman upon a passing car can cause either lever of the switch-moving mechanism to be actuated at will.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on February 5, 1906:

379,109. Switch and Cut-out for Electric Light and Other Electrical Devices. O. S. Bussmann, Somerville, Mass.
397,111. Galvanic Battery. E. J. Colby, Chicago, Ill.
397,116. Galvanic Battery. C. E. Egan, Columbus, O.
397,176. Telephone or Analogous Electric System. A. B. Ferdinand, Oshkosh, Wis.
397,194. Multiple-signal Transmitter. M. Martin, Malden, Mass.
397,218. Insulating Pipe Coupling. S. Bergmann, New York, N. Y.
397,235. Method of Forming Secondary-battery Electrodes. R. M. Hunter, Philadelphia, Pa.
397,260. Electric Stop Valve. R. Wellens, Pittsburg, Pa.
397,270. Electric Railway Signal. A. Z. Boda, Columbus, O.
397,284. Telephone Call Box. A. Griffith, Springfield, and H. A. Burbank, Westfield, Mass.
397,300. Electric-wire conduit. W. B. Mack, Boston, Mass.
397,331. Telephone Circuit and Apparatus. J. A. Barrett, Brooklyn, N. Y.
397,364. Electric Communicating System. A. G. Holcombe, New York, N. Y.
397,385. Cable or Electric Street Railway. W. S. Phelps, San Francisco, Cal.
397,392. Armature for Dynamo-electric Machines. O. B. Shallenberger, Rochester, N. Y.
397,407. Apparatus for Purifying Sewage by Electricity. W. Webster, Jr., Lee Park, Lee, County of Kent, England.
397,418. Protector for Electrical Instruments. J. E. Crandall, Washington, D. C.
397,424. Connection of Electrical Circuits. W. W. Criscom, Haveford College, and H. N. Weidner, Philadelphia, Pa.
397,439. Dynamo-electric Machine and Motor. F. J. Patten, New York, N. Y.
397,443. Secondary Battery. W. A. Shaw, Brooklyn, N. Y.
397,461. Electric Converter. L. Gutmann, Fort Wayne, Ind.
397,466. Printing Telegraph. A. T. McCoy, Boston, Mass.

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The Newest Branch Telephone Exchange in Chicago.

Among the many branch exchanges of the Chicago Telephone Company, the new Humboldt Exchange, located on Western Avenue, near North Avenue, is one of the finest, both in architectural design and in equipment. It was opened early in December, and is fitted with the latest type of telephone apparatus, to promote speed and accuracy of service. In cutting in this office many of the subscribers of West Exchange were transferred to Humboldt, making, all told, about 2,300 incoming lines as the present equipment.

Built in colonial style, of chocolate-colored brick, the building presents a pleasing appearance, as shown in Fig. 3. It is a two-story and basement fireproof structure, the interior being finished entirely in Flemish oak, with the exception of the main operating room (Fig. 1), where mahogany is used, to conform to the woodwork of the switchboards.

The first floor is devoted to the distributing frames and power-plant room (Fig. 2) and to a clubroom used by the maintenance department of the company as a gathering place for one of its technical clubs. There are now four of these clubs in different sections of the city, where those employes who are interested in the technical or maintenance departments of telephone work meet from time to time and discuss questions bearing upon their work.

On the second floor of the building are located the switchboard room, a lunch room for the operators (where appetizing food and drink are furnished them free of cost) and a comfortable and well-lighted rest room, where the operators may comfortably enjoy intervals of rest during the periods they are off duty during the morning and afternoon.

Fig. 4 is a view in the rest room. In the treatment of the furnishings and decorations of this room the Mission type predominates. The lighting fixtures are of wrought iron of special design. The south outlook is upon the garden at the rear of the exchange, which is cared for by the operators themselves. Books and the current periodicals are placed at the disposal of the operators. In the adjoining portion of the room, and separated from it by screens, is the lunch room.

In the basement is located the heating plant, which is the hot-water system; also the storage battery, which is placed in a separate and well-ventilated compartment, so that there is no annoyance from the fumes arising from it. The rest of the basement space is used for storage purposes.

Taking up the telephone equipment of the exchange, it is simplest to follow it from the entrance of the cables to the switchboard. The telephone conductors are brought into the building from underground conduits through lead-covered cables to the pothead in the basement. [illegible] the conductors pass up to the [illegible] frame, which is the right-hand frame [illegible] in Fig. 2. The [illegible] rack are located back of the frame, [illegible] shown in the picture. From the [illegible] cables pass to the intermediate and then to the switchboard, as is the general practice [illegible]

Fig. 1. Operating Switchboard and Chief Operator's Desk on Second Floor.

Fig. 2. Distributing Frames and Power Switchboard on First Floor
THE NEWEST BRANCH TELEPHONE EXCHANGE IN CHICAGO.

changes. This part of the work is all standard, with the exception of the method of running the cables between the frames. Instead of running them all in one large chute, as is commonly practiced the cables are run in a number of small groups from one frame to the other, it being thought that by this method the cables might be more easily installed, and the sapce above the frame would not be used for other purposes anyway. The frames themselves are also arranged in such a manner as to allow of their growth in either direction.

Another feature of the cable work which may be pointed out, is the running of the cables to the terminal blocks on the distributing frame vertically [illegible]

[illegible] It [illegible] duplicate [illegible] One of the [illegible] Edison [illegible] direct current [illegible] may be [illegible] storage battery. The motor-generators for charging the batteries are ordinarily driven by Edison current, but are arranged so that either may be driven by a gas engine, which is held in reserve. By the arrangement described it may be seen that only under the most extraordinary circumstances could the ringing or battery current be interrupted. The power switchboard is shown prominently in Fig. 2.

Coming to the telephone switchboard equipment, there is not a great deal to differentiate it from the standard Bell apparatus which has been thoroughly described in previous articles in the Western Electrician. As shown in Fig. 1, there are six eight-panel subscribers' sections, or the "A" board and three trunk sections, or the "B" board, arranged on three sides of the operating room. One section of the trunk board is used as a "hospital" section. The sections are among the largest built by the Western Electric Company and have an ultimate capacity of 9,000 stations. They have three positions each and are equipped with standard apparatus.

In the installation of exchanges of this type a question of policy arises, as to the trunking of calls from the "A" board to the "B" board, and the use of multiple jacks in the former. Obviously, if all calls originating in an exchange were destined for subscribers whose lines terminate in that exchange the use of trunk lines would be unnecessary and no "B" or trunk board would be needed. On the other hand, if all calls originating in an exchange were destined for subscribers in another exchange, trunk lines would be used exclusively for completing the desired connections, and no multiple would be required. It is equally clear, [illegible] that somewhere between there would be a certain value to the proportion between trunk calls and calls which might be completed directly at which it would be equally as economical to use multiple on the "A" board for completing connections local to that particular exchange as to

complete those calls through the trunk board. There are various determining factors in this problem which must be considered in detail before the method to be adopted is determined upon. In making local connections through the use of multiple jacks there is the great initial cost of the multiple to be considered. On the other hand, if the local connections are all to be made through the medium of the "B" board there must be considered the greater number of operators that will be required, the extra cost of "B" board equipment, etc.

After taking all things into consideration, the method adopted at the Humboldt Exchange is to complete all calls through the trunk board, both

FIG. 3. THE NEW HUMBOLDT BRANCH TELEPHONE EXCHANGE IN CHICAGO.

local and those destined for other exchanges in the city. The proportion between the number of calls which could be handled exclusively by Humboldt and those which would require trunking to other offices was estimated to be such that this plan seemed the more feasible. Therefore there are no "A" board multiples. In addition to other advantages this method insures greater accuracy in making connections.

One of the circuits, which is comparatively new, is shown in Fig. 5 and is the one used in the 10-party-line trunk positions. A close study of this circuit will show that the ringing of the subscriber is done by a special commutator, on the regular office ringing machine. All calls for 10-party subscribers, whether from the local office or from an outside office, are trunked direct to these positions. The subscriber's lines terminate in a special multiple on two jacks, the tip and ring of one being reversed. The ringing key has five buttons, each button being connected to one of five commutator rings. Each revolution of the commutator gives one, two, three, four or five impulses between the pick up and the trip segments. The pickup relay in the cord circuit must close before

FIG. 4. OPERATORS' REST ROOM IN HUMBOLDT EXCHANGE.

the ringing impulse is given over the line. This prevents starting the ring at the wrong time and calling the wrong party. The operator only has to press the button corresponding to the last figure of the called number, and the machine in connection with the pickup relay rings the proper station. As soon as the commutator has completed one revolution a trip relay operates and automatically cuts off the source of the ringing current. This method gives a uniform and positive ring to all subscribers, and is a great improvement over the manual key.

Keyless trunks were installed in this office at the beginning, which makes Humboldt the first office in the system to put in this equipment as a part of its original plant. Other offices have installed this system at various times by tearing out old equipment.

The new office is in the western division of the telephone company and under the management of Mr. R. W. Sullivan, whose office is located at West Exchange. Mrs. M. Regan is the chief operator and has from her desk a direct line to the manager's office, so that he is practically in as close touch with Humboldt as if he were there all the time.

How May Niagara Falls Best Serve the Interests of Mankind?

By Orrin E. Dunlap.

Twenty-five years ago the world was wondering if ever a plan would be discovered whereby the immense power of the Falls of Niagara could be developed for the use of mankind. The hydraulic canal flowed through the then village of Niagara Falls, but the power development connected with it had not commanded very great attention, as there were only a few mills using the power along the high bank of the lower river. The plan of the late Thomas Evershed of Rochester, N. Y., for the construction of a wheel-pit and tunnel tailrace was presented for the consideration of capital, and on October 4, 1890, ground was broken by the Niagara Falls Power Company for the first development of this kind at Niagara. The progress made in electric science was the incentive, and the hope was great that electric power might be transmitted many miles successfully. The Niagara Falls Hydraulic Power and Manufacturing Company felt

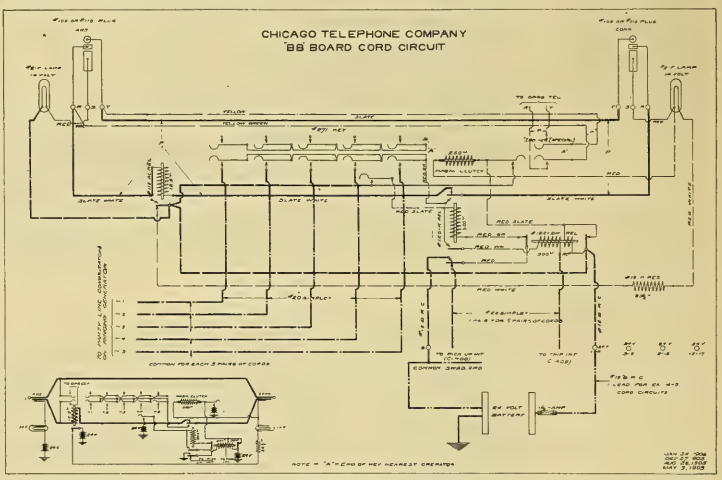

FIG. 5. CORD CIRCUIT FOR 10-PARTY LINES IN HUMBOLDT EXCHANGE.

the approach of the electrical era, and began the erection of a power station at the water's edge in the gorge. Sitting in London, England, the International Niagara Commission decided that the unit of development in the station of the Niagara Falls Power Company should be 5,000 horsepower, the largest at that time attempted.

From the very first the Niagara development has been a very great factor in stirring up other sections of the country to avail themselves of the force of nearby waterpowers, and it might be said to be impossible to trace out the vast benefit the Niagara power development has been in arousing the ambition of capital and engineers. The work at Niagara was the illustration of what might be accomplished, and electrical engineering must realize how that profession has benefited largely by the Niagara enterprises. A marvelous fact is the manner in which capital has been invested in the hydroelectric field of development in a comparatively few years. The plants manufacturing electrical apparatus have attained mammoth proportions, and there has been a large number of young men attracted to this field of research and labor. Educational institutions have been forced to add new departments of instruction, and in many ways general business methods have been affected.

In less than 16 years since the tunnel power development of Niagara was begun a mighty protest comes from all parts of the United States and the Dominion of Canada against the further diversion of the waters of the Upper Niagara for power purposes. All that has been accomplished marks the enterprise and vigor with which American energy has entered into the projects of development, and here is found much that is creditable in the development of the world's resources; but still, public sentiment, wisely or foolishly created, seemingly demands a stoppage along these lines of progress. The public health is not menaced; lives are not being lost; morals are not being corrupted; the welfare of the country is not threatened, but, on the contrary, every horsepower developed adds to the industrial glory of the United States or the Dominion of Canada. If quantity means cheapness, as it does with many things that are sold, every additional horsepower would be an intimation of greater good to a greater number, either by personal application and use or through labor developed in manufacturing plants. More important than all these, however, appears to be the public desire to feast its eyes on the scenic spectacle of the great flood of waters dropping from one level to another at Niagara. History shows that wonderful and remarkable waves of sentiment have swept across the American Continent, recorded by the votes at national elections and in other ways, that serve to indicate how people are stirred. Resolutions passed, from Maine to California, for the preservation of the Falls of Niagara demonstrate that a similar wave has agitated the feelings and sentiments of many people. Many who have viewed the cataract of Niagara have written of its "sublimity," have pictured its "grandeur" and have related its "impressiveness," or told of its "awe-inspiring" features. Its "tranquility" and "horrors" have been portrayed in verse and prose, while its "awful" and "chaotic" manner have found admirers equal in number to those who love its "docile" and "quieting" affects. Thus there is a tremendous conflict of opinion as to why Niagara is great, outside of its volume, and yet human eyes long to view the Horseshoe—this great "central solemnity and shudder-fraught miracle of the monstrous uproar and glory that is rendered exquisite, reposeful and soothing by the lovely rainbows lianging over the turmoil and clamor." Beyond the fact that it is beautiful, there appears no argument for preserving Niagara as a scenic spectacle. Could it be shown that the falling waters are an inspiration to higher actions, nobler deeds or helpful to humanity, the strength of the argument would be intensified.

While the Falls of Niagara are known to have existed for centuries, up to 1890, when the big power development was started, the territory now within the limits of the city of Niagara Falls, N. Y., had a population of about 11,000. In the last 15 years it has increased to 25,000 or 30,000. Millions upon millions of dollars have been invested in developing power, and many other millions have been invested in great manufacturing plants, operating processes that are of untold benefit to various parts of the world, in that their products are helpful to industries far away from Niagara, even across the ocean in other countries. The application of Niagara power to the operation of several of these industries has resulted in a cheapening of their products, to the benefit of the many. Consider the increased output of aluminum, the cheapening of the price, making it available for the manufacture of so many articles used in the home. The manufacture of carborundum and of artificial graphite have both been developed as a result of the plentiful supply of Niagara power, making it possible

for the product of these plants to meet the competition of articles used for similar purposes.

On the New York side, the power development to date is about 150,000 horsepower, while the possibilities of development of the two companies that are operating plants amount to about 350,000 horsepower, which includes the present development. On the Canadian side, machinery for the development of about 80,000 horsepower have been installed, but the franchises granted for the developments in Victoria Park permit of a total development of about 405,000 horsepower, made up as follows: The Canadian Niagara Power Company, 100,000 horsepower; the Ontario Power Company, 180,000 horsepower; the Electrical Development Company of Ontario, Limited, 125,000 horsepower. In addition to these developments, there are supposed to be six other franchises in existence that permit of other developments, but not immediately at Niagara Falls, the plan of all of them being to use the fall at the Niagara escarpment on each side of the Niagara River. It is not known how many of them will develop life enough to effect a power development, but it is quite certain that all of them will not establish works, and it is possible that none of them will, as they have done practically nothing in the period they have held charters.

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THE FALLS OF NIAGARA—THE SPECTACLE WHOSE PRESERVATION IS AROUSING SO MUCH INTEREST.

Thus about all of the upbuilding and development in the Niagara locality; all the influence the great works have exerted on the workshops of many places; all the influence exerted on the lives of the great number who are profiting by the Niagara development is the result of the first 150,000 horsepower. It is shown that the possibilities of development are 525,000 horsepower more than the amount for which machinery has been installed; but to this must be added the 80,000 horsepower not yet utilized on the Canadian side, and we have 605,000 horsepower, through the development and use of which similar influences may yet be exerted. So that, should the development be stopped with the franchises now existing, the Niagara locality is assured a wonderful supply of electric power. This supply at least appears very large today, but how can the demand of the future be estimated? Up to this time the output of the Niagara power houses has been confined to a radius of 34 miles; practically to 25 miles. Now transmission lines are being erected to carry the power to Syracuse, 100 miles from the point of development, and to Toronto, Ont., 85 miles away. Between these points and Niagara there are numerous available markets of considerable size, so that for the entire distance on either side of Niagara there may be a demand for the transmitted power. The possibilities of economical transmission of electrical power should increase, and, if so, then the assault, if such it may be termed, that is today being made on the power development interests is of importance to a still wider circle than that outlined, and the future industrial prospects are threatened.

Never before have the scenic and industrial interests of the Niagara locality been so aired and agitated. The United States and the Dominion of Canada are supposed to have equal rights at the Niagara River, and it is understood that the state of New York and the province of Ontario are profiting by the power [illegible] countries, the state of New York and the province of Ontario are agreed up [illegible] New York state a bill has been introduced in the Legislature by Assemblyman [illegible] that has the most stringent provisions connected in connection with Niagara power. It does the bill rule upon the amount of power to be used for power, but it also denies [illegible] ties for infringement of the rule. It further specifies that no company shall use more water from the river above the falls for commercial purposes than is allowed by its charter. The first of the penalties the bill would impose is that the company shall forfeit its charter; the second that fine of $50 per horsepower for each excess horsepower may be charged; third, that the people may get an injunction against any company guilty of the offense, and, fourth, the offending companies shall be prohibited from doing business in New York state. It is further provided that all of these penalties may be put in force at the same time.

MAP OF LONG-DISTANCE POWER-TRANSMISSION LINES FROM NIAGARA FALLS.

On the Canadian side of the river the boards of trade are asking the government to prohibit manufacturers of electrical power at Niagara Falls either selling or transmitting the same across the line to any American points under any contract not terminable on one year's notice. They point out that as Canada is largely dependent on foreign coal for industrial developments, there should be no interference with Canada's rights to develop waterpower at Niagara Falls or any other point along the international boundary.

This opposition on the part of the Canadians to the transmission of Canadian-Niagara power

[illegible] dian-Niagara power [illegible]

[illegible] At the present time [illegible] but there is a great deal [illegible] using electric [illegible] power companies, but also the [illegible] New York state, and possibly [illegible] of the presence of Ontario [illegible] development made [illegible] must the people be [illegible] ara's greatness. Lord Kelvin said: "I do not myself believe that any such [illegible] power will [illegible] of the great natural gift, and I look forward to the time when the whole water from Lake Erie will feed its way to the lower level of Lake Ontario through machinery, doing more good for the world than that great benefit which we now possess in the contemplation of the splendid scene which we have presented before us at the present time by the waterfall of Niagara. I wish I could think it possible that I could live to see this grand development."

Considering Niagara as a great natural gift, the question is, How was it intended that it should serve man? Was it designed to be a luxury, an eye-feast to coax travel, or was it intended that when man had become sufficiently skilled he should conquer the power of the waterfall and apply it for the world's benefit?

Electricity in Horticulture.

Hon. Warren W. Rawson, a prominent seed dealer of Boston, recently delivered an address on "Vegetable Growing" before the Massachusetts Horticultural Society, in which he briefly referred to his experiments in introducing electric currents into the soil for the purpose of furthering the growth of vegetables. He believes that the idea will prove practical. He is experimenting in two greenhouses—one 400 and the other 200 feet long—and he reported a very noticeable difference between two beds of lettuce, one of which had been electrically treated. He said that the lettuce has grown excellently on the bed charged with electricity, but that the great difficulty had been in getting too much electricity into the ground.

Protection of Alternating-current Generators Against Reversal of Energy.

Where generators are connected in parallel to common bus-bars, reversal of energy in one of the machines, due to failure of the apparatus to work properly, may and very often does result seriously. It is therefore advisable to open the circuit of the apparatus, which is reversed in the quickest time possible, preferably by some automatic means. A device for accomplishing this end has been patented by Mr. Leonard Wilson of Pittsfield, Mass., and it possesses some points of merit.

Referring to Fig. 1, (A) represents the stationary armature of an alternating-current generator carrying the armature coils (a). (F) represents the revolving-field structure, carrying the field poles (f), and mounted on the shaft (S). (s s) represent collector rings on the shaft, by means of which current is led to the field winding from the exciter (E) or other source of current. The armature terminals of the generator are connected to the mains or bus-bars (X). It is evident that if other sources of current are connected to

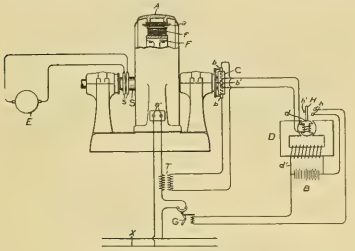

FIG. 1. APPARATUS FOR PROTECTION AGAINST REVERSAL OF ENERGY.

the bus-bars and if the generator drops out of synchronism, or if its field circuit becomes open from any cause, a reversal of energy will take place and current will flow from the bus-bars to the generator, which, if allowed to continue, may result in the damage or destruction of the generator. Furthermore, as in the case of a failure of the field circuit, the potential at the generator terminals may fall to a very small value, since the armature will act as a practical short-circuit across the bus-bars. For this reason a reverse-current cut-out operating upon the shunt-motor or wattmeter principle is not reliable. Consequently in place of utilizing in any way the potential at the generator terminals, Mr. Wilson employs merely the current in the generator leads, and, by properly commutating it, introduces it into one winding of a direct-current relay. Thus (C) represents a commutator or rectifier mounted on a shaft, two brushes of which (b b) are connected to the secondary of a series transformer, the primary of which is connected in one of the generator leads. A second set of brushes (b') is connected to the winding on the movable element (d), of the polarized relay (D), the other element of which has its winding (d') energized from a source of constant current, such as battery, or, if preferred, this element may be formed of a permanent magnet and the field winding (d') omitted. The movable member (d) of the relay carries an arm (H), which when the movable member tends to turn in a counter-clockwise direction is restrained by the stop, but which when the armature tends to turn in a clockwise direction bridges the contacts (h), closing a circuit from the battery through a tripping coil of a switch (G), arranged to open the circuit of the generator.

Referring to the diagrams the action of the commutator will be explained. In Fig. 2, (a) represents diagrammatically the armature winding and (f f) the field poles. (C) (Fig. 1) represents the commutator, which is carried by the shaft and rotates with the field poles (f). The two sets of brushes (b b) and (b' b') are shown connected to the secondary of transformer (T) and the armature of relay (D), respectively. With the brushes arranged as shown, it is evident that the direction of current through the armature of relay (D) will be reversed relative to that in transformer (T) whenever the brushes (b b) pass from one section of the commutator to the other. Moreover, with the brushes fixed in any given position it is evident that the time of this reversal is fixed relative to the position of the field structure, since the commutator revolves with the field structure. Consequently this reversal is fixed relative to the potential induced in the armature winding (a), since this potential depends upon the position of the field poles (f). If the brushes (b b) are so placed that they pass from one section of the commutator to the other at the instant that the field poles (f) are in the position of zero induced electromotive force in the armature winding (A), and if the current in the secondary of transformer (T) is in phase with or in opposition to the induced electromotive force in winding (a) the current curve in the armature of relay (D) may be represented by the curve (i) in diagram 1x of Fig. 3, the induced electromotive force in armature (a) being represented by the curve (e) in the same figure. That is, the current through the armature of the relay is a pulsating unidirectional current and coacting with the constant field of the relay will produce a torque in a given direction. Now assuming that the brushes remain fixed in the same position, if the current in the secondary of transformer (T) is 90 degrees out of phase with the induced electromotive force in the armature (a) the current curve of the armature of the relay will be represented by the curve (i) in diagram 2x. The point of commutation of the current is shifted 90 degrees relatively to the current curve from that in diagram 1x and no torque can be produced in relay (D). The diagram 2x would also represent the current curve if the current in the secondary of transformer (T) were of the same phase as in diagram 1x, but the brushes shifted 90 degrees, or, in other words, the change of the current curve in diagram 2x may represent either a shifting of the current phase or a shifting of the brushes. Consequently it will be seen that by properly adjusting the brushes the current curve of diagram 1x may be obtained with any phase relation of the current in the secondary of the transformer to the induced electromotive force in armature winding (a). Now assume that the brushes (b b) are properly placed relative to the field poles (f), so that the diagram 1x represents the current curve in the armature of the relay when the current in the primary of transformer, or, in other words, the current in the winding (a) is in phase with the induced electromotive force, this would be the condition of unity power factor. With the brushes maintained fixed in position, diagram 2x would represent the conditions for zero power factor, and diagram 3x would represent the conditions for a complete reversal of current—that is, when the current is 180 degrees out of phase with the induced electromotive force. In comparing diagrams 1x and 3x, it will be seen that the current curves in both represent a pulsating unidirectional current; but the direction of current is reversed. Consequently a reversal of current in armature winding (a) relative to the potential produces a reversal of the direction of the torque of the armature of relay (D) and a consequent opening of the generator circuit by means of the arrangement shown in Fig. 1. It will be seen that the operation of the relay is in no way dependent upon the potential across the terminals of the generator,

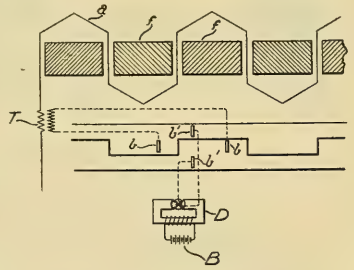

FIG. 2. CUT-OUT ADJUSTMENT FOR PROTECTION AGAINST REVERSAL OF ENERGY.

and consequently its operation is in no way affected by a drop in this potential.

As has been said heretofore, a reverse-current relay of the wattmeter type is subject to the objection not only of failure of current in the potential winding upon a short circuit, but also to a possible overpowering of the potential flux upon the flow of a heavy short-circuit current. A protective device arranged in accordance with this invention is, according to Mr. Wilson, not liable to the first objection, and in order to avoid the second he designs the series transformer so that it will become saturated at a small fraction of normal full-load current. The amount of current-flow of the secondary of the transformer is consequently limited and can never reach an amount liable to produce a false operation of the relay on an overload or a failure to operate upon a reverse short-circuit current. The employment of a saturated transformer has the further advantage that a practically uniform torque of the device (D) is obtained over a wide range, thereby enabling the relay to operate upon

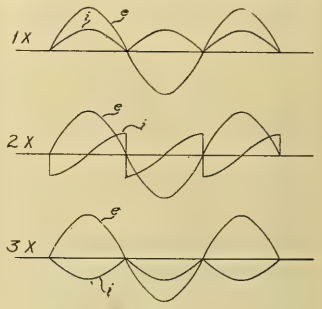

FIG. 3. OPERATING CURVES OF DEVICE FOR PROTECTION AGAINST REVERSAL OF ENERGY.

a comparatively small reverse current, at the same time being reliable upon a heavy short-circuit current.

Chicago Automobile Show.

In variety and number of exhibits and in point of attendance the Chicago Automobile Show of 1906 distanced all its predecessors. The exhibition was held in the Coliseum, with an overflow in the First Regiment Armory, a short distance away, both buildings being crowded to their full capacity. The show was held one week, from February 3d to 10th, and the number and value of sales made are said to have reached exceptionally high figures. The show was given under the auspices of the National Association of Automobile Manufacturers, of which E. H. Cutler of Springfield, Mass., is president and S. A. Miles of New York general manager. There were all told about 250 manufacturers of automobiles and accessories represented. Every type of motor vehicle was to be seen at one or another of the numerous exhibits—touring cars, both gasoline and steam, electric pleasure vehicles, electric trucks, racers, and even the motor cycle pushed itself boldly to the front.

In both buildings the decorations were uniform in color and design and lent to the interiors a handsome appearance. The decorations were in blue and yellow, and the signs indicating the booths of the exhibitors were done in letters of uniform size. The lighting was particularly effective, there being added to the arc and incandescent lights handsome column clusters with opalescent globes which marked the various sections in the buildings.

Foreign machines, though more numerous than last year, were not as many in proportion to the total number as formerly. Prices remain nearly as high as heretofore, though there were some very creditable small runabouts which were to be had for a reasonable sum. One of the noticeable changes, or fashions rather, that has grown up during the last year is the use of leather exclusively as the covering for the tops. Canvas is a thing of the past.

Electric pleasure vehicles were exhibited by seven different concerns, and the group picture on the next page shows some of the latest and most stylish designs of such vehicles. The Woods Motor Vehicle Company of Chicago and New York was the largest exhibitor of electrics, and its particular favorite with the public was a Queen victoria with detachable brougham top. It is shown in the picture with the top in place.

A Pope model 65 stanhope, made by the Pope Motor Car Company of Indianapolis, is also shown in the picture. This vehicle, on account of its graceful lines and substantial construction, attracted much attention.

A Columbia electric hansom made by the Electric Vehicle Company of Hartford, Conn., is designed along original lines. It is finished on the inside in a very pale lavender-colored cloth imported from Paris, giving the carriage a particularly rich appearance.

The Vehicle Equipment Company of Long Island City, N. Y., showed among others a landaulet, seating four persons. This machine has a speed of 12 to 14 miles an hour and a radius on one charge of 40 miles.

The Babcock Electric Carriage Company of

Buffalo presented as its most attractive vehicle the stanhope model 3.

A high class vehicle was the Baker suburban, weighing 1,750 pounds, with a speed of 14 to 22 miles an hour. It is fitted with victoria top and has a radius on one charge of 40 miles.

Studebaker automobiles were well represented, there being among them a number of electric pleasure vehicles.

Many manufacturers of electrical apparatus exhibited such of their apparatus as is connected with the automobile industry. The list is as follows: John A. Hensel & Co. of Chicago; Remy Electric Company of Anderson, Ind.; Heinze Electric Company of Lowell, Mass.; Tritt Electric Company of Union City, Ind.; Franco-American Auto Supply Company (agent of J. Lacoste & Co. of Paris), Chicago; M. & W. Auto-clock Company of Detroit, Mich.; Hutchison Electric Horn Company of New York city; Never-miss Spark Plug Company of Lansing, Mich.; Nungesser Electric Battery Company of Cleveland, Ohio; R. E. Hardy Company of New York city; Warner Instrument Company of Beloit, Wis.; Duplex Ignition Company of New York city; Byrne, Kingston & Co. of Kokomo, Ind.; National Carbon Company of Cleveland, Ohio; C. F. Splitdorf of New York city; Chicago Battery Company of Chicago; American Electrical Novelty and Manufacturing Company of Chicago; Dayton Electrical Manufacturing Company of Dayton, Ohio; Motsinger Device Manufacturing Company of Pendleton, Ind.; Hicks Speed Indicator Company of Brooklyn; C. H. Lang of Chicago; Motor Car Supply Company of Chicago, and the Autocoil Company of Jersey City, N. J.

Connected with its exhibit, the Reo Motor Car Company showed a complete gasoline automobile built one-eighth of full size. This was a machine that would and had run, although it weighed but 242 pounds and carried but two horsepower. It has made a speed of two to eight miles an hour.

Baker Suburban, Babcock Stanhope, Model 3. Woods Queen Victoria with Detachable Top Pope Stanhope, Model 65. Columbia Electric Hansom. Closed Landaulet of Vehicle Equipment Company.

SOME ELECTRIC PLEASURE VEHICLES SHOWN AT CHICAGO AUTOMOBILE SHOW.

25,000-kilowatt Units Predicted.

Mr. B. A. Behrend, chief electrical engineer for the Allis-Chalmers Company of Milwaukee and Cincinnati, recently delivered an address at the University of Wisconsin on "High Speed in Modern Engineering." Mr. Behrend laid stress upon the remarkable change that has been wrought during the last 10 years in the field of prime movers and the fact that the reciprocating steam engine, which held its own for over 100 years, has gradually yielded in a number of important fields of operation to the rotating steam turbine—a change so radical that it may be said to have inaugurated a new epoch in engineering.

Mr. Behrend discussed the conditions to be fulfilled for grappling with the difficult task of designing machinery for such high peripheral speeds as three and four miles a minute, and he showed how rotating bodies had to be shaped in order to uniformly distribute the stresses and minimize them so as to meet these conditions. The lecture was illustrated with slides representing the stresses in rotating discs and details of steam turbo-generators.

The lecturer made the statement that the size of the generating unit in large power plants is going to increase considerably, and that during the next few years units of from 10,000 kilowatts to 25,000 kilowatts, wound for potentials of from 10,000 to 30,000 volts, are likely to be installed, as the steam turbine and generator lend themselves particularly well to units of very large capacity, and units of such capacity can be more readily wound for high potentials.

Space Telegraphy in the Dutch Indies.

By [illegible]

The [illegible] a [illegible] Company of Berlin [illegible] of wireless [illegible] backed by Marconi [illegible] from the Dutch government [illegible] for that country. [illegible]

[illegible] Batavia.

[illegible] the other [illegible] of the province was [illegible] at the disposal of the company part of his own [illegible] for the erection of the station. This is situated outside of the town of Cheribon, at the beginning of the shallow ground, and at about 700 meters distance from the seaside. Though this station has no doubt been completed by now, no particulars as to its construction are as yet available.

In order to appreciate the difficulties to be overcome in installing wireless stations in those faraway countries, it should be remembered that hygienic considerations play an important part in the choice of the ground. The coast is mostly so unwholesome after sunset that Europeans are not able to dwell there. The boggy ground and artificially innundated rice fields, which are found in the neighborhood of most cities, are another danger to the health of Europeans.

SPACE-TELEGRAPH STATION AT BATAVIA, JAVA, DURING CONSTRUCTION.

[illegible] not undertaken any steps toward fulfilling its promises, the Wireless company was afforded an opportunity of demonstrating its stations in practical operation and under the most difficult climatic conditions. The local government, which is taking a lively interest in the question, furthered the undertaking in many ways, appointing two marine officers, in addition to four sailors and telegraphers, to take a part in the experiments.

The two localities at first chosen were Vlakke Hoek and Anjer, the former being 200 kilometers distant from the nearest large harbor, while the other is quite a small town at six hours' distance from Batavia. Complying with the wishes of the Dutch Marine and Royal Parcel Service, therefore, it was eventually decided to install one of the stations in Batavia and the other at Cheribon, 190 kilometers distant, the intervening ground being flat and boggy. In selecting these places the wishes of the Marine were taken into consideration, for Cheribon is a harbor on the north coast of Java, where warships are frequently crossing, while the vessels of the Royal Mail Service touch there several times each week. A military expedition was dispatched to Boni, Celebes Island, in the [illegible]

Chicago Gas Situation.

At a special meeting last week the City Council of Chicago, by a vote of 58 to 9, passed an ordinance fixing the price of gas to consumers at 85 cents a thousand cubic feet. This rate was to stand for five years. The ordinance was passed with practically no amendments. It had been drawn up by the council committee on gas, oil and electric light, and its terms were accepted by the gas companies, as stated in the Western Electrician of February 3d. But Mayor Dunne vetoed the ordinance, on the ground that the price should be 75 cents and that free gas for street lighting should be furnished the city.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

The Newest Branch Telephone Exchange in Chicago. Illustrated 133, 134
How May Niagara Falls Best Serve the Interests of Mankind? By Orrin E. Dunlap. Illustrated 134, 135
Electricity in Horticulture 135
Protection of Alternating-current Generators Against Reversal of Energy. Illustrated 136
Chicago Automobile Show. Illustrated 136, 137
25,000-kilowatt Units Predicted 137
Space Telegraphy in the Dutch Indies. By Dr. Alfred Gradenwitz. Illustrated 137
Chicago Gas Situation 137
Editorial 138
Third Rail versus Single Phase in England 139
Erie Railroad Electrification 139
Central Electric Railway Association 139
Cincinnati Branch of the Institute 139
Electric-light Rate Inquiry in Chicago 139
Notes of Progress from Illinois Cities 139
John Burns on an Incognito Visit 139
Navy Wireless Contract Awarded 139
All-steel Insulator Pin. Illustrated 140
Electrically Operated Electrolytic Copper Plant 140
Some Things to Avoid in Construction Work 140
The Atlantic City Convention 140
Some Large Engines. Illustrated 140
Will Not Build Municipal Light Plant in New York City 140
Light on Dalrymple Report 141
Lincoln Variable-speed Motor. Illustrated 141
Sons of Jove Increasing Rapidly 141, 142
Rubber Shoes or Rubber Gloves? 142
Theater Excursions by Trolley 142
The Allis-Chalmers Club 142
Motive Power Statistics of Maryland 142
Technical Education in Germany Overdone 142
Book Table 142
Independent Telephone Service in Cleveland 143
The Mercury-arc Rectifier for Telephone Work. Illustrated. 143
Canadian Telephone News 143
Michigan Telephone Matters 143, 144
Indiana Telephone Items 144
Telephone News from the Northwest 144
Ohio Telephone Notes 144
Cheaper Telephone Service for Chicago 144
Independent Companies Active in New York 144
General Telephone News 144

DEPARTMENTS.

Correspondence 144, 145, 146, 147
Great Britain 144
New York 144, 145
New England 145
Dominion of Canada 145
Southeastern States 145
Ohio 145, 146
Indiana 146
Michigan 146
Northwestern States 146, 147
Pacific Slope 147
Personal 147
Electric Lighting 147
Electric Railways 147, 148
Publications 148
Miscellaneous 148
Trade News 148, 149
Business 149
Illustrated Electrical Patent Record 149, 150

DATES AHEAD.

Iowa Telephone Association (annual convention), Chamberlain Hotel, Des Moines, March 13th, 14th and 15th.
Central Electric Railway Association (next meeting), Indianapolis, Ind., March 23d.
Indiana Independent Telephone Association (annual meeting), Indianapolis, Ind., May 17th.
National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.
National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.
Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st to 23d.

THE ELECTRIC AUTOMOBILE has a certain grace and distinction which the gasoline and steam vehicles seem unable to reach. This declaration is borne out by the group picture given on page 137 of this issue in connection with the report of the Chicago Automobile Show of last week. With other desirable features, appearance is certainly in favor of the electrics.

IN COMMENTING a couple of weeks ago on the statement of a correspondent of an English electrical journal to the effect that the United States might, as a retaliatory measure in a tariff conflict, impose an export duty on copper and other raw materials, we overlooked the fact that this country, under its fundamental law, is prohibited from laying export duties. In Section 9 of Article I. of the Constitution of the United States it is expressly provided that "no tax or duty shall be laid on articles exported from any state." It is possible, of course, to amend the Constitution, but this contingency is so remote that it is not necessary to consider it. However, Congress has power "to regulate commerce with foreign nations," so that, although no direct export duty may be imposed, means could no doubt be found in case of grave necessity to restrict or possibly altogether prohibit the exportation of raw materials. But it is hardly conceivable that such an emergency will arise. The interesting point to the discussion is the great strength conceded to the United States in possessing unbounded stores of raw materials, many of which foreign nations must have. The fact that this country is by far the largest producer of copper gives its electrical manufacturers an advantage which may possibly have been overlooked.

MR. DUNLAP'S article on the Niagara power situation which we publish in this issue is of much interest. The author puts the case for the power-developing companies strongly; and indeed in the hard-and-fast logic of the situation Utility seems to have Beauty beaten. But human nature is so constituted that emotion and sentiment very often have a stronger influence on conduct than pure reason. Thus we can imagine many millions of Americans and Canadians saying, "Yes; what you say about Niagara Falls' best gift to the race being their power possibilities is very plausible; we shall not attempt to controvert your arguments; nevertheless, we prefer the cataract as it is, without further diminution of the volume of water plunging over the crest. We are indifferent to the money profits of the power distributers and power users of the Niagara region. We are moved in this matter by considerations of a different sort—more worthy, we are persuaded—and to them we shall steadfastly, even passionately, adhere." President Roosevelt's declaration on the subject last December, it will be recalled, was incisive: "Nothing should be allowed to interfere with the preservation of Niagara Falls in all their beauty and majesty." Probably this sentiment coincides with that of the great majority of his fellow-citizens and perhaps with that of their cousins in the Dominion.

With public opinion resolutely opposed to further "desecration" of the Falls, as it undoubtedly is in the United States (although in Canada the matter is more doubtful), it may be well, by international agreement, to prohibit all further diversion of the water of the Upper Niagara River for a period of, say, 10 years. During that time all charters of dormant power-development companies might be summarily revoked, while the projects of existing bona-fide companies might be gradually extended to the full amount now authorized. The result should be carefully watched by the international commission, which should be continued during the period. At the end of the decade we may assume that all of the 750,000 horsepower now authorized will be utilized, and it should then be possible to determine whether more water may safely be taken from the Falls without seriously interfering with their grandeur as a spectacle. The rational compromise is to permit the power companies to draw from the river until a reasonable and predetermined limit is reached. The total permissible amount should be equally divided, too, between the bordering nations, else some international jealousy might be evoked, and the appearance of an apple of discord might alarmingly complicate the whole situation.

PUBLIC OWNERSHIP received a setback recently in the report of the commission appointed by the New Jersey Legislature to investigate the question of limited franchises and the taxation of public-utility companies. The report declares municipal operation of public-utility plants, especially electric railways, impracticable. Limited franchises are recommended. But, fortunately or unfortunately, according to one's point of view, the reasoning of a New Jersey commission has only a moral effect, and perhaps not very much of that, in the city of Chicago. The street-railway situation in this city now waits on the April elections, when the proposed issuance of Mueller-law certificates to the amount of $75,000,000, to provide funds for municipally owned and operated railways in many of the streets, will be submitted to the approval of the voters. Very likely, judging from former elections, the electors will indorse this issue of certificates, but after that the way still bristles with difficulties for municipal ownership, for buyers must be found for the certificates, the validity of which will first have to be established, undoubtedly, by the courts. There are other legal complications in sight and always the chance of any sort of a political surprise, so that he would be a wise prophet indeed who would undertake to foretell the outcome of the long drawn-out controversy. It would be a business-like proceeding to give the companies 20-year franchises, providing for first-class service, with suitable compensation to the city, including the surrender of all rights under the "99-year act." During this time—it would pass soon enough!—the people would enjoy first-class transportation facilities and have leisure to study the problem carefully. The public-franchise rights of the companies would cease conjointly on a given day, and the city government of that time could proceed in its wisdom with a clean slate. But what with impracticable theory on one side and unenlightened selfishness on the other, such a sensible composition does not appear to be in sight.

THERE are two entirely different ideals as to what the work of a technical institution should be—two conceptions that, while not directly opposed, are to a certain degree contradictory. According to President Henry S. Pritchett of the Massachusetts Institute of Technology of Boston, one of these ideals demands that a technical college or department of a university shall remain an undergraduate institution, offering to students fixed and rather rigid courses of undergraduate study leading to the professional work of the engineer, the chemist and the architect. A course of this nature tends toward the disciplinary rather than the educational side, teaching the student the necessity of continued and energetic application along certain fixed lines until the object in view has been attained. The second conception has for its ideal an institution which shall preserve the undergraduate work as its heart and center, making this department, however, the foundation for a great school of professional, graduate and research work.

As Dr. Pritchett points out, this choice of an educational policy is one which every technical institution has to face; each school must lend itself to one or the other of the two conceptions mentioned. Each has its advocates, who are provided with abundant arguments. The undergraduate courses are, and must of necessity be, the real heart of an institution, and the standard in this department must, at all costs, be maintained uniformly high. If the resources of the institution do not permit of the successful carrying on of both undergraduate and graduate work, the latter should be sacrificed. On the other hand, if it is a financial possibility to maintain the undergraduate and graduate courses both on an efficient basis, this plan seems to be the one which promises the greatest results in leadership and power. Opportunity for research work is what attracts the more mature men and those who demand a larger measure of elasticity in their choice of work and more abundant facilities for carrying it out. Men of this stamp are usually the ones who in professional life will contribute most to the reputation of their alma mater and should be attracted to the institution if it is possible to do so without sacrificing the interests of the undergraduate.

Third Rail versus Single Phase in England.

[From the London correspondent of the Western Electrician.]

London, January 31. Although so many railway companies in Great Britain have adopted the third rail low pressure continuous current system that it has almost come to be regarded as the standard system, it is evident that there is to be a big agitation in favor of single phase alternating current at high pressure.

Ever since the famous arbitration as to the system to be adopted upon the Inner Circle, advocates have not been wanting for the introduction of an overhead system at several thousand volts pressure, and an interesting experiment with a 6,000 volt single-phase system is about to be carried out in London. It will not do to treat the experiment lightly or in anything but a serious manner, as may be probable, for it is supported by such eminent men as Mr. A. P. Trotter, the electrical adviser to the Board of Trade, and Prof. Silvanus P. Thompson, to mention only two.

This question of railway electrification is receiving much attention here just at present, and a paper by Mr. Carter, who is well acquainted with the work done in America, in which he rather deprecates single phase, was read before the Institution of Electrical Engineers last week. The paper will no doubt lead to one of the most interesting discussion on this subject, and the advocates of single phase are already strenuously opposing the views expressed in the paper.

Mr. Philip Dawson, the consulting engineer to the London, Brighton and South Coast Railway Company, discussed the paper at great length, and produced figures to prove that the single-phase motors which will be used on this line are even now almost as efficient as direct current, and that in other respects, such as acceleration, etc., the results were more favorable.

Thus once more the old uncertainty in the minds of railway managers, which was engendered a few years ago by the differences of opinion between electrical engineers, has been resuscitated, and the results are already apparent. One London suburban railway at present has intercommunication with the Inner Circle, which is now working on the direct-current system, and also with the Brighton Railway Company's suburban lines, on which single-phase traction is to be adopted. In this company's unfortunate dilemma as to which system it should adopt, it must be agreed that it has adopted the policy to be expected; that is, to sit still and await developments.

Erie Railroad Electrification.

The commission which has in charge the engineering work for the electrification of the suburban and semi-suburban service of the Erie Railroad near New York city is entitled the Erie Railroad Electric Traction Commission and is composed of J. M. Graham, Bion J. Arnold, Lewis B. Stillwell, A. J. Stone, E. A. Williams and C. H. Morrison.

Mr. Graham is third vice-president of the Erie Railroad and chairman of the commission. Mr. Arnold is one of the foremost authorities on electric traction in the United States. He is past-president of the American Institute of Electrical Engineers, a member of the electrification commission of the New York Central Railroad, consulting engineer of the Grand Trunk Railway Company for the Sarnia Tunnel electrification, consulting engineer for the Chicago City Council in the traction problem and advising engineer for the Temiskaming and Northern Ontario Railway Commission of the province of Ontario, Canada, which is considering the possible electrification of the road mentioned. Mr. Stillwell is also a distinguished electrical engineer, his work on the original hydro-electric development at Niagara Falls and as electrical director of the New York Subway having attracted wide attention. Mr. Stillwell is also electrical director for the Hudson Companies—a corporation engaged in the extensive McAdoo tunnel projects at New York city. Mr. Stone is assistant general manager and Mr. Williams is general mechanical superintendent of the Erie Railroad. Mr. Morrison is an engineer in the railroad organization and is the secretary of the commission.

The Erie Railroad operates by steam locomotives a complicated system of railroad lines in Northern New Jersey, radiating from Jersey City. The length of single track which will probably be electrified is about 250 miles. One of the first duties of the commission will be to select one branch, probably about 35 miles long, for electrification. If the tests prove successful on this line, as is apprehended, the whole trackage in the zone of electrification will be equipped for electrical operation. By the [illegible] it is believed that economy in operation [illegible] while the [illegible] will be greatly [illegible].

Central Electric Railway Association.

Permanent headquarters of the Central Electric Railway Association will be opened in the [illegible] Terminal Building in Indianapolis [illegible] month. John H. Merrill of [illegible], secretary of the association, will be in charge. [illegible] of interchangeable mileage will be [illegible] connection with the association headquarters. [illegible] points were definitely determined at a meeting of the officers of the new association held in Indianapolis last week. Among those present were President E. C. Spring, Vice-presidents Charles L. Henry and F. D. Carpenter, and the following named members of the executive board: M. Nichols of Anderson, Will Irwin of Columbus, Ohio, C. C. Reynolds of Indianapolis, Gardner Wells of Terre Haute, H. P. Clegg of Dayton, Ohio, C. N. Wilcoxen of Cleveland, F. J. Sloat of Hamilton, Ohio, and J. H. Brown of Collinsville, Pa. Indianapolis was selected for the headquarters, because it was considered the most central point, in view of the fact that the electric railway associations of Illinois and Kentucky have signified their intention of joining the Central association.

Secretary Merrill, who will be in charge of headquarters, is well known in traction circles, having had 10 years' experience in the business. He has been connected with the Western Ohio Traction Company, and for two years has been chairman of the transportation committee of the Ohio Interurban Association, which merged with the Indiana association to form the Central Electric Railway Association. He is the author of the interchangeable mileage-coupon book. The next meeting of the Central association will be held in Indianapolis on March 22d.

Cincinnati Branch of the Institute.

The first monthly meeting of the Cincinnati chapter of the American Institute of Electrical Engineers was held at the Grand Hotel, Wednesday, February 7th. Prof. C. W. Marx, consulting engineer of the new Sinton Hotel of Cincinnati, gave a talk on "Engineering Practice in Modern Hotels." He said he had visited the principal hotels and office buildings in New York and Chicago to see how successfully the requirements at these places were met. The power plant for the Sinton Hotel, including lighting, power, heating, ventilation and refrigeration, will cost over $200,000.

The proposition was presented to affiliate with the local chapter of the American Society of Architects, American Society of Mechanical Engineers and the Engineers' Club. The local branch voted to favor the affiliation. The articles of agreement provided that each organization shall retain its individuality, and that all the members of the affiliated bodies shall be invited to the meetings of each organization at which professional subjects are under discussion. It is intended to secure a suitable building at which all meetings can be held and which shall be accessible to the members for informal meetings. It is further intended to create a library, which shall be available to all the members.

The new officers of the local chapter are as follows: President, C. S. Reno, chief engineer of the Triumph Electric Company; vice-president, A. G. Wessling, engineer of the Bullock Electric Manufacturing Company; secretary and treasurer, Laurent Lowenberg of the Reliance Engineering Company.

Electric-light Rate Inquiry in Chicago.

The committee on gas, oil and electric light of the Chicago City Council, which is going to take up the subject of electric light and power rates in Chicago, has had its preliminary meeting. The committee has already learned that general rules cannot be applied to the electric-light business.

William G. Beale, general counsel for the Chicago Edison Company and Commonwealth Electric Company, has told the committee that the companies voluntarily reduced their charges as rapidly as the increase in business permitted. The business operations of both companies in Chicago had been beyond reproach. He told the aldermen that it was impossible to charge all customers the same rate on account of the varying conditions.

"From 10 to 15 per cent. of our customers get their current from us under conditions which make it cost us 17 cents per kilowatt-hour and we sell it to them for 16 cents," said Mr. Beale. "Fifty per cent. of our customers cost us nearly as much as the highest rate we charge. Yet we are reducing rates voluntarily as rapidly as it can be done. It is not long since we made a voluntary reduction of 20 per cent. Nothing was said about it. We simply inclosed a note to each customer announcing that the reduction had been put in effect. On the average we use only 30 per cent. of our plant, and there are only 24 hours in the year when we use all the plant continuously to its full capacity. Yet we have to have it for those 24 hours."

Notes of Progress from Illinois Cities.

[illegible]

In [illegible] providing [illegible] the Underwriters' [illegible] to him in bringing [illegible] defective wiring [illegible] the inspection [illegible] and electrical [illegible] as the ordinance [illegible].

In Danville a [illegible] tion ordinance has been [illegible] in the office of the city [illegible] incumbent having been in charge [illegible]. There seems to be [illegible] posed measure, and the [illegible] are said to be in favor of it. [illegible] and workmanship employed in [illegible] installed by the established firms will [illegible] fair, the object of the ordinance being to [illegible] incompetent workmen from interfering with [illegible] already in place or from making installations which may be defective. On invitation of the mayor the underwriters' inspector addressed the City Council, explaining the operation of a municipal electrical inspection department, together with its effect upon electrical construction work.

Jacksonville reports that the supervision of electric wiring has been transferred from the city engineer's office to that of the superintendent of the municipal street-lighting plant, and the change is reported as being beneficial. Under present conditions one man will make all inspections, and considerable improvement is already apparent.

The mayor of Springfield has been prevailed upon to order the electrical inspection department to discontinue the approval of porcelain link fuse cutouts, weatherproof wire for inside work and paper conduit. The ruling prohibiting the use of unlined conduit was verbally rescinded some time ago. The grounding of transformer secondaries was considered by the lighting company, which, owing to infrequency of accidents, is inclined to doubt the advisability of such a step. The company, however, is desirous of keeping abreast of the times, and will consider the matter further. The city electrician has permitted the installation of several motors connected with the grounded trolley system, and a formal protest will be made to the mayor by the insurance people.

John Burns on an Incognito Visit.

A recent writer in the Boston Transcript says that a few weeks ago he found John Burns, the Labor member of the new British cabinet, "prowling about the East Side of New York." The journalist saluted Mr. Burns in surprise, and was told that the latter had been for eight weeks traveling incognito in America without having been recognized by a soul. He was investigating labor conditions, and he did not want public recognition. When asked where he had been and what he had seen, he said: "I traveled 1,600 miles out of my way to meet again the only saint America has produced—Jane Addams." But Jane Addams of Hull House, Chicago, was not all he had seen even in Chicago. He is deeply interested in the principle of municipal ownership, and Chicago's attempts to apply the principle on a larger scale was one object of his investigations here.

Navy Wireless Contract Awarded.

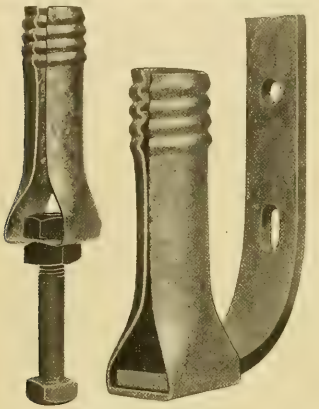
Special dispatch to the Western Electrician.

Washington, D. C., February 13.—The International Telegraph Construction Company has been awarded the contract at $10,000 for furnishing six sets of space-telegraph apparatus for the Navy Department. The other bidders were the Clark Electrical Engineering Company, the Marine Transmission Company, the Massie Wireless Telegraph Company, the National Electric Signaling Company, the Stone Telegraph and Telephone Company and the Telefunken Company. T.

All-steel Insulator Pin.

One of the latest additions to the construction-material list to be patented is an all-steel insulator pin, the invention of Frank MacKean of Chicago, who has succeeded in bringing out an article that does away with the annoying wood ends, segments and other devices that have heretofore been the adjuncts of metal pins other than the heavy, rigid cast and malleable ones. It is believed by many that the era of the wooden pin is fast passing away, locust becoming each year higher priced and more difficult to obtain, while other woods are not so suitable for this work.

The unique feature of the construction of the MacKean all-steel pin is that it is composed of one strip of metal sheet, which is stamped into a pin with perfectly formed threads, a base and a rounded stem, so shaped as to make it amply strong to carry the strains of the heaviest line work. Ready adaptation to all the different forms of brackets, as well as to the numerous styles of special pins that have come into general use with



ALL-STEEL INSULATOR PIN.

the advent of high-tension transmission, will, Mr. MacKean believes, quickly make it a general favorite with the construction man, whether he be building a rural telephone line, a village lighting system or a 40,000-volt power-transmission line.

Illustrated herewith are two adaptations of this pin, one to cross-arm construction and the other to a bracket. Any standard carriage or machine bolt can be used to place this pin on a cross-arm, or it can be fastened readily to any surface by such a bolt, or a lag screw, using a socket wrench for the last-named method.

It is declared that the lines of this pin insure ample strength and resilience. Any glass or porcelain insulator fits it, while the extremes of heat and cold do not add any extra strain to the insulator. The split sections, with only their top points engaging each other, makes a pin that, it is said, will save its first cost annually in insulators, as well as annoying breakdowns.

George D. Wilson, 30 North Desplaines Street, Chicago, is the manufacturing and sales agent for this article.

Electrically Operated Electrolytic Copper Plant.

The Nevada Consolidated Copper Company, San Francisco, whose properties are located near Ely, Nev., where a new 1,000-ton concentrating, roasting and smelting plant is in process of construction, has recently let the contracts for the entire equipment to the Allis-Chalmers Company of Milwaukee. The new works, when completed, will constitute one of the most carefully equipped and thoroughly modern plants in the United States. The product from the plant will be electrolytic copper. Up to the present time the work on the company's properties has been largely that of development, awaiting the completion of a plant with adequate capacity to handle the output. The process of treatment will consist in the concentration of ores, which concentrates will be passed to the McDougal roasters and thence to the reverberatory furnaces and converters in the usual manner.

One of the features of the equipment will be the battery of six McDougal roasting furnaces, each standing 19 feet six inches high and 18 feet in diameter. The main shafting for the entire group of six furnaces will be driven from a 20-horsepower Bullock induction motor running at a speed of 850 revolutions per minute. The operator will be enabled to control the operation of each furnace from any one of three floors or stages about them. The power-house equipment consists of two 22 and 48 by 48-inch compound-condensing heavy duty engine, a blowing engine with cylinders 16 by 32 inches to deliver 6,000 cubic feet of free air per minute; and electrical machinery as follows: Two 800-kilowat Allis-Chalmers alternators, two exciters and seven motors, ranging from 20 to 100 horsepower for the operation of the various ore-reducing devices, furnaces, etc. Mr. Thomas W. Cox is engineer of the company. It is expected that the new plant will be ready to begin operations by early summer.

Some Things to Avoid in Construction Work.

The subjoined list of defects found to exist in the electrical equipment of various towns and cities in the West by the Underwriters' Electrical Bureau may prove of interest to contractors and other electricians. It is not intended as a "counsel of perfection," but points out possible weaknesses which should be carefully watched.

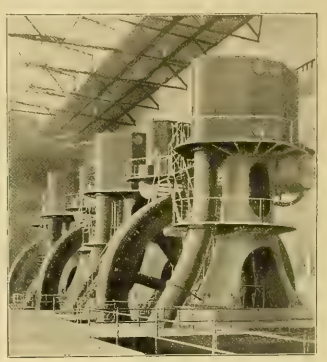
1. Wires too near roof.
2. Wires not properly insulated from cornice, awning frames, etc.
3. Service wires not properly installed and insulated.
4. Wires undersized.
5. Circuit or line wires overloaded.
6. Wires not properly bushed through floors, walls or partitions.
7. Wires not protected from mechanical injury.
8. Wires not properly installed in elevator shaft.
9. Wires do not have sufficient support.
10. Wires supported by wood cleats, staples, etc.
11. Wires not properly bushed at outlets.
12. Wires do not have approved insulated covering.
13. Wires crossed or are in contact with gas or water pipe.
14. Lamp cord used in show windows.
15. Use of unapproved lamp cord.
16. Lamp cord used for circuit wires or excess lengths of cord.
17. Lamp cord used to support clusters.
18. Lamp cord subjected to moisture or corrosive vapors.
19. Pendant wires not supported independently of line wires.
20. Joints and splices not properly soldered and taped.
21. Signal-service wires not properly installed and bushed.
22. No protective device for signal wires.
23. Signal wires not properly installed.
24. No service cut-out.
25. Use of open cut-outs.
26. Cut-outs not properly protected against mechanical injury.
27. Change in size of wires without fusible protection.
28. Use of canopy cut-outs in fixtures.
29. Outside cut-out not properly protected against the weather.
30. Cut-out cabinet unlined.
31. No service switch.
32. No service switch for series arc lighting.
33. Knife switches not properly installed.
34. Flush switches not provided with iron or steel boxes.
35. Snap switches not provided with a sub-base.
36. Outside switch not properly protected against the weather.
37. Fixtures wired with unapproved wire.
38. No insulating joint for combination fixtures.
39. Wood hanger boards.
40. No spark arrester for arc lamp.
41. Incandescent lamps too near inflammable materials.
42. Unlined or broken sockets.
43. Use of metal sockets in damp places.
44. Sockets not properly protected from inflammable gases.
45. Sockets not provided with bushings.
46. Wooden, broken or unapproved rosettes.
47. Use of fused rosettes in places containing dust or gases.
48. Use of untreated or improperly constructed molding.
49. Molding used in damp places.
50. Molding not properly installed on walls.
51. Transformer in or on building.
52. Wood rheostat.
53. Rheostat not properly protected from combustible materials.
54. Unlined snap switch.
55. Uninsulated fixture canopy.
56. No magnetic release for rheostat.

The Atlantic City Convention.

The annual convention of the National Electric Light Association will be held at Atlantic City on June 5th, 6th, 7th and 8th next. The meeting hall will be in the small auditorium of Young's Pier, and the large exhibition room on the front of the pier has been secured for the exhibits of the associate members. The present programme is to open the exhibition hall on Monday evening, to hold a reception and ball in the New Blenheim on Tuesday evening, and a banquet, at which will be present the governor of the state and many other notables, on Thursday evening. A part of the entertainment of the ladies will consist of a trip to Philadelphia in a special car, lunching at the Bellevue-Stratford, and returning in the late afternoon. The entertainment of the members will be confined to other than meeting hours, as it is intended that this shall be a working convention. A feature of the banquet will be the cooking of the menu by electric current. This is now being arranged, and it is expected that all the prominent manufacturers of electrical heating devices will take part. The attendance during the last two conventions has been about 1,300, and it is expected that Atlantic City will increase the number to not less than 3,000. It is hoped that many ladies will be in attendance.

Some Large Engines.

"Allis-Chalmers Engines at Home and Abroad" is the title of a rather unique bulletin about to be issued by the Milwaukee company whose name is given. It is unique from the fact that it contains 68 pages without reading matter, except brief descriptions underneath the cuts and a list of the company's products at the end. The title-page illustration, a reproduction of which is given herewith, represents a row of large and imposing engine-generators installed in the power house of the Twin City Rapid Transit Company, Minneapolis. Other plants shown are those of the New York Interborough Rapid Transit Company, New York City Railway Company, Brooklyn Rapid Transit Company, Chicago Metropolitan West Side Elevated Railway Company, Central London (England) Underground Railway, London United Tramways, Dubin (Ireland) Tramways, Cincinnati Gas and Electric Company, St. Louis Union Electric Light and Power Company, Barcelona (Spain) Tramway Company, Sidney (New South Wales) Government Tramways, Buenos Aires (Argentina) Compania Alemana Transatlantica de Electricidad, and other well-known companies. Pumping engines, a number of which hold world's records for economy and efficiency in their respective fields of operation, are shown installed in various plants in American cities. Blowing engines are represented



VERTICAL CROSS-COMPOUND ENGINES OF 5,500 HORSE-POWER EACH IN POWER-HOUSE AT MINNEAPOLIS.

by impressive lines at furnaces of the Carnegie Steel Company and the American Steel and Wire Company; air compressors by machines in operation for the Anaconda Copper Mining Company and the Atlas Portland Cement Company, and hoisting engines by numerous mining installations, prominent among which is that of the famous Le Roi mine at Rossland, B. C.

Will Not Build Municipal Light Plant in New York City.

Recent interviews with Mayor McClellan of New York city are said to indicate that he has no thought of pressing to completion the plans for the construction of a municipal street-lighting plant for that city. The mayor is quoted as saying: "Municipal ownership and operation are to be considered only when private interests fail to provide suitable service for a price within which the city could do the work itself. I am not certain that the lighting companies have reduced their figures for the next year to this point, but I understand they are much lower. I shall take no action until I am thoroughly informed on every point."

It is reported as probable that the bids of the electric-light companies will be accepted and contracts entered into. In this case nothing further will be done with the sites which the city owns on which it was proposed to erect municipal plants. It is said the city will endeavor to abandon all of the gas street lamps now in use and to substitute generally arc lamps in their stead. This move will bring the number of arc lamps up to more than 15,000 in Manhattan and the Bronx and to the same figure in Brooklyn, and thus enable the city to get the minimum rate of $80 per lamp bid by the companies.

Light on Dalrymple Report.

Although Mayor Dunne of Chicago still refuses to make public the report of James Dalrymple of Glasgow, concerning the Chicago traction situation, information revealing what may be taken as the essence of the report has been gathered from several sources. Mr. Dalrymple makes it plain that he and the City Council of Glasgow supposed as a matter of course that whatever he had to say on the subject was for the benefit of the City Council and people of Chicago. If it had been anticipated that Mayor Dunne would withhold the report as private property Mr. Dalrymple, who is manager of the Glasgow municipal street-railway system, would not have been permitted to visit Chicago.

To make the public familiar with the Glasgow manager's views on the municipal-ownership proposition in Chicago it will hardly be necessary to publish the report, as the trend of Mr. Dalrymple's conclusions are now well known. However, as the matter now stands, unless Mayor Dunne gives some good and sufficient reason to the Glasgow council why it should not be done, that body, it is said, will mail a copy of the Dalrymple report to the Chicago City Council.

The Engineer and Iron Trades Advertiser of Glasgow reports a lecture in that city last month by Mr. Dalrymple on the subject, "Tramways in Glasgow and Elsewhere." It says in part: "Referring to the Chicago tramway system, he said that the city had an area of 194 square miles—exactly ten times the size of Glasgow—and a tramway system extending to 700 miles single line, serving a population of 2,000,000 people. It was his opinion that there was the making of the largest and finest tramway system in the world in Chicago. He had visited many cities both in Europe and America, but the system at present existing in Chicago was the worst, in almost every respect, he had ever seen."

The difficulties in the way of municipal ownership of street railways in Chicago and his views of the Chicago traction situation are contained in a statement dictated by Mr. Dalrymple for the Chicago Daily Tribune and published in that paper on February 9th. The following is the essence of the interview:

1. The Chicago street railways to-day are in wretched condition. The entire plant is utterly worn out.

2. The companies have no inducements to spend money on betterments owing to their uncertain position.

3. As to the best and quickest way of bringing about municipalization, the proposals made by the companies are fair and reasonable.

4. If the city will not extend the franchises, the proposal of the companies that the city acquire the entire system gradually is fair. This would surmount the difficulties of the long franchises owned by the companies.

5. If the city insists in taking over all the lines at once $75,000,000 would be only a starter. Enormous sums would have to be spent to bring the lines up to a state of efficiency.

6. Glasgow under municipal ownership does not operate street cars any cheaper per car-mile than do the private companies of Chicago. Wages are lower in Glasgow, but hours are shorter. Glasgow cars do not run so fast.

The council of the Armstrong College, Newcastle-on-Tyne, England, has resolved to establish a chair of electrical engineering, and voted a sum of £2,600 toward forming new electrical engineering laboratories. It has also decided to offer for competition two scholarships, each worth £125, annually, to be held by graduates at the college on the condition that they spend their time in the prosecution of definite research.

Lincoln Variable-speed Motor.

A motor p[illegible] ing a [illegible] ing speed [illegible] Electric Manufacturing Co[illegible] The motor is an ordinary [illegible] field winding being connected [illegible] ture is wound as an ordinary [illegible] shunt wound motor. The [illegible] tion how the motor alone [illegible] drive.

Speed variation is obtained by [illegible] armature from the influence of the [illegible] the armature is withdrawn, the magnetic [illegible] between the field poles and the armature [illegible] thereby decreasing the magnetic [illegible] the speed.

It is possible to obtain a [illegible] speed with a given lateral motion by making the armature slightly conical. When a conical armature is used, the withdrawal of the armature decreases the area of the air gap in the same proportion as it would if a cylindrical armature was used, but at the same time increases the length of the air gap, which would not occur with the cylindrical armature. Thus the increase in the resistance of the air gap is more rapid with a conical armature than with a cylindrical armature, so that a given variation in speed can be more readily obtained with a conical than with a cylindrical armature.

As the armature is withdrawn, the speed increases. Special commutating poles are provided, under the influence of which the armature comes as it is withdrawn into its positions of high speed. The special commutating poles produce sparkless commutation at all loads from no load to 100 per cent. overload.

The special feature of advantage in this motor is in the extraordinary wide ranges of speed which are obtained. A variation of 10 to 1 is easily obtained, and wider variation can be obtained if there is a demeand for it. The reason why this motor can obtain such wide variation in speed is that there is no more distortion of the main flux at high speeds than there is at the low speeds. This is due to the fact that the full field strength is used, no matter what the speed of the motor may be.

A hand wheel is used, in connection with a screw mechanism, to move the armature laterally, and by means of this hand wheel it is possible to get an infinite variety of speeds, from the lowest to the highest speed. The magnetic pull of the armature is carried on ball-thrust bearings, which eliminate all friction. The brushes are carried on the thrust bearing, and as the thrust bearing, armature and commutator all move together, there is no relative lateral movement between the commutator and brushes.

At all speeds the motor can be overloaded 100 per cent. without sparking, and at low and intermediate speeds the motor will carry, for a short period, even a greater load than this. The fields and the armature coils are shaped and treated so as to provide the best ventilation and heat radiation, so that, notwithstanding the exceptional small size and weight of the motor, the heating, even at very low speeds, is well within the margin of safety. The efficiency is said to be high, and the horsepower capacity throughout the range is constant.

A Cook County coroner's jury which heard evidence presented at the inquest over the body of a schoolgirl who had been killed by a street car, recommended that an ordinance be introduced in the Chicago council compelling street-railway companies to bring their cars to a full stop 100 feet on each side of a school building during the time school is in session.

Sons of Jove Increasing Rapidly.

[illegible]

Building [illegible]

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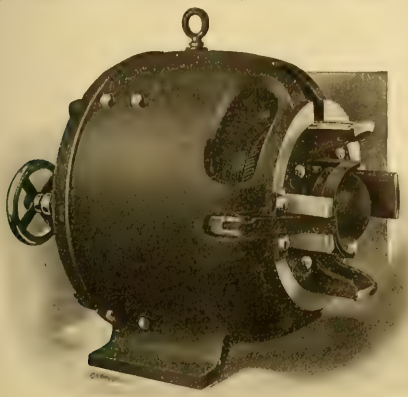
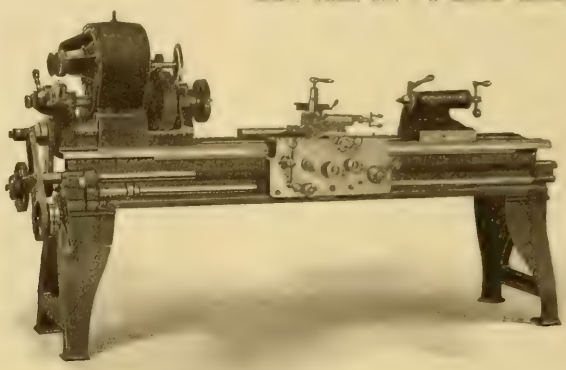


LINCOLN VARIABLE-SPEED MOTOR.



LINCOLN VARIABLE-SPEED MOTOR DRIVING LATHE.

Detroit, Mich.; Jas. Clark, Jr., J. Clark, Jr. Co., Louisville, Ky.; W. P. Crockett, W. P. Crockett, Chicago, Ill.; J. Robert Crouse, Co-Operative Electrical Development Association, Cleveland, Ohio; W. M. Deming, Electric Supply Company, Memphis, Tenn.; S. A. Densmore, Electric Appliance Company, Chicago, Ill.; B. B. Downs, St. Paul Electric Company, St. Paul, Minn.; A. S. Doxsee, Doxsee-B. Electric Company, St. Louis, Mo.; W. H. Fairclough, Jr., Chicago Edison Company, Chicago, Ill.; J. H. Feiring, Electrical Inspector, St. Louis, Mo.; E. H. Fox, Phœnix Glass Company, Chicago, Ill.; H. M. Frantz, H. W. Johns-Manville Company, Chicago, Ill.; C. C. Fricke, Phœnix Glass Company, Chicago, Ill.; W. R. Garton, W. R. Garton Company, Chicago, Ill.; F. W. Godfrey, Bryan-Marsh Company, Chicago, Ill.; W. S. Goll, Fort Wayne Electric Works, Chicago, Ill.; T. G. Grier, American Circular Loom Company, Chicago, Ill.; J. A. Haines, 324 Dearborn St., Chicago, Ill.; E. M. Hamlin, Lord Electric Company, Boston, Mass.; W. P. Hessel, Pass & Seymour, Incorporated, Chicago, Ill.; P. C. P. Holmes, Chicago Edison Co., Chicago, Ill.; E. H. Haughton, Bryan-Marsh Company, Chicago, Ill.; C. A. S. Howlett, Western Electric Company, Chicago, Ill.; R. E. Hull, O'Kane-Hull Company, Columbus, Ohio; E. W. Hurst, Farr Telephone and Construction Company, Chicago, Ill.; G. W. Johnston, Western Electrical Company, Omaha, Neb.; R. L. Kimble, Central Electric Company, Flint, Mich.; M. F. King, American Circular Loom Company, Detroit, Mich.; H. B. Kirkland, American Circular Loom Company, Chelsea, Mass.; A. H. Kling, Peru Electric and Manufacturing Company, Peru, Ind.; G. A. Knoche, Wesco Supply Company, St. Louis, Mo.; H. G. Landis, Landis Electric Company, Wichita, Kan.; E. W. Lathrop, 6220 Jefferson Ave., Chicago, Ill.; G. Long, American Steel and Wire Company, Chicago, Ill.; W. W. Low, Electric Appliance Company, Chicago, Ill.; P. F. Lyons, National India Rubber Company, Bristol, R. I.; J. B. McCarthy, "Electrocraft," Detroit, Mich.; S. D. MacDonald, Electric Appliance Company, Chicago, Ill.; J. H. McGill, Crescent Electric and Manufacturing Company, Valparaiso, Ind.; J. B. McMullin, Electric Appliance Company, Tomah, Wis.; Geo. MacElwee, of H. T. Paiste Company, Philadelphia, Pa.; E. P. Magoon, Illinois Electric Company, Chicago, Ill.; S. Mankowitz, Monarch Electric and Wire Company, Chicago, Ill.; D. L. Marble, Mark Manufacturing Company, Chicago, Ill.; D. A. Merriman, American Steel and Wire Company, Chicago, Ill.; C. Messer, Dearborn Electric Company, Chicago, Ill.; M. Mill, Ering-Merkle Electric Company, St. Louis, Mo.; A. L. Millard, Westinghouse Electric and Manufacturing Company, Chicago, Ill.; E. E. Nash, Warren Electric and Supply Company, Warren, Ohio; H. C. Niesz, Chicago Edison Company, Chicago, Ill.; J. B. Olson, J. B. R. & P. Insulating Company, New York; W. T. Osborne, W. T. Osborne Company, Kansas City, Mo.; F. Overbagh, Overbagh & Ayres Manufacturing Company, Chicago, Ill.; E. K. Patton, Bryant Electric Company, Chicago, Ill.; H. A. Petersen, H. A. Petersen Manufacturing Company, Chicago, Ill.; I. W. Phelps, Solar Electric Company, Oak Park, Ill.; F. D. Phillips, American Electrical Supply Company, Chicago, Ill.; W. R. Pinekard, Westinghouse Electric and Manufacturing Company, Chicago, Ill.; S. A. Rall, I. A. Bennett, Chicago, Ill.; F. Raymond, Manufacturers' Agent, Chicago, Ill.; S. A. Roth, Roth Bros. & Co., Chicago, Ill.; R. A. Schaefers, Sarco Company, New York; R. Schrumf, Beardsley Chandelier Manufacturing Company, Chicago, Ill.; F. D. Schwartz, Electric Appliance Company, Chicago, Ill.; R. Schweitzer, Crawfordsville W. & N. Company, Crawfordsville, Ind.; G. S. Spearing, Hart & Hegeman Manufacturing Company, Chicago, Ill.; F. G. Simpson, H. W. Johns-Manville Company, Chicago, Ill.; W. S. Sisson, D. & W. Fuse Company, Providence, R. I.; F. F. Skeel, Crouse-Hinds Company, Chicago, Ill.; J. C. Smith, Solar Electric Company, Oak Park, Ill.; W. M. Smith, Chicago Insulated Wire Company, Chicago, Ill.; W. T. Spragens, Spragens & Reed, New Orleans, La.; P. Stern, Interstate Electric Company, New Orleans, La.; C. J. Sutter, Electrical Contractor, St. Louis, Mo.; A. B. Thomson, Stanley & Patterson, New York; H. Tideman, Menominee Electrical Manufacturing Company, Menominee, Mich.; O. C. Turner, South-

ern Electric Company, Nashville, Tenn.; W. P. Upham, Electric Appliance Company, Chicago, Ill.; O. W. Uthoff, Watts & Uthoff Supply Company, St. Louis, Mo.; H. L. Walker, Henry L. Walker, Detroit, Mich.; H. E. Watson, Benjamin Electric Manufacturing Company, Chicago, Ill.; J. A. White, Electric Storage Battery Company, Chicago, Ill.; F. S. Weimeyer, Fort Wayne Electric Works, Chicago, Ill.; C. M. Wilkins, Patrick, Carter & Wilkins, Philadelphia, Pa.; James Wolff, H. T. Paiste Company, Chicago, Ill.

Rubber Shoes or Rubber Gloves?

The London Electrical Review advises the use of rubber boots or shoes for the protection of electrical workers rather than rubber gloves. Discussing the subject, Mr. G. W. Partridge, engineer for the London Electric Supply Corporation, says:

"It has been the rule for a great many years in this corporation that all employes in our sub-stations wear rubber shoes; also that under no circumstances whatever are rubber gloves to be used, except under the direct supervision of an engineer who has to be personally responsible that the gloves used are in proper condition.

"From my experience, rubber shoes, besides minimizing the chance of a man getting a dangerous shock to earth, very often prevent him slipping and falling against live terminals. Hand-to-hand shocks are very rare; and, after some 17 years' experience of working with high-tension current, I have seldom had a serious case of this kind brought to my notice.

"I am afraid your suggestion that rubber boots should be put on 'outside the ordinary footwear' will hardly work in practice, as the boot of the ordinary lineman, what with nails, etc., forms a fairly good metallic contact with the foot itself, especially after the owner has walked from home on a rainy morning.

"All switchmen and assistants should be made to change their boots when they come on duty, and I find this system works exceedingly well. For outside work I am afraid rubber boots are out of the question; but even here I should prefer a portable insulated platform to rubber gloves.

"Now that the example set by Deptford 15 years ago to the rest of the world, of generating at a pressure of 10,000 volts, has been followed by other engineers in this country, thereby bringing into use a large number of sub-stations, etc., the question of protecting one's employes from shock is a very serious one. I find that men at times, either from carelessness or absent-mindedness, touch live terminals which they have known for years to be alive and dangerous, although there is a danger plate and pilot lamp staring them in the face at the time, to say nothing of printed rules which have been before them for years with their signature attached as having been read and noted by them.

"I anticipate that, if this matter is taken up in your columns, you will have numerous letters, probably from makers of switchgear, to say that if their system is used such accidents are impossible; but I have had some experience in switchgear myself, and, no matter what precautions are taken, or how much money is spent, some unfortunate man sooner or later gets a severe shock; and when asked why he broke the rules or deliberately removed an earthed shield and touched a line terminal, he says he cannot account for it."

Mr. G. C. Allingham of Cardiff adds this: "With regard to your leaderette on india-rubber boots in your issue of January 26th, I also have often wondered that these are not more used. For some years I have worn ordinary American rubber overshoes or goloshes when inspecting accumulators. These shoes are of course made of very poor rubber and would not be good enough for high-voltage work, but I have found them satisfactory for anything up to 500 volts, and they are very convenient, for as long as they are kept fairly dry, one can touch any part of a battery, or even dip one's finger into the acid, without getting the slightest shock. From my own experience I should judge that slippers or boots made of good rubber, of a fair thickness, would be extremely useful and convenient for high-tension work."

Theater Excursions by Trolley.

In an article in The World Today entitled "The Trolley Car as a Social Factor" Karl Edwin Harriman says that every trolley line radiating from the Campus Martius in Detroit runs regular theater excursions, and the interesting feature of the plan is that these theater cars are not operated so much for the benefit of dwellers in the outlying terminal towns as they are for the farm households along the right-of-way. Indeed, the theaters of Detroit have for some years carried advertisements in the village newspapers published within 30 miles of the city. Mr. Harriman quotes James A. Bailey, proprietor of the Barnum and Bailey Circus, as follows:

"Ten years ago this country was the richest circus country in the United States. It still is, for that matter, yet circus receipts have fallen off appreciably here in the last seven years. I blame the innumerable trolley systems you have in this section for it. They have placed the farmers in easy touch with the towns, and this has resulted in their paying fairly frequent visits to the town theaters. The familiarity with professional entertainments has served to lessen their interest in the circus which, 10 years ago, offered them the only entertainment it was possible for them to enjoy."

The Allis-Chalmers Club.

The Allis-Chalmers Club of Milwaukee, Wis., has issued an attractive little brochure containing its constitution and by-laws, which are complete and concise. The printing of these rules is not in itself particularly noteworthy; but it calls attention to a class of organizations growing up in connection with some of the largest manufacturing and industrial plants of the country—clubs designed to contribute to the comfort, social intercourse and efficiency of employes. The Allis-Chalmers Company has established for its office men, superintendents and foremen a well-appointed club, occupying quarters in a former mansion house near the works, where for a nominal yearly fee members are given all the benefits usual to such organizations. During the noon hour a course dinner is served at approximately what the service actually costs, and supper may also be had by those who are obliged to stay late at the office.

As the club building stands in a residence district and is easily accessible from all parts of the city it is kept open every evening for the benefit of members, who make free use of the periodicals, games, etc., contained in the reading room. Nights are also frequently set apart for general receptions and entertainments given separately by members of either sex, the annual dues being devoted to a fund for such purposes.

The club has a beneficial effect on employes. One of the greatest of the advantages is from bringing men in different departments together at least once a day, thereby tending to establish more of a feeling of fellowship and consequently closer co-operation between them. David Harlowe is president and Max W. Babb secretary.

Motive Power Statistics of Maryland.

The census enumeration of manufactures in the state of Maryland shows a large increase in motive power employed during the last five years. The total number of establishments reporting power used in 1900 was 2,074, increasing to 2,177 in 1905. The total horsepower reported in 1900 was 135,493, and in 1905, 180,787.

The number of steam engines reported under private ownership in 1900 was 2,153, with 115,590 horsepower. In 1905 the number is only 2,121, with an increased horsepower, however, of 142,096. Gas or gasoline engines reported under private ownership in 1900 numbered 332, with 3,139 horsepower. In 1905 the number had increased to 398, with 4,377 horsepower.

Waterwheels decreased in number and increased in power, 323 wheels, with 10,415 horsepower, being in use in 1900, against 265 at 10,613 horsepower in 1905. No water motors were reported in 1900, whereas in 1905 six are reported at 167 horsepower.

Electric motors show the most marked increases. In 1900 there were installed under private ownership 229 electric motors, with 3,441 horsepower, or 2.5 per cent. of the total power used. In 1905 there were 800 electric motors reported, with a total of 15,314 horsepower, or 8.5 per cent. of the whole horsepower used throughout the state and installed under individual ownership. There were in addition to this 46 other motors of various kinds with a horsepower of 3,561, as against eight at 525 horsepower in 1900.

Rented electric power shows an increase from 733 horsepower in 1900 to 3,300 horsepower in 1905, while of other kinds of power there has been a decrease from 1,650 to 1,359 horsepower.

Technical Education in Germany Overdone.

Mr. Harris, the United States consul at Mannheim, Germany, says that the German empire is rapidly building up a class of men for whom it has no employment at fair wages, and for whom the demand does not increase as fast as the supply. The question of erecting a school for the building trades in Mannheim being at present under discussion, a prominent constructing engineer has contributed an article to a leading newspaper of the city, in which he aims to show that technical education in Germany has gone beyond actual needs. He contrasts the number of those taking such training with the number in other professions, and concludes that the ranks of the technically trained are at present much overcrowded. The number of those studying in the technical high schools in Germany in the winter of 1899-91 was 5,432, and in the winter of 1904-5 15,866, or, in other words, there was an increase of about 200 per cent. In the scientific technical branches of the departments of philosophy in the advanced schools (as the universities), which, as shown by experience, prepare a large percentage of technically trained students, the number of such students in the winter of 1901-2 was 1,100, and in the winter of 1903-4, 3,015. One consequence of this great influx of technically trained men is that salaries are kept at a very low level.

BOOK TABLE.

PRACTICAL PATTERN MAKING. By F. W. Barrows. New York: The Norman W. Henley Publishing Company. 1906. Pp. (5 by 7½ inches) 326, with 149 illustrations. Price, $2.

Pattern making either for the professional or amateur is described in detail. The materials of the pattern maker, the tools he uses—both the hand tools and the more interesting machine tools—and the products of the art are all taken up in their proper relationship. A section is devoted to rules and formulas which will be found useful in estimating weights with the accuracy required for quotations to prospective customers. The final section of the book will be found of value in keeping down the cost of patterns, including as it does plain rules and complete systems for checking and the marking of patterns. This section concludes with an original and practical method for the inventory and valuation of patterns.

ELECTRIC-WIRING DIAGRAMS AND SWITCHBOARDS. By Newton Harrison. New York: The Norman W. Henley Publishing Company. 1906. Pp. (5 by 7½ inches) 272, with 105 illustrations. Price, $1.50.

Contractors, engineers, architects and others will appreciate this book as a practical guide in the matter of wiring, and also as treating the important features to be found in all large power and lighting plants. There are special chapters on the design of switchboards for light and power and on the sizes of wire for alternating-current circuits of single, two and three-phases, with various degrees of inductance. The diagrams are simple and clear and are accompanied by adequate explanatory matter. To show the means of calculating the drop, finding the circular mils and arriving at the numbered gauge of the wire for a given installation may be said to be the primary object of the book. The further expansion of the simple circuit into those of a more complex nature is the next stage; while from this step the subject matter leads into a consideration of switchboard design, with reference to shunt and compound-wound generators.

PRACTICAL TALKS ON ELECTRICITY. By William Baxter, Jr. (Parts I. and II.) Chicago: The Engineer Publishing Company. 1905. Pp. (4¾ by 6¾) 362, with 233 illustrations. Price, $2.50.

This book has been written for the operating engineer and fills admirably the particular requirements of such a work. It is in two parts, Part I. being devoted to the principles and construction of dynamos and switchboards, and Part II. to the care and management of dynamos and motors. The two parts may be obtained separately or bound together in one volume. Briefly, the object of the work is to explain to the operating engineer or electrician the things he desires to know concerning the operation of electrical machinery in the power plant, such as dynamos, motors, switchboards, storage batteries, motor controllers, measuring apparatus, etc. Starting with the elementary principles of electricity and magnetism, explanations concerning dynamo-electric machinery, its construction and operation, are gone into thoroughly and the details of connections explained. In the same way switchboards are taken up and the operation of measuring instruments. Controllers and starters for regulating the speed of motors and insuring safety of operation are fully treated. The book is durably bound in cloth, with full and convenient indexing.

THE PRACTICAL ENGINEER'S HANDBOOK—THE CARE AND MANAGEMENT OF ELECTRIC POWER PLANTS. By Norman H. Schneider. New York: Spon & Chamberlain. (London: E. & F. N. Spon.) 1906. Pp. (4¾ by 7¼) 274, with 203 illustrations. Price, $1.50.

This is the second edition of the handbook, something over a year having passed since the first edition made its appearance. The manual is intended as a handbook of practical information to those who are called upon to operate a commercial or military electric plant without having had the proper preliminary training. One commendable feature of the book is the manner in which the first principles are treated. Space is not wasted on long explanations of magnetism and the lines of force, why electricity flows in a wire (if it does flow), etc.—things which are very well in a book which is intended as a text rather than a pocket guide for the practical man. Almost at the start the subject of "Standard Wiring" is taken up with instructions as to the use of the wiring table. Generators and motors are treated in two separate chapters and form the subject matter of a large portion of the book. The directions given apply to all the latest types of apparatus. Testing and measuring is given attention, as is also the storage battery. That important adjunct to the efficient operation of a lighting plant—the incandescent lamp—is treated in a chapter by itself. Too often in a book of this nature the incandescent lamp is supposed to be so well understood and so simple as to require no treatment. There is much, however, which can be said of an extremely practical nature as to the photometry of lamps, length of life, plotting of test curves, etc., all of which are given some space in this book.

The Independent Telephone Service in Cleveland.

The annual report of President F. S. Dickson to the stockholders of the Cuyahoga Telephone Company (Independent) of Cleveland shows the company to be in a prosperous condition and popular with the public. During the year 1905, $719,502 was spent in the development of the plant. This expenditure enabled the company to add 6,070 telephones to its system, to add six sections to the central-exchange switchboard, to increase the private-branch exchange switchboards by 39 and the intercommunicating office system by 16, besides increasing the switchboard capacity in the Shore, Chagrin Falls, Independence and Mayfield exchanges. Recommendation is made to the directors for an expenditure of $600,000 for development work in 1906.

The total number of telephones in service at the end of 1905 was 20,440, an increase for the year of 6,070. Although a new rate has been established commensurate with a broader and better service, subscribers are readily signing the new contracts. The year closed with 725 pay stations, yielding a return of $33,735—an increase over the preceding year of 232 stations and $13,627. There were 133 private-branch exchanges in service at the close of the year and the average receipts from each was $317.18.

The Electric Building, owned and occupied by the company, yielded a fair return. The total rentals was $53,179, and expenses, taxes and ground rental aggregated $40,230.

Gross earnings for the year 1905 were $587,487, compared with $435,274 for 1904. The earnings included: Telephone rentals, $488,451; long-distance toll service, $8,161, suburban toll service, $2,404; exchange toll service, $33,735. The expenses are accounted for in this way: Operating, $77,577; maintenance, $135,958; general, $82,299; extraordinary, $11,014; total, $306,848; total with taxes, $332,133. The net earnings are thus $255,354. The percentage of gross earnings paid out for expenses is placed at 52.23. The deductions from net earnings, principally for bond interest, amount to $159,459, leaving a surplus of $95,895. From this was paid $51,398 in dividends on preferred stock and $13,482 as employes' share of profits, leaving a balance of $31,014. The total surplus at the beginning of 1906 was $58,324.

Mr. Dickson says that it is difficult to make a comparison of the Cuyahoga company with its rival, the Cleveland Telephone Company (Bell). The November directory of the Cuyahoga company contained 330 more names than the October book of the Bell. A representative of the Merchants' Association of New York city, who made an investigation of the telephone situation in Cleveland, is mentioned by Mr. Dickson as authority for the figures which, on July 1, 1905, gave 16,342 subscribers to the Bell system and 16,745 to the Cuyahoga company in the city of Cleveland.

The president pays a high compliment to the employes of the company. He says the corporation is in excellent condition, its employes are loyal, enthusiastic and capable, and the business is thoroughly systematized. The gratifying growth of the business, he says, has been largely due to the energy, wisdom and efficiency of Mr. W. B. Woodbury, who had charge of the contract department.

The average time for the Cuyahoga exchange to answer a call is four seconds; it takes six seconds more to complete the connection and ring, and the subscriber called consumes 14 seconds in getting ready to answer. It is said that 88½ per cent. secure an answer on the first call. In 10 per cent. of the calls the line is noted as "busy," 1.3 per cent. fail to answer the bell, and in two-tenths of one per cent. some line trouble interferes. As 37 people every day leave their receivers off the hook, a portion of the "busy" trouble is accounted for. On an average 2,050 people ask daily for the time of day, 136 wish to know the weather forecasts, 3,111 ask for football returns in season and 4,790 wish to know of baseball scores, while 37,839 subscribers asked for election returns in one day last November and got what they wanted. Seventy-five subscribers ask daily to be wakened at a certain hour in the morning. From the careful counts taken periodically during 1905 the total number of calls cared for by this company reached the number of 51,516,324.

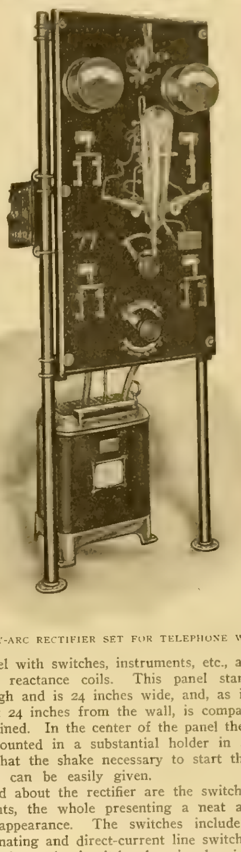
At the annual meeting of the stockholders the following-named directors were chosen: B. Mahler, F. S. Dickson, H. A. Everett, R. A. Harman, W. H. Lamprecht, E. W. Moore, H. R. Newcomb, Calavary Mooris, F. M. Stearns, C. W. Wason, H. P. McIntosh, J. B. Hoge, Joseph S. Brailey, Jay Secor and W. F. Robinson. The stockholders organized by the election of the following-named officers: President, Frederick S. Dickson; vice-president, H. A. Everett; secretary, W. L. Carey, Jr.; treasurer, R. W. Judd. James B. Hoge retired as secretary of the company, after a long service, on account of his time being taken up with other matters.

The Indiana Independent Telephone Association will hold its first annual meeting at Indianapolis on May 17th. The various districts of the state should choose their delegates to the meeting soon. One delegate from each district is also to be chosen to represent the Indiana association at the National-Interstate convention in St. Louis in June.

The Mercury-arc Rectifier for Telephone Work.

Hitherto the [illegible] by the General [illegible] extensively used [illegible] been found to be [illegible] of charging automobile [illegible] reasons which have led [illegible] purpose also adapt it to [illegible] phone battery charging. [illegible] low cost, compactness and [illegible] of transforming alternating [illegible] created a demand for a telephone [illegible] panel, and this has been met by the [illegible] the General Electric Company.

The neat and compact appearance of one of these sets is seen in the accompanying illustration of a 30-ampere rectifier outfit. It consists of a [illegible] arc rectifier tube mounted on a black enameled



MERCURY-ARC RECTIFIER SET FOR TELEPHONE WORK.

slate panel with switches, instruments, etc., and the necessary reactance coils. This panel stands 76 inches high and is 24 inches wide, and, as it need stand but 24 inches from the wall, is compact and self-contained. In the center of the panel the rectifier is mounted in a substantial holder in such a manner that the shake necessary to start the tube in atcion can be easily given.

Grouped about the rectifier are the switches and instruments, the whole presenting a neat and attractive appearance. The switches include starting, alternating and direct-current line switches and load switches. A circuit-breaker is also included in the direct-current line. High-grade instruments are supplied, the ammeter having its zero at the center of the scale, so as to read in either direction. There is also provided an external shunt with 30-foot leads so that the current may be measured at any convenient point desired. A small selective switch, shown at the left center of the panel, is so connected that the direct-current voltage may be conveniently taken across the battery terminals, rectifier terminals, etc.

On the floor beneath the panel proper is located the reactance coil for adjusting the alternating-current supply, thereby controlling the direct current. In addition the company furnishes with this outfit a suitable reactance which is so connected that it reduces the humming on the telephone circuits to a minimum. Tests of this rectifier, made by the American Telephone and Telegraph Company, indicate that there is no noise on the line when the batteries are being charged. This is a point of great importance in the satisfactory operation of any charging device for telephone service.

A number of these mercury arc rectifier outfits are in successful commercial operation in telephone exchanges. The space required for an installation of these rectifiers is but one-third of that necessary with the ordinary equipment, and the efficiency is undoubtedly higher than any other method of transforming alternating to direct current.

Canadian Telephone News.

A bill [illegible]

[illegible] Manitoba [illegible] the province, the Bell [illegible] now has 85 exchanges [illegible] proposes to open 30 more [illegible] made for delivery [illegible] use in this province the [illegible] company expect to spend $7[illegible] outside of Winnipeg. [illegible] the highest calling rate of any [illegible] average per subscriber being [illegible] 1901 a switchboard for 4,000 subscribers was put in with the expectation that it [illegible] but the company is now arranging to [illegible] board which will connect 10,000 [illegible]

The Grand Trunk railway [illegible] contract with the Bell Telephone Company [illegible] long-distance service, it being the [illegible] railway company to install a long-distance service of its own. It has short [illegible] from Toronto to outside towns with little expense [illegible] to the operation, and will also extend over the lines of the Grand Trunk Pacific as fast as the railway is built and put in operation.

The Bell Telephone Company has completed its long-distance line from Indian Head to Regina and from Winnipeg to Moosemin.

The Bell Telephone Company has built [illegible] additional metallic circuits between Toronto and Hamilton, which will relieve the congestion of traffic. The company is arranging with F. C. Patterson, the general manager of the company's western branches, and Mr. Bull of Calgary, manager of the company's Albertas branches to connect the long-distance wires of the company with Edmonton.

The Bell Telephone Company of Canada is applying to the Dominion Parliament for authority to increase its capital over and above the present authorized amount of $10,000,000. At present the company has issued $9,000,000 of common stock, but that will not be fully paid up until next July. The last issue was $1,000,000, made on May 31, 1905. Bell telephone stock has not moved very much of late on the Montreal Stock Exchange, although there has been a little investment demand around 157. In recent years the stock was as high as 193, in December, 1899, and as low as 132 in March, 1904. The company's net earnings in 1904 were $701,905 against $582,152 the year previous. H.

Michigan Telephone Matters.

The Citizens' Telephone Company of Grand Rapids is now using its own power for lighting the Exchange Building. The new gas-producing engine has proved satisfactory, but the company, it is said, has contracted with the Edison company for emergency power.

It is said that the Michigan Telephone Company has decided to enlarge its present building at the corner of Ionia and Fountain streets in Grand Rapids. It is proposed to build an addition which will cover the entire lot, and a new switchboard will also be installed.

Daniel I. Dixon, wire chief for the Michigan Telephone Company in Menominee, and Miss Elsie Strauss were married some time last fall, the fact of the wedding having been kept a secret until a few days ago.

At a meeting of the board of directors of the Lake Shore Telephone Company at Hart it was voted to lower the rate on rural telephones, and resident telephones from $15 to $12 per year, beginning the first of next April. They also decided to sell their rural lines to the farmers and make a suitable arrangement to do the switching for them. The Mason division of the system will be sold and the whole energy of the company spent on the Oceana division. The rate charge for business telephones is $20 a year.

A. A. Shephard of Iron Mountain, district manager of the Michigan State Telephone Company, has received approved estimates for the rebuilding

of the cable lines of the company in Iron Mountain, the reconstruction of the pole leads in the city of Norway and the rebuilding of the toll lines between Iron Mountain, Powers and Iron River, which will mean an outlay of over $17,000 in the range district. B.

Indiana Telephone Items.

The Mutual Telephone Company of Shipshewana has filed articles of incorporation and proposes to build an exchange in Shipshewana and extend lines throughout LaGrange County. David A. Platz and others are the incorporators.

The Central Union Telephone Company has compromised three claims for damages aggregating $17,000 by the payment of $7,000. The suits were of a peculiar character and were brought by the representatives of wiremen who were killed or injured by the explosion of dynamite which the men had in the repair wagon on which they were sent out to make repairs in Bedford.

The Independent telephone companies of Boone County have organized the Protective Telephone Association, with P. B. Little of Whitestown, president; B. F. Stoner of New Brunswick, vice-president, and George Lyster of Thorntown, secretary. The purposes of the association are to devise plans of mutual protection, to establish uniform rules and to improve the telephone service and relation of the companies throughout the county.

The Northern Indiana Toll Line Association was scheduled to hold its first annual meeting in Elkhart on February 13th. This association is the outgrowth of the merging of the several companies in St. Joseph and surrounding counties for toll-line service. Theodore Thorward is president and M. A. Crow secretary.

The Board of Public Works of the city of Evansville has granted a 35-year franchise to the Cumberland Telephone Company. It is thought the council will ratify the grant at its next meeting. The city will, according to the terms of the franchise, get three per cent. of the gross receipts, and the telephone company will also pay the city for the last three years it has been operating without a franchise and will stand the cost of the three years' litigation, which amounts to almost $75,000. An attempt was made to secure an exclusive franchise, but this provision was eliminated. It is thought an Independent company will also receive a franchise.

Theodore Thorward, president of the Home Telephone Company of South Bend, reports that his company has tried the experiment of employing 500 automatic electric telephones in connection with a 2,400-line manual system and that the two systems are interworking very satisfactorily. S.

Telephone News from the Northwest.

The Brown County Telephone Company has completed its system at Green Bay, Wis., and opened for business.

The Northwestern Telephone Exchange Company is extending a toll line from Cambridge, Minn., to Grandy, Stanchfield, Braham and Rush City.

The Farm and Home Telephone Company of Wagner, S. D., has been incorporated with $5,000 capital stock.

The Northwestern Telephone Exchange Company will install a new switchboard at Excelsior, Minn., for its system at Lake Minnetonka. Among other changes will be a system of connections whereby the lake steamers can plug in at docks and secure information of passengers, and similarly passengers can secure information of boats' movements.

W. E. Glotzbach seeks a franchise at Anamoose, N. D., for a local telephone exchange.

The headquarters of the Peoples' Mutual Telephone Company will be moved from Hampton to Sheffield, Iowa. E. N. Egge of Rockwell has succeeded to the position of manager of the company.

An ordinance compelling telephone companies to put their wires underground has been proposed at Clinton, Iowa. R.

Ohio Telephone Notes.

J. S. Eaton has been in Cincinnati giving demonstrations of Dr. Poulson's telegraphone, and it is said that the Cincinnati and Suburban Bell Telephone Company may take up the invention and put it into use. The instrument records sound received over the telephone for future reproduction.

Another restraining order has been issued against Sol P. Kineon to prevent him from building a line through Covington, Ky., and Kenton County, to connect his long-distance line with Cincinnati. Other telephone companies are interested in preventing him from doing this.

Most of the preferred stock recently issued by the Newark Telephone Company of Newark has been sold to Columbus people.

Wire Chief Harley Cole saved the new automatic switchboard of the Bell company at Chardon from destruction a few days ago at the risk of his life. The wires became entangled with a trolley wire and were grounded at the exchange. Mr. Cole caught a red-hot wire and broke it in two and then began to put out the fire in the building with a bucket of water. The fire department arrived and began to throw water, but Mr. Cole stopped them, and thus saved the delicate mechanism. C.

Cheaper Telephone Service for Chicago.

The Chicago Telephone Company has told the Chicago Council committee on gas, oil and electric light that it is willing to expend $15,000,000 in extensions and improvements, to reduce the charges for telephone service in the city and to abolish toll charges in the city limits, but to do this the company must have a 20-year extension to its franchise, which expires in three years. Besides this the company offers to pay three per cent. compensation to the city on all business done within the city limits. The proposition of the company is to substitute the measured-service system, almost entirely for the flat-rate system, the exception being only for residence service.

Independent Companies Active in New York.

The Great Eastern Telephone Company (Independent) has made an application to Commissioner Ellison of New York city to open the streets to lay new subways under the franchise recently declared valid by Attorney-general Mayer. D. A. Reynolds, president of the company, is quoted as saying: "We secured over 29,000 contracts for telephones during January, and now have more than 67,000 as the result of 14 weeks canvass. We have filed maps with the department for one exchange in Lower Manhattan and one in the Bronx, which will be followed by others. Our orders for material will be placed at once upon receiving our permit."

GENERAL TELEPHONE NEWS.

The Du Boise Telephone Company of Du Boise, Neb., at its annual meeting reduced its telephone rates to $1 a month.

John Harris, George Medlar and Samuel Harris have incorporated as the Oregon Mutual Telephone Company of Oregon, Ill. The capital is $6,000.

W. Balder, formerly with the Northwestern Telephone Exchange Company, at Albert Lea, Minn., has been made manager of the exchange of the Melrose Telephone Company at Melrose, Minn.

C. R. Messenger, manager of the local telephone exchange at Wadena, Minn., has resigned, to take effect March 15th, and will remove to Aberdeen, S. D., where he will become district manager for the Dakota Central Telephone Company.

The number of the New York Telephone Company's telephones in service in Manhattan and the Bronx is reported to have increased last month by 3,231. This is 1,012 more than the gain in the corresponding month last year. More than 180,000 telephones are now in use in the two boroughs.

The Iowa Telephone Association will hold its annual meeting at the Chamberlain Hotel, Des Moines, on March 13th, 14th and 15th. Charles C. Deering of Boone is secretary of the association, S. S. Lichty of Vinton is president and J. S. Bellamy of Knoxville heads the executive committee.

Henry T. Scott, who was the choice of the directors of the Pacific States Telephone and Telegraph Company to fill the position formerly held by the late John I. Sabin, was duly elected president of that corporation by the new board of directors following the annual meeting of stockholders held at Portland, Ore., on February 8th. The number of directors was increased.

At the annual meeting of the Southern New England Telephone Company, held recently, it was voted to increase the capital stock from $5,000,000 to $6,000,000. The Legislature has authorized an increase to $10,000,000 as needed. The annual report of the company, which operates in Connecticut, shows gross earnings for 1905 amounting to $1,563,610, and net $307,500. Dividends were $277,500, surplus $30,000; total surplus, $112,800.

The Illinois Central Railroad is improving the telephone circuits along its line between Chicago and Fulton, Ky. They were originally strung with copper wire weighing 166 pounds to the mile, and this is being replaced with 435-pound wire. The work is being done by the railroad company, and it has a contract with the Cumberland Telephone and Telegraph Company for an exclusive metallic circuit between Fulton and New Orleans, via Memphis, Vicksburg and Baton Rouge.

W. H. Hayes, district manager of the Canadian Bell Telephone Company at Windsor, Ont., has been promoted to be district manager for Manitoba, including the city of Winnipeg. He is succeeded by William Quinn of Sarnia, Ont. Mr. Hayes is one of the oldest telephone men in the Bell service, having started in the London office as messenger and worked his way up to be assistant manager in that city. He was transferred to Windsor a few years ago and later was made district manager.

CORRESPONDENCE.

Great Britain.

London, January 31.—The interest with which the opening of Parliament this session is awaited by those interested in the electrical industry is greater than for very many years. The remarkable change in the composition of the government has created many misgivings, and the fact that all the London electric power bills are to commence in the House of Commons lends color to the suggestion that the House authorities are indulging in a little intelligent anticipation. It would not be improbable, so strong is the municipalist party, that all the companies' bills were rejected at a very early stage, and only the London County Council bill allowed to proceed—a calamitous result from every point of view, but for the reflection that there still exists a House of Lords; which may always be depended upon to check—very often unceremoniously—any flagrant disregard of economic principles such as this. Therefore, unless a royal commission is appointed, there is every prospect that the session may again bring forth no definite issue in this matter, while even in the former event an unwarranted delay would be occasioned.

The quarrel between the City of London Corporation and the Electric Supply Company as to the electric lighting of the streets has not been allowed to rest at the granting of a contract to the gas company. The city authorities have made it their proud boast that they wish to get the best system for the ratepayers. The City of London Electric Lighting Company has made an offer which cannot be passed over without good reason. It is that the company shall carry out a demonstration, at its own expense, of street lighting on the most modern system. So far, the electric-lighting company has been refused the offer to submit a tender competitive with the gas company, but its latest suggestion goes a good deal farther.

The General Post Office telephone system in London has progressed at such a rapid rate that it has been found necessary to build an additional switchboard in the original exchange buildings. The original board gave accommodations for nearly 15,000 subscribers, and the new board has been designed for a similar number. The new board has many features of interest, which could not, however, be treated in these brief notes. The system now necessitates the use of a power plant, which is the largest used in connection with any other exchange in this country.

In view of the increasing importance of the questions arising in connection with locomotives in London, the London County Council has resolved to appoint a special traffic committee to watch these matters. The council also intends in a few months time to commence the reconstruction, for electric traction, of the old horse tramways in the north of London.

Foreign competition is always more or less with us, and the directors of the District Railway Company have been largely blamed for placing orders for rolling stock in America, in defiance of Mr. Yerkes' promise years ago in the committee rooms of Parliament that the contrary would be the case. On the other hand, the Metropolitan company, the joint owner of the Inner Circle with the District company, has placed all its orders with British firms, and is convinced that it has paid no more than if it had gone abroad. But it is one of those matters in which there is no finality, so I will not discuss it. G.

New York.

New York city, February 10.—The New York Central's electric locomotive, No. 6,000, was tried at Schenectaday yesterday over snowbound tracks, and succeeded in making between 60 and 70 miles an hour easily on the experimental line of the General Electric Company. No troubles were caused on account of the power rail.

Traction affairs have been prominent at Albany all through the week. An attack on the Interborough-Metropolitan merger has been headed off and the Elsberg measure referred to the railroad committee. The true purport of the latter measure is not yet entirely revealed. According to its opponents, it is in reality a municipal-ownership measure. Other pending bills affect claims for subway-construction damages, the consolidation of suits arising out of refusals to grant transfers, and for the compulsory placing of guard rails at subway stations. William Barclay Parsons, who was the chief engineer of the present subway, in giving evidence before the state Senate committee, prophesied that the cost of construction of future subways would be 50 per cent. greater than the existing system. A West Side subway from the Battery to the Bronx, he said, would cost $85,000,000, and a similar amount for a subway on the East Side.

The Metropolitan Railway Company is experimenting on the Sixth Avenue surface lines with a new type of car fender which comes almost to a point in front and runs back alongside the wheels of the forward truck.

Bridge Commissioner Stevenson announces a scheme to double trolley facilities at the Manhattan end of the Williamsburg Bridge by increasing the number of stopping places and making the roadway

wider. A timber trestle track is suggested, pending the completion of the underground terminal at this point.

The Hoboken and Manhattan Tunnel Company has been permanently enjoined by the New Jersey courts from invading the territory of the Public Service Corporation of New Jersey.

President L. B. Marks will make an address before the meeting of the Society of Illuminating Engineers at the Hotel Astor on Tuesday evening.

At a meeting of the Boards of Trade of Brooklyn it was proposed to build an independent trolley road to compete with the Brooklyn Rapid Transit Company to East New York. Plans and suggestions to attain this purpose were advanced.

The new police commissioner, General Bingham, has abolished the police telephone squad, and hereafter will employ civilians for police telephone work at lower salaries. This order releases 128 policemen for much needed patrol duties.

The reduced terms offered by the lighting companies for public lighting has led Mayor McClellan to intimate that he will not push the project for a municipal lighting plant.

The New York Edison Company reports a total of 19,860 separate contracts for electrical service, involving current equivalent to 1,657,408 16-candle-power lamps.

The Thomas F. Ward Coal Company at West Seventy-ninth Street has recently erected an electrically operated hoist. The weight of the loaded bucket is 3,300 pounds, and the cost of handling coal per ton is less than three cents.

The Hale horse groomer, an ingenious electrically operated brush mechanism, has been introduced into this city.

The Hudson River and Eastern Traction Company has been incorporated with a capital of $400,000 to operate an electric road nine miles long near Ossining.

The Dobbs Ferry Traction Company has been incorporated to operate an electric street railway from Hastings to Dobbs Ferry, Westchester County, N. Y. The capital involved is $30,000.

J. P. Grant and associates have incorporated as the West Branch Light and Power Company, with headquarters at Stamford, N. Y., with a capital of $50,000.

The Railway Electric Signal Company has been incorporated with a capital of $50,000 and headquarters in Jersey City, N. J. D. W. W.

New England.

Boston, February 10.—The rules committee of the Massachusetts House of Representatives seems disposed to report against a suspension of the rules to admit the bills for the incorporation of the Boston-Lowell Interurban Street Railway Company and the Massachusetts and Rhode Island Electric Street Railway Company. These companies have been meeting considerable opposition. The Boston-Lowell company proposes to build a high-speed electric railway between Boston and Lowell, Mass., a distance of about 26 miles, and seems to be honestly endeavoring to establish a first-class electric service between Boston and the important manufacturing city of Lowell. The Massachusetts and Rhode Island company proposes to connect Boston and Providence, R. I., with an interurban electric railway, largely built on private rights-of-way. The people interested in this company attempted to get an incorporation bill passed by the Legislature of 1905, but other persons offered similar petitions, and when the legislative committee had prepared a "compromise" bill the question of taking land by eminent domain came up and tended to complicate matters so that no bill was passed. Of course the New York, New Haven and Hartford Railroad Company would suffer from the competition of such a road.

The Beacon Manufacturing Company of New Bedford, Mass., has contracted for a Westinghouse steam turbine of 1,000 kilowatts capacity for its plant.

The Boston Common Council has refused to pass an order providing for the municipal ownership of lighting plants. It required a vote of two-thirds of the membership of the body to pass the order, or 50 votes. The ballot resulted: Yeas, 42; nays, 16; absent or not voting, 17. The matter will come up on a question of reconsideration at the next meeting of the council. The debate on the order lasted over four hours.

The Taunton and Buzzard's Bay Street Railway Company has stopped running cars over its road. Officials of the company state that the earnings have not been sufficient to pay the running expenses. The company has obtained the power for its electric railway from the New Bedford and Onset Street Railway Company, and a Taunton and Buzzard's Bay Company's official says that differences in regard to the amount to be paid for this power have been an important factor in the decision to suspend operations. The Taunton and Buzzard's Bay Company was organized to buy and operate the financially embarrassed Middleboro, Wareham and Buzzard's Bay Street Railway Company's property, which comprised 25 miles of electric railway between Middleboro and Monument Beach, Mass., via Onset Bay and Buzzard's Bay, covering considerable summer-resort territory.

A new electrical engineering laboratory is to be built for the [illegible] Worcester, [illegible] the Boston [illegible] Worcester [illegible] night, [illegible] Mass., lectured [illegible] the Boston [illegible] [illegible]

A petition [illegible] car tracks in [illegible] vard Square and [illegible] station has been [illegible] Cambridge, Mass. [illegible] along the route [illegible] is carried out it would [illegible] ing of the tracks [illegible] sleepers and [illegible] rails, the tracks to be [illegible] argued that the change [illegible] jar of passing cars [illegible] claim that the Boston Elevated Railway Company can be made to pay most of the expense, and it is more than likely that the company will oppose the petition, although the company will reap some advantage from the fact that the change would allow its cars to make uninterrupted runs between stops, saving some power and the wear and tear incident to "slowing up" for teams, etc.

A mass meeting in Winchester, Mass., recently voted to appoint a committee of three men to investigate the subject of municipal lighting and report at the annual town meeting. The meeting was called to protest against alleged excessive charges by the Edison Electric Illuminating Company.

The Massachusetts railroad commissioners are taking observations on the Boston and Worcester and the Natick and Cochituate street railway companies' searchlight headlights, of which the Wellesley (Mass.) people have complained, claiming that they were dangerous because they blinded people and horses and caused them to become confused. The commissioners have been asked to compel the adoption of such headlights by companies operating electric railways in some towns in other parts of the state, and they desire to form some regulation which will prevent the annoyance of which the Wellesley people complain without lessening the protective effect of the lights.

The Burlington (Vt.) municipal and electric-light plant is to be enlarged, the city government having appropriated $25,000 for the purpose. More will be appropriated as it is needed. The enlargement is necessitated by the heavy demand for commercial light and power.

The directors of the Consolidated Lighting Company of Montpelier, Vt., have voted to expend $100,000 in improving and extending the company's system. Additional waterwheels giving 7,200 horsepower will be installed at Bolton Falls.

B.

Dominion of Canada.

Ottawa, February 10.—The City Council of Sherbrooke, Que., has decided to instruct the city solicitor to take proceedings to force the Power, Light and Heat Company of Sherbrooke to sell its plant to the city at a price to be fixed by arbitration.

The report of the light department of the city of Kingston, Ont., shows that the city's light, heat and power plant earned a surplus over all expenditures of $5,674 for the year 1905. During the year there was spent out of the earnings $25,000 on capital account and $10,000 for repairs and betterment of the plant; at the same time there was a reduction in price of light, heat and power to consumers from the rates charged by the private company of $4,500.

A cable from London, Eng., states that the Sperling company is offering through the Bank of Scotland and the Bank of Commerce 11,000 shares of $100 each in the Canadian General Electric Company at 142½ per share. This block of stock was sold to the British syndicate, which undertook not to offer it on the market on this side of the ocean. The price paid for the block was $1,320,000, which was a premium of 20 per cent. net above par after payment of all cost and charges incidental to the stock being placed upon the London market.

The Canadian Pacific Railway Company is to spend $25,000 this year in the construction of new telegraph lines in the Canadian Northwest. The exceptional activity that is likely to be characteristic of the coming summer in railway building renders several hundreds of miles of new wire imperative. The company is also to have a new direct copper wire from Winnipeg to Montreal this year, giving a service of half a dozen direct wires.

Hauling by electric locomotives is no experiment in Canada. Already the Canadian Pacific railway freight cars and freight are hauled by electric locomotives from Galt to Oreston, Hespeler, Berlin and Waterloo, in the province of Ontario. In the province of Quebec the problem of substituting electricity for steam on the Montreal-Quebec section is now under consideration of the railway officials, who are consulting with experts as to the advisability and probable cost of the change, which, if decided upon, will be begun within the next six [illegible] Canada, the Montreal [illegible] [illegible] of 11.25 [illegible]

Southeastern States.

Charlotte, N. C., February [illegible] house company [illegible] plying machinery for the [illegible] the Great Falls waterpower on the [illegible] by the Southern Power Company of [illegible] N. C. There will be available about 45,000 horsepower at the first of the three falls [illegible] be developed first. While a good [illegible] will be used for commercial purposes, it is likely that many cotton mills and [illegible] towns will use the current for lighting streets or private property.

A great deal of argument has been precipitated in Louisville, Ky., over the question of a franchise to a new lighting company [illegible] Lee Atherton. Argument has been [illegible] gas and water committee by representatives of the Louisville Gas Company, to prevent the passage of an ordinance preventing the Louisville Lighting Company from bidding on the franchise to sell light, heat and power in the central portion of the city. It was predicted, however, that the ordinance would be passed by the General Council.

The Harmony Grove cotton mills of Commerce, Ga., have made a bid for lighting the streets of the town with electricity generated in connection with the mill's electrical plant, and it is expected that the proposition will be accepted. The bid is for both municipal and private lighting in Commerce.

The town of Ensley, Ala., has granted a franchise to the Birmingham Railway, Light and Power Company to build an electric road connecting Ensley and Jonesboro.

The annual meeting of the Aiken-Augusta Electric railway was held in Jersey City on February 5th, at which 21,000 out of 22,000 shares were represented. A resolution was passed to merge all of the companies into the Augusta and Columbia (S. C.) Railway Company. Improvements were planned for Augusta.

A bill to apply the Jim-crow law to street railways in the state of Kentucky has been defeated in the Senate.

The Alcorn Electric Company of Corinth, Miss., is chartered with $25,000 capital. J. H. Jones is among the incorporators.

The United Railways and Electric Company of Baltimore will probably ask for bids soon for the car-trust certificates to be issued to cover the cost of 100 new cars to be ordered, according to a recent report from that city. The new cars will cost about $5,000 each, and will be built by the J. G. Brill Company. L.

Ohio.

Cleveland, February 10.—The Legislature has enacted a law that will compel steam roads to carry passengers at the rate of two cents a mile. By some it was thought that this would injure the business of the electric roads, but a number of managers interviewed said they thought it would have no effect. The convenience of electric-railway travel, the cleanliness and frequency of cars, will be factors in holding the business. Most of the roads are now charging less than two cents a mile, and this difference will still cut a figure. The average rate would perhaps have been increased later on, as there has been talk of that at the meeting of the associations, but this may not be done now.

At a meeting of the representatives of electric roads forming a through route between Detroit, Mich., and Dayton, Ohio, held in Toledo a few days ago, a decision was reached that the various lines would co-operate in forming continuous

through lines to the various points that may be reached. C. C. Collins, general freight agent of the Western Ohio, and C. M. Paxton of the Dayton and Troy, were appointed to arrange a passenger and freight traffic rate. Tickets will be sold between Detroit, Toledo, Dayton, Springfield, Columbus, Newark, Cincinnati, Richmond, Indianapolis and all intermediate points.

An ordinance has been introduced in the City Council at Columbus providing for a bond issue of $140,000 to increase the capacity of the municipal light plant. The estimate furnished is as follows: Generators, $70,000; condenser, $15,000; boilers, $25,000; piping, $5,400; stokers, $5,000; foundations and ash pits, $2,000; coal bins, $3,000; addition to switchboard, $2,500; incidentals, $2,500; 300 lamps, $9,000.

Judge E. P. Middleton of the Common Pleas Court of Champaign County has decided that the contract existing between the city of Urbana and the Urbana Light Company is illegal.

The bills requiring that motormen's vestibules be heated, and requiring street-railway companies to sprinkle their rights-of-way, have been enacted into laws and signed by the governor.

At the annual meeting of the stockholders of the Sandusky Southern Electric Railway Company at Lima a few days ago it was announced that the receivership would be lifted within a short time, as all the claims had been satisfied. The branch of the road between Lima and Bellefontaine will be completed first, it is stated, that between Wapakoneta and Kenton being taken up later.

The Forest City Incandescent Light Company of Cleveland has been incorporated with a capital stock of $10,000 by A. Louis Betz, Albert E. Green, John M. Garfield and others. O. M. C.

Indiana.

Indianapolis, February 10.—An extension of the Wabash Valley Traction Company's line will be made along the line of the old Wabash and Erie Canal. While the persons now obtaining the right-of-way from the owners of the canal lands are not interested directly in the Wabash Valley, they are understood to be acting for the latter. The plan is to parallel the Wabash railroad from Fort Wayne to Toledo, Ohio, 95 miles, connecting at Toledo with all the Ohio interurban systems and forming a direct line from Detroit to Indianapolis.

A steam road in this state has granted to a competing electric railway the free right to use its track in crossing another steam road at a junction, and the State Railroad Commission has set the seal of approval on the arrangement, which, as Union B. Hunt, the head of the commission, says, is one entirely new to railroading. This arrangement has been entered into between the Big Four Railroad and the Winona Interurban Railway Company, which is building an electric line to parallel the Big Four road between Warsaw and Goshen. The Big Four officials are friendly toward the electric line, partly because the Winona line controls the only outlet for the Big Four through-traffic to the Winona Assembly grounds. The Baltimore and Ohio steam road has shown a disposition to be hostile to the idea of the electric railway crossing its tracks at Milford Junction.

The Indianapolis Star has inaugurated a novel plan of conducting free excursions to Indianapolis over the interurban lines. The managers of the Star sent out 2,632 free tickets, good for transportation coming into the city and also good for the return trip, providing the holders had their tickets stamped by three Indianapolis stores advertising in the Star. The first excursion was run Thursday, and the interurban lines were surprised at the large crowd brought in. One store stamped 1,017 tickets, and other stores are loud in their praise of the scheme. Traction service has placed cities and towns distant 50 to 100 miles from Indianapolis in as close touch with the city as the suburbs were 15 years ago, before the modern and rapid trolley lines were put in operation. Merchants estimate that the crowd of shoppers brought to the city free of cost expended $25,000 while in the city for a single day.

The interurban railways operating in Indiana are making preparation for the threatened strike of the coal miners and will store large quantities of steam coal. The recent tests made of Indiana coal by the government at the testing plant at St. Louis have demonstrated that the Indiana coal is the greatest steam-making coal in the country. This one fact has attracted the attention of interurban and other electric power companies all over the country. Steps have been taken by some of the Indiana traction companies to mine their own coal. To this end the United Traction Coal Company has been incorporated, with headquarters in Indianapolis. The company is capitalized at $300,000 and will open mines in Sullivan and Greene counties soon, to be reached by traction lines.

The Lafayette and State Line Traction Company filed articles of incorporation on February 6th. The capital is $10,000. It proposes to build electric roads in Lafayette and State Line City, and connecting these cities, passing through Attica, Williamsport, West Lebanon, Marshfield and Johnsfield. Headquarters will be in Williamsport. Freemont Goodwine, W. S. Nail and John Hover are among the incorporators.

The Niles and Buchanan Railway Company and the South Bend and Michigan Southern Railway Company have consolidated and reincorporated under the name of the Southern Michigan Electric Railway Company, with headquarters in South Bend. These properties, lines, power houses, etc., will hereafter be operated jointly and the construction work now on hand and the extensions contemplated will be conducted by the newly consolidated company. Mortimer Reed, James B. McCance, William Babcock and E. F. Gaffrey are at the head of the new company.

The next interurban line to be completed to Indianapolis is the Indianapolis and Western, and April 1st is the date set by the contractors. This line will be of great importance, because it will not only connect Danville, Green Castle, Brazil and Terre Haute, but will enter the coal fields. A specialty of freighting coal is to be made.

The officials of the Indiana Union Traction Company have rejected all the bids submitted for the construction of a new traction station at Kokomo and announced that some changes would be made in the specifications at once and new bids asked for in a short time.

D. G. Edwards, general traffic manager of the recently merged traction lines, has entered upon his duties and is out making an inspection of the Indiana lines over which he has jurisdiction.

G. K. Jeffries, formerly superintendent of the Indianapolis and Northwestern electric railway, has been made superintendent of the Indianapolis and Eastern, and C. E. Morgan, formerly with the Indianapolis and Eastern, has been made superintendent of the Indianapolis and Martinsville and Indianapolis and Plainville lines.

The Waterloo Electric Light and Water Works Company of Waterloo has been incorporated, capitalized at $25,000. The object of the corporation is to construct and operate a combined electric-light and waterworks plant in Waterloo. Charles A. Wilding, John Dreibelbiss and W. J. Vesset are the incorporators. S. S.

Michigan.

Grand Rapids, February 10.—The Boyne City Electric Light Company of Boyne City has just closed a deal whereby it secured three acres of land along the river front. The company will begin the erection of a new power plant early in April. Prominent Grand Rapids capitalists are interested in this enterprise.

The St. Clair aldermen who caused a deadlock in the council for seven weeks by objecting to enter into a contract to buy electric power for the operation of the waterworks were finally voted down, the mayor casting the deciding ballot. The men held out, believing that to purchase power would be to compromise the municipal-ownership idea. The other aldermen and mayor took a different view, believing it would be cheaper to purchase electric power than generate steam power.

Mayor Fleming of Muskegon has proposed that the old waterworks building be equipped for a lighting plant at an expense of perhaps $15,000. The cost of operation, he says, would not exceed $10,000 a year, and the present contract for city lighting calls for a payment of $15,000 a year.

The village of L'Anse will within the next few weeks have the distinction of being the only municipality in the copper country, having its own electric-light plant. The machinery is being installed and everything is practically in shape to commence active operations.

Dr. Fred J. Corliss of Kalamazoo had full charge of the electrical effects and lighting at the junior ball of the University of Michigan at Ann Arbor on February 9th. Dr. Corliss furnished two flood lights of several thousand candlepower each, slides for the "Men of Yost," the electrical effects for the orchestra and the entire lighting of the hall. Previous to this time the lighting had ben done by Detroit and Chicago concerns.

Because of the washing out of the electric-light company's dam at Big Rapids a contract for furnishing power for commercial lighting has been made with Jones & Green. This power will be for the incandescent and not for the arc lights. The plant is out of commission for an indefinite length of time.

With the completion of the Niles-St. Josepeh branch of the Indiana Railway Company's lines the company and the Graham & Morton Transportation Company of Benton Harbor and St. Joseph will co-operate in the handling of freight and passengers between Chicago and Goshen, Ind., and the intervening points. The Indiana Railway Company has purchased the right-of-way of the old Michigan Central roadbed between Niles and Buchanan. A franchise has been asked for to cross the St. Joseph River in Niles, and it is now up to the City Council.

In all probability verbal and memorandum terms for the sale of the Detroit, Monroe and Toledo Short Line electric railway have been made. This was a definite story circulated in Griswold Street, Detroit's commercial center, this week. The general belief among those who come in contact with the managers of these properties or their securities is that the closing of a sale of the Detroit and Toledo Short Line to the Detroit United Railway is now only a matter of detail.

J. G. Emery of Grand Rapids, one of the directors of the Grand Rapids-Muskegon Water Power Electric Company, states that everything will be in readiness to deliver power in Muskegon by March 1st. It is expected that some time in April this company will begin its service for the Grand Rapids, Grand Haven and Muskegon Electric Railway Company. It is said that the main feed lines will connect the road at Walker or Fruit Port.

The St. Joseph River Traction Company of Benton Harbor, organized to build a road from Benton Harbor to Niles, Dowagiac and Kalamazoo, has been consolidated with the Southern Michigan Light and Power Company under the name of the Benton Harbor and St. Joseph Electric Railroad and Light Company. The capital of the new organization is $1,000,000. Colonel W. W. Bean, former owner of the Benton Harbor and St. Joseph street-railway and lighting system, has turned over the property to the new owners. James G. McMichael, vice-president of the merged companies, is president of the Atlas Railway Supply Company of Chicago. The other officers are Charles K. Minary of Springfield, Ill., president; L. W. Botts of Louisville, secretary; Frank M. Mills of Benton Harbor, treasurer; Henry C. Mason, general manager, and H. S. Gray of Benton Harbor, attorney. The company has purchased the steel for the extension of the line to Eau Claire by the way of Fair Plain and Tabor's. The grading for this line is now completed and it is the expectation that all bridges will be built and the road ready for operation to Eau Claire by the middle of June. The company expects to be operating its line to Fair Plain in April. Besides the line to Eau Claire the company has in contemplation a road to Kalamazoo, and unless some other company begins construction of such a line this spring it will undertake the work later in the season. The new power from Buchanan is expected to be put in use in two weeks. With its installation the rates for light and power will be reduced and better service will be given. Colonel Bean, who retires from the company, will take a well-earned vacation. He located at Benton Harbor 17 years ago, coming from Dayton, Ky., where he sold a horse-car line. He bought the street-railway line between Benton Harbor and St. Joseph. The equipment consisted of a few horses and a few second-hand street cars. Colonel Bean equipped the road with electric power, secured the construction of the Wayne Street Viaduct in St. Joseph and made the road one of the best and most profitable in the state.

In 1905 the Detroit United Railway system, in which the Rapid and Sandwich, Windsor and Amherstburg railways are not included, carried 92,838,540 revenue passengers, 27,593,325 transfer passengers and 4,193,445 employe passengers. For betterments $1,139,338 was expended. Of this nearly $1,000,000 was spent on the Detroit city system. The gross earnings for all the lines—Detroit United Railway, Rapid and Sandwich, Windsor and Amherstburg—were $5,125,563. Deduction of operating expenses and taxes left $2,128,116 net.

L. W. B.

Northwestern States.

Minneapolis, February 10.—Calls for bids for the new transforming station on Lake Street, Minneapolis, are out. The new building will cost about $10,000 and is to be completed by the first of June. This new station will receive power at high tension from the main power house and will distribute it for service at a low voltage over the system in that portion of the city. It will also furnish current for the new Lake Street-Marshall Avenue interurban to St. Paul. It is the intention of the Twin City Rapid Transit Company to establish a trolley express service on this line.

Charles D. Smith, president of the Wisconsin Rapid Transit Company, has announced that sufficient capital has been secured to warrant starting work on the proposed electric road from Milwaukee to Port Washington and Fond du Lac. The estimated cost of the new line is $1,500,000.

The option held by the Newton and Northwestern Railway Company on the purchase of the Fort Dodge (Iowa) street-railway system has been closed and the purchase made.

The Minnesota Water Works Company of Brainerd, Minn., proposes to dam the Crow Wing River and build a large power plant for the waterworks system for a new electric-light plant. The proposed plant would cost $225,000, and its construction is contingent on the extension of the waterworks franchise.

A company is being organized at Hibbing, Minn., for the purpose of building an independent telegraph line from that and other Range towns to Duluth, Minn.

The Council at Fort Pierre, S. D., has granted a franchise for a street-railway and interurban system to F. G. Fisher of that city and H. Newbanks of Pierre. A similar proposition is pending in the Pierre Council.

The Madison (Wis.) Interurban Traction Company will extend a line to South Madison at a cost of $50,000. A new power house is also planned.

The electric-light plant at Reinbeck, Iowa, has been damaged by fire.

The Council at Creston, Iowa, proposes, it is said, to purchase the new electric-light plant at that city and operate it under municipal ownership.

The Charles City (Iowa) Water Power Company has sold its plant to E. S. Marrenner of Chicago.

He will develop the property at once by putting in a new concrete dam and an electric light plant. It has been idle since it burned last spring. The consideration was $25,000.

It is said that it will be impossible for the city of Aberdeen, S. D., to dispose of its new electric light bonds for the reason that the city has already reached the limit of its legal indebtedness.

N. A. Hoffard, county auditor, will receive sealed bids until March 6th for installing an electric light plant in the courthouse at Crookston, Minn. Each bidder must furnish his own plans and specifications.

An electric-light system is to be installed at Bertha, Minn.

It has been decided to construct an electric light plant at Sebeka, Minn. R

Pacific Slope.

San Francisco, Cal., February 9. The Fort Bragg Electric Power Company, which operates an electric-light plant at the Union Lumber Company's mill at Fort Bragg, Cal., has purchased, through a San Francisco agency, an additional 300 kilowatt alternating-current generator and a direct connected engine. Arrangements have been made to furnish electric power to the Mendocino Electric Light and Power Company, at a price below the present cost of generation at Mendocino, Cal. It will be necessary to build a 10-mile pole line down the coast from Fort Bragg to Mendocino to fill the contract.

W. J. Patterson is the promoter of a 30-mile electric road, which is to be constructed at a cost of $500,000, in the territory tributary to Baker City, Ore., skirting Eagle and Pine Valleys. It is reported that financial arrangements have been consummated for building the road. It is proposed to construct a hydro-electric plant on Eagle Creek for the operation of the cars. The reclamation of 50,000 acres of land is also included in the plans. The site for the power plant is to be furnished by State Senator Pierce of Umatilla County, J. K. Romig and others.

The Inland Power and Electric Company of Spokane, Wash., has filed articles of incorporation which authorize it to construct, acquire and operate railroads, irrigation systems and electric power transportation business. The capital stock is given at $1,000,000. The incorporators are Arthur Phillips, F. P. Waters and C. A. Lunceford of Spokane.

The Forest Grove Transportation Company has been organized, capitalized at $10,000, and proposes to build an electric road in the principal business center of Forest Grove, Ore. The road is to be completed this summer. The power to operate the line will be furnished by E. W. Haines' water-power plant, 12 miles west of Forest Grove. The following officers have been chosen for the ensuing year: E. W. Haines, president; Judge Hillis, secretary; J. E. Loomis, treasurer.

J. S. McDonald has been granted a franchise for an electric-light and power line along certain streets in Napa, Cal.

A company has been formed at Colonia Juarez, Mexico, to establish an electric-lighting plant. August A. Wilson, electrical engineer, has drawn plans, which have been accepted.

The new owners of the San Jose and Santa Clara Electric Railroad Company have made application for a 50-year franchise in Santa Clara, Cal., for a double track along Franklin Street, to the terminus of the present road.

Work has commenced at San Diego, Cal., on the construction of a new electric plant for the San Diego Consolidated Gas and Electric Company. R. J. Hill, engineer, of Chicago, is supervising the job. A.

PERSONAL

Stephen L. Coles, formerly well known in electrical journalism, is no longer connected with Railway and Marine News of Seattle, Wash.

George D. MacMillan, president of the La Crosse (Wis.) Gas and Electric Company, died on February 12th. Besides his activity in business affairs Mr. MacMillan was active in politics and in the local and state organization of the Presbyterian Church. He was 61 years old.

Eugene N. Foss has been elected a director of the Brooklyn Rapid Transit Company, vice R. Somers Hayes, deceased. He is the head of the B. F. Sturtevant Company and has been very prominent in advocating Canadian reciprocity, having unsuccessfully attempted to be elected Congressman on that issue.

George P. Hutchins has resigned from the advertising department of the Joseph Dixon Crucible Company of Jersey City and has opened an office at 120 Liberty Street, New York city, to serve in the capacity of advertising manager for manufacturers whose publicity work lies within the mechanical and engineering fields.

Henry M. Sperry has been appointed resident manager in New York for the General Railway Signal Company. He succeeds W. G. Hovey, who has been appointed construction manager. Mr. Sperry is well known as a man of large experience in general railroad and signal engineering, having been engaged in the [illegible] Pennsylvania [illegible] ing of Chicago [illegible]

Twenty-one members of [illegible] of Electrical Engineers [illegible] urging their [illegible] Sheldon, professor of [illegible] the Brooklyn Polytechnic [illegible] titute. Dr. Sheldon [illegible] of his work for the Institute [illegible] tional funding.

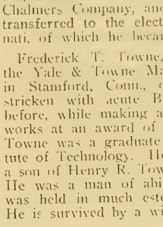
Robert L. Elliott and Miss [illegible] both of Chicago, were married in [illegible] on February 7th. Mr. Elliott [illegible] and attorney for the Chicago [illegible] Company. He has many friends who will congratulate him. Miss Fowler is also of Chicago, but has been visiting in London for some time. Following the wedding at the Holy Trinity Church a reception and breakfast were given at the home of one of Miss Fowler's English friends in Regent Park Terrace. Mr. and Mrs. Elliott are believed to be in Italy on their wedding journey.

Mr. L. F. Bower has been appointed comptroller of the Allis-Chalmers Company of Milwaukee, succeeding Mr. J. A. Milne, who has become manager of Allis-Chalmers-Bullock Company, Ltd., of Montreal, as noted below. Mr. Bower graduated from Wesleyan University in 1879. For some years previous to 1901 he was secretary and treasurer of the Dickson Manufacturing Company at Scranton, Pa., which was at that time absorbed by the Allis-Chalmers Company, and on April 1, 1904, he was transferred to the electrical department at Cincinnati, of which he became manager.

Frederick T. Towne, general superintendent of the Yale & Towne Manufacturing Company, died in Stamford, Conn., on February 4th. He was stricken with acute Bright's disease the evening before, while making a speech to employes of the works at an award of prizes for suggestions. Mr. Towne was a graduate of the Massachusetts Institute of Technology. He was only 34 years old, and a son of Henry R. Towne, the company's president. He was a man of ability and high character and was held in much esteem by all who knew him. He is survived by a widow and two sons.

Dr. William F. Ostwald of Leipsic, Germany, was tendered a reception by the New York section of the American Electrochemical Society at the Chemists' Club on the evening of February 2d. Dr. Joseph W. Richards welcomed Dr. Ostwald on behalf of the American Electrochemical Society and Prof. C. F. Chandler performed a like duty for the American Chemical Society and the Society of Chemical Industry. A number of men prominent in chemical and electrochemical circles spoke. After the formal exercises of the evening were closed the guests remained to meet the distinguished chemist. Dr. Ostwald has been giving a series of lectures at Harvard University and has just completed a course of six lectures at Columbia. He sailed on his return journey to Germany on February 6th.

Mr. James A. Milne, who for a number of years has been comptroller of the Allis-Chalmers Company, Milwaukee, has accepted the position of general manager of Allis-Chalmers-Bullock, Ltd., Montreal, Canada, to become effective on or before May 1st. Mr. Milne is a native of Canada, having ben born at Waterdown, Ontario, in 1872. After completing a public-school and collegiate course he began his business career at Toronto in 1888. In 1892 he removed to Chicago, entering the employment of Carson, Pirie, Scott & Co. Subsequently he worked for Reid, Murdock & Co. and the Chicago Packing and Provision Company—for the latter as chief accountant. Then he became associated with Jones, Cæsar & Co., chartered accountants, and it was this connection which brought him into touch with the Allis-Chalmers Company. In August, 1901, he entered its employment as chief cost clerk, and one month later was appointed acting comptroller, being formally elected to that position at the meeting of the board of directors in May, 1902. Since the early part of last autumn Mr. Milne has been one of the directors of Allis-Chalmers-Bullock, Ltd., and the fact that he still retains Canadian citizenship and is deeply attached to his early associations has been an important factor in influencing him to heed a recall to the Dominion. The Allis-Chalmers-Bullock, Ltd., of Montreal, is an allied interest of the Allis-Chalmers Company and owns a large manufacturing plant located at Montreal, the direct management of which will now be assumed by Mr. Milne. The Canadian company is conducted as an entirely separate organization, but, in addition to its own production, sells the products of the Allis-Chalmers Company in the Dominion of Canada.



JAMES A. MILNE.

ELECTRIC LIGHTING

[illegible]

[illegible] pany i[illegible]

[illegible] J. V. [illegible]

[illegible] and Sinclair Mainland [illegible]

[illegible] Glenwood.

The [illegible] Electric Light Company [illegible] Iowa, has transferred the [illegible] and the [illegible] property [illegible] River to J. A. [illegible] possession about March 1st. [illegible] $85,000 and several tracts of [illegible]

John W. Shaw, receiver for the [illegible] Water, Light and Power Company, [illegible] Ill., by permission of the court [illegible] addition to the company's present electrical plant, consisting of a 110-kilowatt single phase [illegible] belted alternator with exciter. [illegible] to carry the lighting load of the [illegible] equipment will be furnished by the Allis-Chalmers Company, Milwaukee.

Citizens in a section of the West End of Peoria, Ill., have become impatient with the [illegible] of the lighting company to extend its electric-light circuits to their houses and have decided to build a small plant of their own. A local paper of Peoria says that at a meeting of the citizens of the district $2,500 was raised, a lot was selected and plans were made to install a gasoline engine plant. "Twenty-five customers have already been signed up, and it is fondly hoped that eventually as many as 40 seekers of the true light may put down their names on the list," says the account.

Consul Ruffin of Asuncion has transmitted a copy of the recent act of the Paraguayan Congress calling for bids for the electric lighting of the capital city and for motive power. The city's decision to give the lighting over to a private company is thus rescinded and the city ordered to ask for public bids, which will be opened April 2d. This will afford an opportunity not only to American contracting electrician, but to a line of electric appliances for buildings and industrial plants as well. The complete translated text of the electric-lighting law can be examined at the Bureau of Manufactures in Washington.

ELECTRIC RAILWAYS

The Consolidated Railway Company has been granted a franchise for an electric street-railway system in Cottonwood Falls, Kan.

E. S. Alnut of Pueblo, Colo., has been granted a franchise for an interurban street railway entering Salina, Kan.

The City Council of Fort Smith, S. D., has granted a franchise for a street-railway system to Newbanks & Fisher.

Traffic of the Chicago and Oak Park Elevated railway for January continued the good record of 1905. The daily average of passengers carried was 47,921, against 44,668 for the corresponding month last year. The increase was 7.28 per cent.

The transaction by which the Illinois Traction System comes into possession of the Engel Manufacturing Company's site in Peoria, Ill., has been concluded and work on a large new power house for the interurban company will be begun soon.

In the annual report of a German street-railway company appears the following paragraph: "During the year 1905 our cars have run over and killed five sparrows, three dogs, one fowl; since the opening of the various lines the street cars have run over 10 sparrows, seven dogs, one cat, one goose, two ducks and one fowl."

The Detroit United Railway Company of Detroit, Mich., reports gross earnings for the year 1905 of $5,125,503, compared with $4,541,805 the year before. Operating expenses, taxes, etc., were $3,041,523 and $2,763,002, respectively, for 1905 and 1904. The car mileage in 1905 was 23,488,285, against 21,972,093 in 1904. Earnings per car-mile were 0.2182 cent

in 1905, against 0.2067 cent in the previous year. Expenses per car-mile were 0.1295 cent, against 0.1257 cent. Net earnings per car-mile were 0.0887 cent, against 0.810 cent in 1904.

The Southern Traction Company of Illinois has been incorporated, with principal office in East St. Louis. It is proposed to build in St. Clair County and through Washington, Clinton, Randolph and Perry counties, to Pickneyville, Ill. The incorporators include H. C. Begole of Belleville and W. E. Trautmann of East St. Louis.

Extensive improvements are under way and in contemplation by the Memphis Street Railway Company of Memphis, Tenn. The road is to be extended to East End Park, a summer theater, and a large number of new cars are to be put on. A new power house is to be erected and a 2,000-kilowatt generator will be installed.

There are only three small street-car lines in Porto Rico—one in San Juan, one in Ponce, and a very small line in Mayaguez. The lines in San Juan and Ponce use electric power. The number of men employed is extremely small. The pay of conductors ranges from 91 cents to $1.23½ a day, and the motormen receive from 82 cents to $1.15 a day.

G. W. Thompson and F. J. Randolph of Lewiston, J. W. Ramey and A. C. Eitzen of Nez Perce and Robert Jones of Grangeville, Idaho, are working in the interests of the Lewiston and Southern electric railway. They say that it is definitely decided to install a power plant on the Salmon River, where a site has been selected. Early commencement of construction work is promised.

The charter of the San Marcos-Luling Traction Company, with office at San Marcos, Texas, has been filed. It has a capital stock of $500,000 and its purpose is to build and operate an interurban electric railway between San Marcos and Luling. Judge J. W. Scott of St. Louis and a number of local capitalists of San Marcos and Luling are the incorporators. It will be about 23 miles long and will traverse the valley of the San Marcos River.

Birmingham (England) is committing itself further and further in its electrical undertakings. Application now has been made for permission to expend £132,690 more upon them. When the corporation took over the tramways there were then about 33 miles of single line in operation; by the time this money is expended there will be 64 miles. This work will all have to be executed during the next 18 months, as the corporation is to have the lines in operation within that period.

The Winona Interurban Railway Company of Winona Lake, Ind., will operate an electric railway from Warsaw to Goshen, Ind., about 27 miles, for which the right-of-way has been acquired and the grading completed. The Allis-Chalmers Company of Milwaukee will furnish the electrical equipment for the proposed line through the Electrical Installation Company of Chicago, in charge of the actual construction and installation. It is expected that the line will be in operation by April.

The executive committee of the American Street and Interurban Railway Association held a meeting at the association headquarters, 60 Wall Street, New York city, on February 6th. The meeting was called for the purpose of discussing a number of important matters relating to the association and affiliated bodies. Secretary B. V. Swenson presented a report covering the affairs of the association. At this meeting the committee approved the constitutions and by-laws of the affiliated associations. Other matters considered related to the distribution of the printed proceedings of the current year, the binding of past volumes and the privileges of associated membership.

The Illinois Traction System, which owns and operates the Danville Street Railway and Light Company, the Danville, Urbana and Champaign Railway Company, the Urbana and Champaign Railway, Gas and Electric Company, the Decatur Railway and Light Company, the Illinois Central Traction Company and the St. Louis and Springfield Railway Company, has recently purchased the Springfield and Northeastern Railroad Company, an unfinished interurban line between Springfield and Bloomington, Ill., about 60 miles, of which 30 miles have been graded. Construction will begin at once between Springfield and Lincoln, thus completing another link in the line this company is building from St. Louis to Springfield.

The Buffalo Subway Railroad Company of Buffalo, N. Y., has been incorporated with a capital of $1,000,000 to operate a street railroad, wholly or partly underground, by electricity in Buffalo. The road is to extend from a point on Carolina Street southwest of the lands of the New York Central and Hudson River Railroad Company, thence easterly beyond the easterly city line to a point about 2,000 feet beyond the lands of the Terminal railway of Buffalo in the town of Cheektowaga. A branch will run from the main line at William Street and Fillmore Avenue to the intersection of Curtiss and Lovejoy streets. The directors are Albert W. Bonynge and Theodore B. Chancellor of Hoboken, N. J.; Frederick B. Bard, Henderson Peck, Roscoe P. Peck, Edward McInnes and Harry M. Spencer of New York city, and Frank S. McGraw and William B. Cutler of Buffalo.

PUBLICATIONS.

The Westinghouse Companies' Publishing Department has issued in pamphlet form three important papers, one upon "Gas Power for High-pressure City Fire Service," by J. R. Bibbins, and both the others upon the subject of gas power in electric-railway work. The last two are papers that were read before the American Street and Interurban Railway Association at the Philadelphia convention. They are "Notes on the Design of Large Gas Engines with Special Reference to Railway Work," by Arthur West, and the "Application of Gas Power to Electric Railway Service," by J. R. Bibbins. The two are bound in one pamphlet and the discussion upon the two papers is included.

The Aiton Machine Company of 126 Liberty Street, New York city, has just issued its bulletin No. 2 describing its eight-drum stranding machine. This machine carries spools 12 by eight inches at a speed of 200 revolutions per minute. The entire machine is mounted on a stiff bed plate and is equipped throughout with cut gearing.

The Allis-Chalmers Company is about to issue Bulletin No. 1051, "Alternating-current Generators, Belted Type." While direct-connected alternators have largely displaced belted machines in modern power stations, there are many places, particularly in comparatively small installations, where belted units are desired. Belted machines are easily connected to the existing source of power, as, for example, a line shaft used for driving other machinery, and for these installations of lesser size they are lower in first cost than direct-connected apparatus. The Bullock machines described in this bulletin are adapted to a wide range of output.

MISCELLANEOUS.

An authority in the United Kingdom says that it seems probable that the future development of the electric furnace will be in combination with some form of continuous open-hearth process, in which molten pig iron is first converted into "molten scrap steel" in a gas-fired furnace and then transferred in the molten state to the electric furnace for final purification.

The ship physician of the Hamburg-American liner Patricia publishes his account of a method for treating seasickness by means of an electric-vibration chair. Six of these chairs were placed aboard the Patricia and connected with the electric-light circuit. The sedative effect on the patient when vibrated in the chair was noticeable, reducing the pulse and nervous excitement. The use of these electric chairs will be extended to other steamers, it is said.

A new world's record for automobiles was made by H. B. Marriott in a Stanley steam car at Ormond, Fla., recently. One mile was made in 28 1-5 seconds, or at the rate of 127.66 miles an hour. This is probably the fastest official time on record for any contrivance driven by man. During the high speed electric-railway trials of the German government near Zossen, Germany, in an unofficial trial 131 miles an hour was reached. The highest official speed, however, was four or five miles at the rate of 125 miles an hour.

The United States Circuit Court of Appeals has decided that the city of Indianapolis has a legal right to purchase and operate the plant of the Consumers' Gas Trust Company, and reversed the decree of the court in Indianapolis which restrained the city from purchasing the plant. The franchise of the company has expired, and suit to wind up its business was started by Byron C. Quinby. The decree in this suit, allowing the termination of the business of the company, the natural gas having been exhausted, was confirmed by the Court of Appeals. The city of Indianapolis asserted the right to become the exclusive purchaser of the gas plant.

A prize contest has been organized by the Hydraulic Power Syndicate of Grenoble, France, relating to a current-limiting device for use in electric-light or power stations. In a system of distribution, branch circuits to subscribers are to be limited to a certain power the maximum of which is determined in advance. If the maximum is exceeded the device must notify the subscriber that he may return to the condition of his contract without causing trouble upon the whole system. A complete description is to be sent before April 1st to the Siège Social du Syndicat des Forces Hydrauliques, 63 Boulevard Haussmann, Paris; also (if accepted) two apparatus, which are to be tested on the line and in the laboratory. A prize of 2,000 francs ($400) is to be awarded for the best device.

The Bureau of Labor is preparing a report covering the various systems of workingmen's insurance and employers' liability both in this country and abroad. The report will cover insurance against sickness, accident, disability, old age, death and unemployment. The bureau is endeavoring to secure information concerning mutual relief or insurance funds organized and maintained by the employes of an industrial establishment, or relief funds supported either wholly or in part by the employers themselves. It is desired to obtain, wherever possible, copies of constitutions, rules and by-laws, blank-certificate forms and any other matter relating to funds of this character. In the absence of other data the name and location of establishments in which such funds exist are desired. Information should be sent to Charles P. Neill, commissioner, Bureau of Labor, Department of Commerce and Labor, Washington, D. C.

An interesting method of cutting an irregular box cam is described by the Chicago Pneumatic Tool Company. The cam was to be cut in the Cleveland plant of the company, and as the groove was located very close to the center of the gear at one point and close to the rim at another, no single tool could be used to cut it, as it was necessary to have the sides absolutely parallel. Not having a machine particularly adapted to the work, an emergency method was devised consisting of a block mounted on the slide of an engine lathe in which a milling cutter was free to revolve. A master cam was attached to a mandrel with a gear in proper relation to it. As the lathe revolved slowly (the slide rest having previously been disconnected from the cross-feed screw) the milling cutter arbor was kept in contact with the master cam by means of a weight fastened to the end of the cross-feed slide. The cutter arbor in contact with the master cam was the same diameter as the milling cutter used; this insured an absolutely parallel slot. A Little Giant drill was used for driving the cutter.

TRADE NEWS.

Curtis & Curtis of Chariton, Iowa, have sold their electrical supply business to Veirs Bros.

Announcement is made of a change in address of the Salt Lake City branch office of the Allis-Chalmers Company, of which Mr. Frank E. Marcy is district manager. The offices have been removed to the Dooly Building at 117-119 East Second South Street, where they are centrally located.

On March 1st Dodge & Day will remove to their new offices, located in the Drexel Building, Fifth and Chestnut Streets, Philadelphia, in order to be nearer to the financial center as well as to obtain more commodious quarters. This step is the natural result of the rapid growth of their engineering business.

The Westinghouse Machine Company filed a bill of complaint on February 9th, in the Circuit Court of the United States for the District of New Jersey, against the Allis-Chalmers Company, alleging that the Allis-Chalmers Company, in the manufacture and sale of its turbine, is infringing patent No. 655,414, issued to Mr. Charles A. Parsons, on August 7, 1900.

Dossert & Co., manufacturers of connections for electric wires, gas and water pipes, announce their removal to their new factory and offices at 242 West Forty-first Street, New York, where they will have quarters more suitable to their increasing business. They are making radical changes and installing many improvements in their manufacturing system that will largely increase production, improve the quality of the goods and enable the firm to make prompt deliveries hereafter of all orders.

The American Electric Company of New Jersey and the Missouri American Electric Company of Missouri announce that they have arrived at an understanding with the General Electric Company and the Edison Electric Light Company, whereby all litigation between the parties has been terminated, the first two companies having the right to use all the patents used by the licensed manufacturers of incandescent lamps. The American and Missouri companies add that they are "entirely and absolutely free from entangling alliances," their "claim of independence being fully and unalterably established."

The Interborough Rapid Transit Company of New York has just placed an order with the Electric Cable Company of New York for 15 miles of cables insulated with Voltax, the new potential insulating compound which has just been placed on the market. This compound, which for the last eight years has been given severe tests, is rapidly coming into prominence. Recent tests of the material made by the Electrical Testing Laboratories of New York show, it is said, that this material can withstand a voltage 100 per cent. greater than rubber insulation and has withstood high-potential insulation, resistance and melting-point tests that no other compound yet discovered has withstood.

Following the custom of several years past the branch managers and salesmen of the H. W. Johns-Manville Company met in New York last week for

their annual convention and banquet. About 150 men were present. The object of the convention was for the purpose of general discussions in reference to the business of the company and to enable the various representatives to get acquainted with one another. After sessions lasting four days the convention wound up with a farewell dinner at the New York Athletic Club on Friday evening, February 2d. The H. W. Johns-Manville Company is well known as a manufacturer of asbestos and magnesia products and electrical materials. Representatives were present from the branches in Milwaukee, Chicago, Boston, Philadelphia, St. Louis, Pittsburg, Cleveland, San Francisco, Los Angeles, Seattle, Kansas City, Minneapolis, Little Rock and New Orleans. The headquarters of the company are in New York city.

The fourth annual report of the president to the shareholders of the Chicago Pneumatic Tool Company for the year ended December 31, 1905, shows the largest sales since the company was organized. Profits realized amounted to 9.15 per cent., available for dividends, of which four per cent. has been appropriated for dividends declared, and the remainder, amounting to $315,134.39, has been carried to surplus account as additional working capital required on account of the [illegible] and the increasing [illegible] transacted. During the [illegible] Pneumatic Tool Company, Ltd., [illegible] developing the organization [illegible] plant, Scotland, and [illegible] at the present time it is [illegible]. Foreign operations have been [illegible] during the last year by the [illegible] International Compressed Air and Electric Company, Berlin, which company acquired the [illegible] Isaac G. Eckstein, and [illegible] nental operations. The company during the year acquired the business of the Philadelphia Pneumatic Tool Company, Philadelphia, and the [illegible] plant of the Canadian Pneumatic Tool Company, Ltd., Montreal, Canada, which company is now conducting the Canadian business. Of the authorized issue of $2,500,000 bonds, $200,000 are in the treasury and $208,000 have been retired for sinking-fund purposes, leaving the outstanding issue $2,092,000. In addition to the assets acquired through the foreign organizations, approximately $350,000 have been spent in permanent betterments to plants, all of which has added to the securities [illegible]

BUSINESS

[illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 6, 1906.

811,533. Control of Automobile Motors. Edward H. Anderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 29, 1905.

The vehicle motor has two field windings, a resistance and a controller having contacts, being arranged to connect the motor to the source of current supply with the field windings in series with each other, then connect the field windings in parallel with the resistance, then shunt one of the field windings, then remove the resistance and cut out the latter field winding without opening the shunt and finally connect the idle field winding in parallel with the remaining field winding.

811,538. Electrolytic Electricity Meter. Charles O. Bastian, London, England, assignor to the Bastian Meter Company, Limited, London, England. Application filed March 10, 1904.

In an electrolytic meter are combined an elctrolyte, electrodes mounted therein and a scale supported by the electrodes and arranged to measure the column of the electrolyte.

In an electric-wave detector are electrodes in a magnetic field and bridged by magnetizable conducting particles, with means of producing motion between the electrodes.

811,656. Spark Coil. Charles P. L. Noxon, Syracuse, N. Y. Application filed September 26, 1904.

A primary circuit, a secondary circuit, means for interrupting the current in the primary circuit, means for holding the first-mentioned means in its position assumed when the current is interrupted thereby and mechanical means for making and breaking the primary circuit are the characteristic features.

811,673. Electrical Brush Holder. Moffat St. Clair, Fort Wayne, Ind. Application filed March 27, 1905.

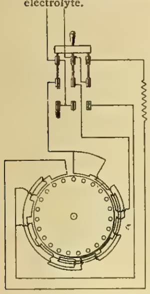
A supporting casting has in connection with it a rest, a guide slot in the rest, a contact plate in connection with a brush, the former ranging in the slot and the latter seated upon the rest, a retracting spring having connection with the casting and also with the contact plate and acting to hold the brush against the rest, and an adjustable spring acting against the top of the brush to hold it in contact with the commutator. (See cut.)

In combination with a [illegible] induction motors [illegible] wheels of the [illegible] motormen [illegible] means for adjusting the [illegible]

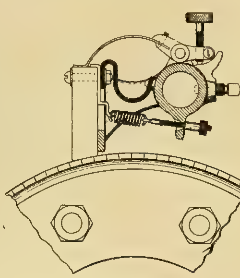
811,759. Electrodeposition. William C. [illegible], Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 25, 1904.

The process of electrodeposition [illegible] alternating current between [illegible] tion of a platinum salt, [illegible] solution being such that the [illegible] by the current will not substantially [illegible] metal.

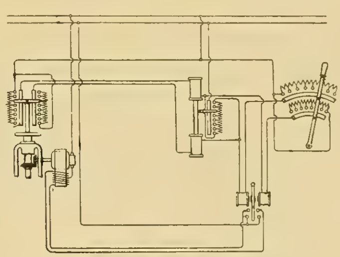
811,766. System of Motor Control. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 1, 1904.



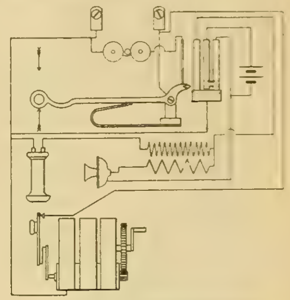
NO. 811,644.—SINGLE-PHASE ALTERNATING-CURRENT MOTOR.



NO. 811,673.—BRUSH-HOLDER.



NO. 811,773.—REMOTE-CONTROL APPARATUS.



NO. 811,972.—TELEPHONE SYSTEM.

811,539. Electrical Control System. Ralph E. Bates, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 1, 1905.

Electromagnets operate the motor controller, a master controller comprising terminal pieces and conducting segments that are respectively connected to the windings of the electromagnets and that are separated and insulated from each other and engage all but one of the terminal pieces.

811,589. Electric Time Switch. Clyde O. Shatto, Sharon, Pa., and Linus S. Denison, Ravenna, Ohio. Application filed June 18, 1903.

Details are described.

811,644. Single-phase Alternating-current Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 27, 1904.

A single-phase induction motor has a main primary winding comprising two portions, means for connecting the portions in series for starting and in parallel for running and at the same time changing the number of magnetic poles produced by the winding, and an auxiliary winding having a different time constant from that of the main winding. (See cut.)

811,645. Electrical Measuring Instrument. Edwin E. Lehr, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 21, 1903.

In an electrical measuring instrument are an iron core comprising two approximately concentric rings connected together at one side and a stationary winding on a portion of the core. There are also a movable coil surrounding a portion of the core, means for opposing the movement of the movable coil and means for indicating the degree of the movement.

811,654. Electric-wave Detector. Thomas J. Murphy, New York, N. Y. Application filed December 17, 1904.

811,680. Controller for Sparking Devices of Gas Engines. Daniel B. Willix, Alexandria Bay, N. Y., assignor of one-half to George W. Willix, Alexandria Bay, N. Y. Application filed April 24, 1905.

In a gas engine are means for controlling the current to the igniters, comprising a set of contact terminals for each igniter, each set consisting of contact terminal connected in a primary circuit of an induction coil, and contact terminals connected in the secondary circuit of the coil and to the igniter. All of the contacts are arranged in a single row, and means operating with the main shaft of the engine close the contacts.

811,691. Party Telephone Line. Edward A. Buell, Dekalb, Ill. Application filed March 17, 1905.

Each of the subscribers' stations of the party line include selecting switching mechanism having a magnet in circuit relation with the line, a ratchet wheel, a pawl operated by the magnet to escape the teeth of the ratchet wheel, a spring operating upon the pawl to cause it to move the ratchet wheel, and a second magnet governing the circuit of the first magnet.

811,692. Party Telephone Line. Edward A. Buell, Dekalb, Ill. Application filed May 1, 1905.

A subscriber's station equipment includes a signal receiver, a signaling generator normally in operative relation with the signal receiver and switching mechanism operated by the signal receiver and serving to control the association of the telephone, signal receiver and generator with the line.

811,702. Initiating Apparatus. Lewis D. Cook, Mount Holly Springs, Pa. Application filed April 10, 1905.

Electric lamps form a part of the initiating device, being displayed by the rotation of a revoluble member.

811,758. Induction-motor Control. Albert H. Armstrong, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 28, 1905.

A switch for determining the direction in which current passes through the motors and for controlling the series and parallel motor connections is associated with a number of operating devices acting in succession to produce successively series and parallel motor connection, the order in which the operating devices are actuated determining the direction of rotation of the motors.

811,773. System of Distant Electrical Control. Joel Gomborow, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 14, 1904.

A relay controls the motor and has opposed electromagnets. Rheostats are in circuit with the magnets and means simultaneously vary the rheostats in inverse ratio. There is also a rheostat in circuit with both magnets and means for automatically varying the portion in circuit with each magnet in accordance with the movement of the driven machine. (See cut.)

811,778. Insulating Material. Charles C. Hall, Alexandria, Ind. Application filed May 11, 1905.

An insulating material consists of a commixture of asbestos and ground wood pulp in the proportion of 92 per cent of asbestos and 8 per cent of wood pulp, and an oleaginous substance with which the compound is permeated throughout.

811,792. Dynamo-electric Machine. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 7, 1904.

An annular core has conductors projecting from it and is surrounded by a casing. Brackets are formed on the casing, a ring being supported by the brackets against which the projecting conductors rest. A ring concentric with and surrounding the first-mentioned ring engages the outer edges of the conductors.

811,795. Wall Receptacle. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 19, 1902.

A receptacle comprising a base of insulating material has a central and two end cavities in its upper side, a

contact sleeve and center contact being secured in the central cavity. A binding post is secured in each of the end cavities and electrically connected to the sleeve and center contact respectively, and a face plate is connected to the base and provided with a central opening and a lid.

811,796. Snap Switch. Howard G. Sargent, Schenectady, N.Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 5, 1904.

In a quick-break switch are combined a contact post and a clip secured to the top of the post, and consisting of a middle portion having integral overlapping end portions folded over in opposite directions.

811,819. Thermoelectric Couple. William H. Bristol, New York, N. Y. Application filed June 30, 1905.

Associated with an indicating or recording instrument is a thermo-electric couple comprising a primary section and a secondary section and means adapted to connect the primary and secondary sections between the hot and cold ends of the couple.

811,822. Automatic Circuit-breaking Safety Appliance for Use in Trolley-wire Systems for Electric Traction. James Carter, Stalybridge; George Hall, Manchester, and Arthur Parsons, Leeds, England. Application filed October 29, 1904.

The mechanical features are described.

811,836. Electrical Hose-signaling Apparatus. William Fowler, Colorado Springs, Colo. Application filed June 14, 1904.

An arrangement by which signals may be transmitted electrically along a line of hose is described in the patent.

811,837. Support for Incandescent Lamps. Edwin R. Gill, Yonkers, N. Y. Application filed January 17, 1905.

Features of a wall or ceiling socket are set forth.

811,859. Electric Resistance Element. Albert L. Marsh, Lake Bluff, Ill., assignor to the Hoskins Company, Chicago, Ill. Application filed March 15, 1905.

An electric resistance element is composed of a metal alloy consisting of one of the metals of the chromium group, in the proportion of less than 50 per cent of the element, and more than 50 per cent of metal having the properties of nickel and cobalt.

811,865. Centrifuge Attachment for Electric Fans. William L. Moore, Honolulu, Hawaii. Application filed June 15, 1905.

An attachment for electric fans comprises a socket to receive a test tube and means for securing the socket to a fan blade.

811,903. Announcing Device for Railway Cars. Arthur D. Cloud, Davenport, Iowa. Application filed April 1, 1905.

A car provided with a laterally swinging trolley pole carries an electrically actuated announcing device, a switch for controlling the circuit that operates the announcing device and an electromagnet carried by the trolley pole for operating the switch.

811,906. Electric Coupling. John J. Dossert, New York, N. Y., assignor to Dossert & Co., New York, N. Y. Application filed August 17, 1904.

Coupling sections having conductor-receiving openings are associated with an intermediate coupling section having a conductor-receiver opening. Split sleeves having oppositely tapered ends are housed between each of the end coupling sections and the intermediate section and means for drawing the end sections toward the intermediate section to compress the split sleeves and force them into close mechanical and electrical contact with conductor ends are provided.

811,907. Branch Coupling for Electric Conductors. John J. Dossert, New York, N. Y., assignor to Dossert & Co., New York. Application filed February 9, 1905.

A branch coupling for electric conductors consists of a hook provided with a shank, the hook constituting one member of a clamp. A member mounted on the shank and formed with a clamping portion directly opposed to the hook is movable to bring the clamping portion in clamping relation to the hook. Means are provided whereby the member is removable from the shank by lateral movement with relation thereto and means on the shank to move the member.

811,908. Split-sleeve Connector. John J. Dossert, New York, N. Y., assignor to Dossert & Co., New York, N. Y. Application filed February 9, 1905.

As an element of a coupling for the ends of conducting wires or cables, a conducting split sleeve is formed in interlocking sections, each section composed of segments having flexible connections between them.

811,913. Electric Gun. Samuel T. Foster, Jr., Victoria, Mexico, assignor of three-fourths to Obed C. Billman, Lodi, Ohio. Application filed December 10, 1902.

A series of electromagnets along the barrel of the gun furnish the necessary propelling force for the projectile.

811,919. Trolley Replacer. Robert B. Higgins, St. Louis, Mo. Application filed August 14, 1905.

Combined with a trolley wire is a member having a shoulder extending longitudinally thereof and adjacent to and below the wire, the shoulder widening laterally throughout its length and provided along its outer longitudinal edge with a downturned flange.

811,956. Electrical Measuring Instrument. Maurice C. Rypinski, New York, N. Y. Application filed March 15, 1905.

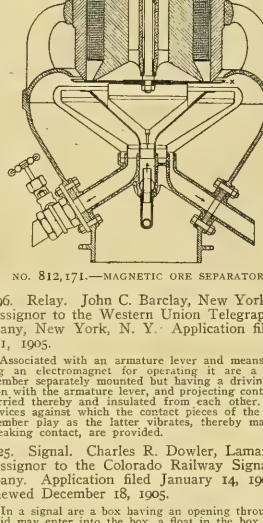
In an electrical measuring instrument there are a stationary coil, a receptacle containing a damping fluid supported within the coil, a moving system comprising magnetic members suspended within the receptacle and an indicating needle supported exteriorly of the receptacle.

811,959. Automatic Controlling Device for Gas Stoves. William B. Schofield and Millard P. Osbourn, Merchantville, N. J. Application filed February 27, 1905.

Combined with a bracket having a clamping device for detachable attachment to the stove is a movable primary actuating device carried by the bracket and adapted to be actuated by the weight of a vessel placed upon it. A valve controls the fuel supply to the burner and there are power transmitting connections between the valve and movable primary actuating device. Igniting devices carried by the bracket are controlled by the movement of the primary actuating device.

811,972. Telephone System. Elmer A. Terpening, Geneseo, Ill. Application filed September 3, 1903.

In a telephone set are a transmitter, a receiver, a switch hook and means, including circuit connections, whereby the switch hook, when in one position, connects the receiver and transmitter in closed local circuits, and when in another position operatively connects the transmitter and receiver to transmit and receive over the line.
(See cut on preceding page.)



NO. 812,171.—MAGNETIC ORE SEPARATOR.

811,996. Relay. John C. Barclay, New York, N. Y., assignor to the Western Union Telegraph Company, New York, N. Y. Application filed July 11, 1905.

Associated with an armature lever and means comprising an electromagnet for operating it are a vibrating member separately mounted but having a driving connection with the armature lever, and projecting contact pieces carried thereby and insulated from each other. Contact devices against which the contact pieces of the vibrating member play as the latter vibrates, thereby making and breaking contact, are provided.

812,025. Signal. Charles R. Dowler, Lamar, Colo., assignor to the Colorado Railway Signal Company. Application filed January 14, 1905. Renewed December 18, 1905.

In a signal are a box having an opening through which fluid may enter into the box, a float in the box, a circuit closer adapted for operation through rising action of the float, an electrical circuit having a battery and signal device therein and means whereby the circuit closer may be held set for operation through suitable connection, upon the next rising action of the float.

812,038. Regulation of Electric Currents which Feed Electric Arcs. Johannes Hessberger, Ludwigshafen-on-the-Rhine, Germany, assignor to Badische Anilin and Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. Application filed November 22, 1904.

The process of supplying currents to a number of circuits containing arcs suitable for the production of compounds of nitrogen and oxygen with the minimum displacement of phase consists in generating an alternating current, supplying therewith the primary of a transformer and an arc and feeding a different arc with the secondary current from the transformer.

812,089. Electric Transformer and Connections. Herbert F. Provandie, Melrose, Mass. Application filed November 11, 1904.

Details of a high-power induction coil are set forth.

812,117. Electrically Actuated and Controlled Self-playing Musical Instrument. George H. Davis, West Orange, N. J. Application filed March 29, 1904.

An electrically controlled playing attachment for musical instruments embodies a number of electromagnets, a dynamo forming a part of the attachment, circuit connections between the dynamo and the magnets and a prime motor for driving the dynamo.

812,125. Telephone-transmitter Arm. William D. Gharky, Philadelphia, Pa. Application filed March 7, 1901.

Mechanical features are set forth.

812,126. Lightning Arrester. William Gifford, Thompsonville, Mich., assignor of one-half to E. M. Dixon, Thompsonville, Mich. Application filed May 25, 1905.

The lightning arrester is made up of a series of insulating tubes adapted to hold a non-inductive material, metallic caps fitted to the ends of the tubes and a bar connected to corresponding caps. A binding post projects from the bar and a line wire is connected to the post. Means are provided for holding the bar to the caps, a series of plugs having shank portions being fitted to the caps at the lower ends of the tubes. A carbon rests upon the bottom of the tubes, and carbon dishes screw into the ends of the tubes.

812,142. Facsimile Telegraph. Edward E. Kleinschmidt, New York, N. Y., assignor to Frederick Kleinschmidt, New York, N. Y. Application filed January 18, 1901.

A facsimile telegraph comprises means for holding a message sheet, a number of styluses arranged to travel in a straight line over a single individual and legibly separate line of the message, means for causing successive lines of the message to be intermittently presented to and to be traversed by the styluses and means for connecting the styluses to a single line wire.

812,164. Contact Box for Electric-railway Systems. George L. Campbell, Williamsport, Pa., assignor to the Railways Surface Contact Supplies Company. Application filed December 30, 1904.

In contact boxes for electric railway systems are a casing formed with internal lugs, a box within the casing and insulated therefrom, the box having means cooperating with the lugs to hold it and the casing in proper relative position, and the spaces between the box and casing being filled with an insulating viscous sealing medium.

812,170. Apparatus for Magnetic Separation of Iron Ore. Gustaf Gröndal, Djursholm, Sweden. Application filed November 12, 1903.

Apparatus for magnetically separating ores consists of a magnet, a moving surface under the magnet pole and two compartments. The first compartment is adapted to receive the ore suspended in water and to overflow it into the second compartment, the two adapted to maintain the body of liquid with a surface level in proximity to but out of contact with the moving surface under the magnet pole. An outlet for the non-magnetic material from the lower part of the second compartment and a channel to carry off the magnetic material which has been drawn out by the water are provided.

812,171. Magnetic Ore Separator. Gustaf Gröndal, Djursholm, Sweden. Application filed November 3, 1904.

A magnetic separator for ore suspended in water comprises an electromagnet with its pole pieces directed downward, a horizontal rotary disk beneath the poles and means for feeding ore suspended in water upward from below toward the disk and horizontally in close proximity to it, but out of contact. (See cut.)

812,172. Magnetic Separation of Iron Ore. Gustaf Gröndal, Djursholm, Sweden. Original application filed November 12, 1903. Divided and this application filed December 3, 1904.

The process of separating pulverized ore consists in suspending the ore in a body of liquid, maintaining the surface level of this liquid substantially horizontal under a moving surface in proximity to but free from contact with the surface of the liquid and magnetically lifting the more magnetic particles out of the water to the moving surface.

812,173. Magnetic Ore Separator. Gustaf Gröndal, Djursholm, Sweden. Original application filed November 3, 1904. Divided and this application filed April 7, 1905.

A magnetic separator for powdered ore suspended in water contains an upright cylindrical electromagnet having its pole pieces directed downward in the shape of concentric rings, beneath the pole pieces a rapidly rotating disk mounted on a vertical shaft and beneath the disk two annular vessels concentric to each other, an inlet for the fluid to the outer vessel and an adjustable discharge at the bottom of the inner vessel, the space inside the inner annular vessel being provided with an outlet for the fluid.

REISSUE.

12,449. Electrically Propelled Vehicle. Russell Thayer, Philadelphia, Pa. Application filed July 29, 1905. Original application dated July 5, 1904.

An automobile provided with an electric motor and a storage battery has wheels constructed and arranged to traverse the tracks of a railway supply system, with the motor in operative connection with the system and the battery connected to be charged thereby. At other times the vehicle traverses a trackless roadbed independently of the system, with the motor in operative connection with the battery

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on February 12, 1906:

397,489. Method of Protecting the Negative Plates of Electrical Batteries. F. J. Blamer and J. G. Hendrickson, Philadelphia, Pa.

397,492. Brush for Electric Generators. R. Eickemeyer, Yonkers, N. Y.

397,526. Galvanic Battery. C. M. Thompson, Brooklyn, N. Y.

397,537. Electrical Stop-motion Mechanism for Knitting Machines. E. G. Conrei, Valatie, N. Y.

397,538. Electric Meter. H. H. Cutler, Newton, Mass

397,548. Telethermometer. C. G. Hoffmann, Leipsic, Saxony, Germany.

397,550. Dynamo-electric Machine. R. M. Hunter, Philadelphia, Pa.

397,553. Electric Coupling for Railway Train Signaling. W. C. Johnston, Jr., Lynn, Mass.

397,557. Secondary Battery Plates. E. R. Knowles, Brooklyn, N. Y.

397,594. Electromagnetic Grain Scale. W. A. Holley and U. Main, Holand, Mich.

397,607. Process of Preparing Electrodes for Secondary Batteries. L. Paget, New York, N. Y.

397,608. Electrode for Secondary Batteries. L. Paget, New York, N. Y.

397,613. Regulation of Dynamos. E. W. Rice, Jr., Lynn, Mass.

397,616. Regulating and Motive Device for Alternating Currents. E. Thomson, Lynn, Mass.

397,650. Secondary Battery. W. Kingsland, Gunnersbury, County of Middlesex, England.

397,702. Electric Motor. J. P. Denison, New Haven, Conn.

397,795. Method of Winding Field Magnets. T. E. Edison, Llewellyn Park, N. J.

397,715. Safety Device for Electrical Circuits. W. J. Hamer, Boston, Mass.

397,729. Automatic Switch for Electric Arc Lamps. E. R. Knowles, Brooklyn, N. Y.

397,734. Electric-light Carbon. H. S. Rheiner, Camden, N. J.

397,773. Regulating Switch for Electric Motors. H. H. Blades, Detroit, Mich.

397,790. Electromagnetic Attachment for Eye Glasses. F. Fear, New York, N. Y.

397,796. Storage-battery Plate. C. D. P. Gibson, New York, N. Y.

397,806. Battery for Electric Belts. W. G. Johnson, London, England.

397,817. System of Synchronizing Electric Motors. F. J. Patten, New York, N. Y.

397,826. Electric Switch. A. Edwin Andrews, Hartford, Conn.

397,838. Electric Signaling and Alarm Apparatus. W. L. Denio, Rochester, N. Y.

397,857. Apparatus for Heating Cars by Electricity. R. M. Hunter, Philadelphia, Pa.

397,875. Overhead Line for Electrical Railways. F. J. Sprague, New York, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Transmission Line from Niagara Falls to Syracuse.

By Orrin E. Dunlap

A power-transmission line that may become the greatest in the United States is being constructed from Niagara Falls, N. Y., to Syracuse in the same state. Syracuse is 157 miles east from Niagara Falls, and for this entire distance the new transmission line will run through a thickly populated section of country in which there are numerous cities and villages that would like to be supplied with electricity from Niagara. This power line is being erected by the Niagara, Lockport and Ontario Power Company, which company will receive its power supply from the station of the Ontario Power Company at the water's edge in the gorge on the Canadian side of the river. The Ontario Power Company is understood to be under contract with the Niagara, Lockport and Ontario Power Company to deliver it power in large blocks at the international boundary line. Extending from the transformer or distributing station of the Ontario Power Company on the Canadian side of the river, the Ontario Power Transmission Company, Limited, has built a transmission line northward beyond the city of Niagara Falls, Ont., to a point below Foster's Flat, on the Canadian side, or better known by the name of "Devil's Hole" on the New York side.

At this point the cables of the line drop from the towers to cantilever arms that project out from the edge of the high bank and then drop to steel towers located near the water's edge in the gorge. From the top of the towers on the Canadian side to the top of similar steel towers on the New York side, the span is about 600 feet, and the cables are stretched over the river. Passing the towers on the New York shore, the cables run up to cantilever arms projecting over the edge of the high bank. At this point the cables pass over the Lewiston track of the New York Central, built midway between the top of the high bank and the water's edge. At the outer edge of the track three steel towers have been erected, and these are connected by wire at the top to prevent the cables dropping on to the track in case of accident. At the top of the high bank on the New York side the cables pass to poles and onward to a double row of steel towers that extend eastward to Rochester. These towers are placed at intervals of 750 feet, and are of tripartite construction, the three legs being of 2½ inch tubing filled with concrete and sunk five feet below the surface of the ground in concrete footings. The total weight of each tower is about 2,800 pounds. It is said that the greatest possible strain to which the towers will be subjected is about 4,700 pounds, which considers the weight of the cables, a wind of 100 miles an hour, and a coating of ice or sleet. From Niagara Falls to Lockport the company's right-of-way is 300 feet wide. From Lockport to Rochester it is 200 feet wide, and from Rochester to Syracuse it is 100 feet in width. In all, there will be about 1,500 steel towers on the work, and in addition to these there will be something like 2,500 "A" frames between Rochester and Syracuse, which will serve in place of the towers for the cable supports, along a railroad, until the private right-of-way has been perfected. The steel towers are about 55 feet high, and at a height of 49 feet they have an arm which supports two insulators, the third insulator being on the apex of the tower, as seen in the accompanying illustration. The insulators have two petticoats and a hood, the latter being the largest, and having a diameter of 14.5 inches. Each insulator is about 28 inches high and has a weight of about 75 pounds.

The cables on this transmission line are of aluminum, and where they cross the Niagara River are nine in number. Each cable is made up of 19 No. 5 wires. The nine cables provide for three three-phase transmission systems, and up to the present time six cables have been run eastward from Niagara Falls to Lockport, where a transformer station is being built on the Ernest farm. [illegible] to West Seneca [illegible] 200 feet wide. [illegible] Holley, [illegible] Rochester. [illegible] of Rochester at Mortimer, a small station. A substation will be located at Mortimer [illegible] point the cables will extend [illegible] right-of-way on "A" frames to Syracuse. The frames are nearly 50 feet high and will be set 220 feet apart. [illegible]

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ALUMINUM CABLES TO TRANSMIT ELECTRIC POWER GENERATED AT NIAGARA FALLS FROM CANADA TO THE UNITED STATES OVER NIAGARA RIVER. (THE SPAN IS 600 FEET).

their shape. Other transformer or distributing stations will be located at desirable points.

As there are 19 aluminum wires in each cable, it will be interesting to know the number of miles of wire to be used in all the cables to be erected on the main and branch lines, and it is safe to assume that it will be 10,000 or 12,000 miles, possibly more. The aluminum cables of this transmission across the Niagara gorge are the only cables that cross or span the gorge in this way, as the connection between the stations of the Niagara Falls Power Company and the station of the Canadian Niagara Power Company is made by cables run across the upper steel-arch bridge. A bill has been introduced in the New York state Legislature providing for the construction of a bridge across the river near where this transmission line crosses, but the men named as commissioners of the company have no connection with the power interests. However, should the bridge be built, provision might be made for carrying transmission cables over it.

It is intimated that in transmitting Niagara power to Syracuse, it is not expected to have a loss of more than 7½ per cent. The agreement the Ontario Power Company, as well as the other Canadian Niagara power companies, has with the Ontario government, through the commissioners of Victoria Park, permits of the transmission of one-

half of its product to the United States, but the agitation in the United States for the preservation of Niagara has aroused some of the residents of the Dominion to believe that the United States has no right to ask that the power development on the Canadian side be stopped.

A Canadian View of the Niagara Power Situation.

The Western Electrician has received from Mr. J. A. Macdonald of Ottawa, Canada, a communication in relation to the Niagara power situation which gives a Canadian view and seems to hint at future international bargaining. While the case is not so one-sided as this gentleman seems to think, the statement and argument given are at least interesting and will be read with attention.

Beginning with the announcement that the Ottawa Board of Trade will soon put itself on record as being strongly opposed to allowing power at Niagara Falls to be transmitted across the border except under short contracts, Mr. Macdonald proceeds:

"The complication of interests concerning water from Niagara Falls is much more intricate than seems generally understood. Everybody knows that the flow over the cliff has been slightly, even perceptibly, diminished; that it is likely to be much more notably lessened soon, and that the industrial interests may divert all the water in time, if not prevented. But the people do not know that the popular demand for preservation is often loudly voiced by persons stimulated by the existing power companies, who are striving to consummate and maintain a monopoly, and are sure to go in for further exploitation later if they are not barred off perfectly. But it is not in the esthetic nor the public interest that opinion should become prejudiced against projects for taking Niagara water by canal to some point near Lockport, and there employing it at much greater head than is now employed in using Niagara water. The ultimate problem of conserving the Falls must be very much that of using a greater head than is now utilizing the amount of water already or soon to be diverted. It is being wasted by use at from 130 to 135 feet head; it could be used at 250 to 300 feet head. Were it thus used the water now granted would supply all the power likely to be sought for a long time.

"There is a lot of loose talk about an international treaty for Niagara preservation. This comes of the obvious lack of power in New York state and in Ontario to agree firmly and permanently upon a preservative policy. It is preposterous to imagine that Sir Wilfrid Laurier will fail to bargain shrewdly and tenaciously for those material and political interests that would be given away by an international agreement securing the present power situation, or by conceding gratis to New York or to the United States an equality in Niagara exploitation.

"About one-thirteenth of the river minimum flow is being diverted from the cliff, and passed around the falls into the lower river by tunnels. The power companies are now rapidly installing more plants, with design to utilize soon one-fifth of the minimum flow. Such additional concessions are sought, and such sites for future water drafts authoritatively located, that diversion of 67 per cent. of the minimum or 50 per cent. of the maximum flow is clearly meditated. The demand for Niagara power swiftly increases, and will probably increase more swiftly. It may not, during the next few years, overtake the supply of 615,000 electrical horsepower that could be collectively generated by the various plants now installed or in course of installation. But, meantime, imminent competition seems likely so to lower the price of electric power as to attract to the Niagara region many of the new industrial establishments that are ever arising from the rapid increase of population in the republic and in the Dominion, as well as many of the going concerns whose owners contemplate, from time to time, renovation or enlargement of plant.

"Again, because the Niagara region is populous, steam railways within it run many trains daily, and are therefore likely to take to electric traction soon. That would magnify, perhaps double, the existent demand for Niagara power. Then the total interest in further exploitation of the water would probably be strong enough, not only to smash any political force favorable to Niagara conservation, but strong enough to effect revision of any international treaty made to save the Falls. To suppose that the industrial interest can be permanent must seem exceedingly improbable to the Canadian government.

"Hence that government is bound to proceed for the conservation of all the advantages of situation which the Canadian side of the Falls enjoys by nature in respect of water exploitation. The greater part of the existing plant, or that soon to be operated, is on that side. To that side the water runs naturally, so much so that fully 70 per cent. of the total exploitation possible without a limiting treaty would, it is credibly stated, necessarily be on the Canadian side, if that total exploitation were effected. No Canadian government could venture to give this natural advantage away for nothing. A future Canadian interest of great magnitude would be sacrificed by a treaty unless the treaty contained provisions for securing to Canada, at any future time when Niagara exploitation may be enhanced, the proportion of natural advantage Canada now has by the natural 'lay of the land' or river bed.

"The advantage is not merely in respect of water-taking power. It is largely in respect of a future Canadian power to tax Buffalo, Niagara Falls, N. Y., and all places and plants on the American side which may use electrical horsepower derived from generators on the Canadian side. No one who goes to Niagara, looks over the ground, and reflects on the manufacturing progress visible there, is likely to doubt that the greatest of American manufacturing regions must be there within 50 years. Quite likely it will be the greatest manufacturing region in the world. Such is the attractiveness of cheap electrical power. Well, that prodigiously busy American city or region must depend on the Canadian side for a large proportion of its power. The bigger the manufacturing development, the more dependence on generators in Canada, no matter whether owned by Americans or Canadians. Now every horsepower transmitted from Canada may be made subject to a Canadian export duty. A New York state legislator talked lately of the propriety there would be in some sort of state tax on power transmitted from New York to Ontario. There is at present little such. He did not seem to have any notion that much the greater power to tax electricity transmitted across the river will very soon be in the Dominion government.

"It is not merely in power to raise revenue by an export duty on electrical horsepower that Canada's advantage lies. That connotes power to levy on future American plants so heavily that it might be expedient for many of these to move across the river into Ontario, and thus get untaxed electrical horsepower. And that, in its turn, signifies an important addition to the strength of Canada's position in any future bargaining for reciprocity.

"If all this be correct, the problem of Niagara conservation involves not only bringing the Washington and Ottawa governments to conference for a truly preservatory treaty; but the education of the American public to a perception that Canada may fairly claim some important concessions in return for agreeing so to limit exploitation that no more Niagara water may be taken than has been conceded already. Were such an agreement internationally made, then surely the existing concessionaires ought to be smartly taxed for the monopoly thus secured to them in nominal perpetuity."

[A further communication on the subject of the preservation of Niagara Falls will be found on page 159.]

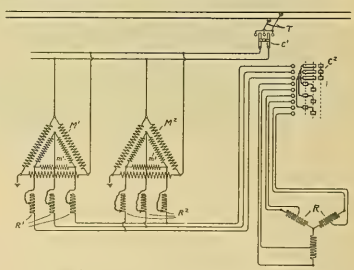
NEW NIAGARA TRANSMISSION LINE CARRIED BY CANTILEVER ARMS ON NEW YORK BANK OF NIAGARA RIVER OVER RAILROAD TRACK.

NEW TRANSMISSION LINE RUNNING EAST FROM NIAGARA FALLS.

Armstrong's Method for the Control of Induction Motors for Railway Purposes.

Induction motors, although they have been put forward as one of the means whereby alternating current may be utilized for purposes of electric traction, have not met with the success that the single-phase series alternating-current motor has achieved. Several reasons for this are apparent; for instance, their inability to start under load without some extraneous means and the difficulty of maintaining an equal distribution of load on several motors at all times. Their possibilities, however, have not been lost sight of, as is shown by the recent issuance of a patent to Albert H. Armstrong of Schenectady, N. Y., upon a method of controlling induction motors for car operation. Mr. Armstrong is well known in the field of electric traction, and the patent, which he has assigned to the General Electric Company, was applied for on June 28, 1905.

Mr. Armstrong says that an efficient induction motor is substantially a synchronous machine—that is, it operates normally with a small slip. Consequently, if the driving wheels of a vehicle are of unequal size, as may frequently be the case, due to unequal wear, or if two cars or locomotives with wheels of different size are coupled together in a train the synchronous characteristic of the motors produces an unequal distribution of load. Thus, for instance, if the motors operate at full load with a five per cent. slip and if one driving wheel is five per cent. smaller than another, the motor geared to the larger wheel may be operating at full load with five per cent. slip, while the motor geared to the smaller wheel may be running at synchronism, and consequently doing no work whatever. If the inequality between the wheels is greater than the slip, the motor geared to the smaller wheel may even be operating as a generator, returning power to the line, and thereby acting as a brake to overload further the other motors.



ARMSTRONG'S METHOD OF INDUCTION-MOTOR CONTROL.

The invention in its broadest aspect consists in providing means for independently adjusting the torque of the several motors, so that the load may be equally distributed at all times. It consists, in the combination with a number of motors, of a switch for controlling them simultaneously and independent adjustable resistances placed near the motors and connected in series with the secondary windings of the several motors, respectively. With this arrangement, if the adjustable resistance in series with the rotor winding of the motor which is connected to the smallest wheel is completely cut out while a certain amount of resistance is left in the secondary circuit of the motor connected to a

larger wheel, the slip of the latter motor will be increased so that the torque of both motors may be made the same, although they are running at somewhat different speeds.

In the accompanying illustration is shown a diagram of the circuit connection of Mr. Armstrong's device. The switch (C') in the primary circuit is arranged as a reversing switch and the switch (C²) is arranged to connect variable portions of resistance (R) in circuit with the secondary windings of the motors, which are connected in parallel. The primary windings of the motors are indicated by (M') and (M²), respectively, and the secondary windings by (m') and (m²). (R') and (R) represent independent adjustable resistances connected in the secondary circuits of the motors. The resistance (R²), which is in the secondary circuit of the motor (M²), which is supposed to be connected to the smaller driving wheel, is shown entirely cut out of the circuit, while a portion of the resistance (R') is left in circuit with the secondary winding (m'). With this arrangement the two motors will have equal torques at speeds differing in amount, depending on the design of the motors and the amount of resistance (R') in the secondary winding (m').

New Simplon Tunnel Electrical Equipment.

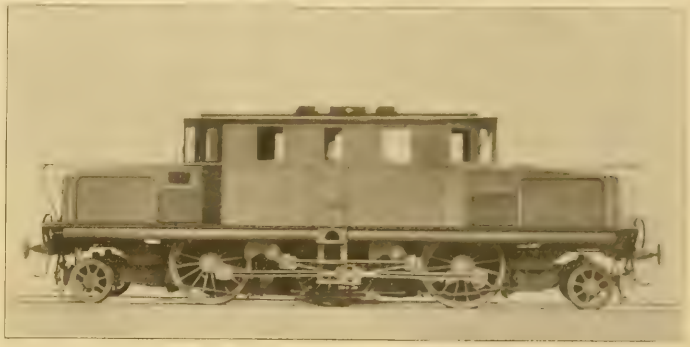
By Frank C. Perkins.

One of the accompanying illustrations shows one of the first two three-phase Brown-Boveri electric locomotives for the Simplon Tunnel. These heavy electric engines operate at a pressure of 3,000 volts and are equipped with two 450-horsepower electric motors of the Swiss type, constructed at Baden, for a frequency of 15 cycles a second. The mechanical portions of these locomotives are constructed by the Societa Svizzera per la Construction di Locomotive e Macchine. An electrically driven air compressor is provided in the cab for supplying the necessary air for the brakes, for operating the controller mechanism and for raising and lowering the collector from the trolley wires. The two motors operate in parallel, the cascade system not being used on these locomotives. The two speeds desired are obtained by two sets of windings on the motors.

It is asserted that the most eminent engineers were finally brought around to the idea that electric traction was the only safe and sure method of operation of the Simplon Tunnel railway, largely on account of its great length (20 kilometers) and the difficulty of properly ventilating the tunnel were steam locomotives employed. It was also clearly shown by the Swiss electrical engineers and eminent mechanical engineers that electric motive power could be used unhesitatingly, even on railways of the greatest importance.

The decision in favor of electric traction for the Simplon Tunnel was finally made after careful examination of the Valtellina line in Northern Italy, and other important electric railways. Several of the Valtellina three-phase electric locomotives will be employed for the Simplon Tunnel service. [illegible] Baden and Winterthur [illegible] Brown & Co. [illegible] and Machine [illegible]

The two 450 [illegible] mentioned were ordered by the [illegible] State Railways for their own experimental use as [illegible] would be interchangeable [illegible]



NEW ELECTRIC LOCOMOTIVE FOR SIMPLON TUNNEL.

motives in time for the opening of the Simplon tunnel, these engines were transferred for use on the Simplon Tunnel railway, three-phase traction having been adopted, and the consent of the Italian railway authorities having been obtained.

At the Brigue or Swiss end of the tunnel, as well as at the south end at Iselle, Italy, there are hydraulic power stations which have heretofore been employed for supplying power to the large plants used in the construction of the wonderful 20-kilometer tunnel. These hydraulic installations will ultimately supply the current for operating the electric locomotives, and are now being enlarged and altered as required, several turbines having already been shipped by Escher, Wyss & Co. for the Brigue power plant, and will soon be installed with Brown-Boveri electric generators for supplying three-phase current at 15 cycles and 3,300 volts, which is to be conducted directly to the trolley wires passing through the tunnel, no transformation being contemplated.

Current is conducted to two trolley wires, the return current passing through the rails. The contact line is suspended in the tunnel on transverse suspension wires, which are fixed at about 25 meters distance from each other. A short distance was considered unnecessary on account of the constant temperature within the tunnel, little or no variation in the sag of the transverse suspension wires with a system of [illegible] two 150 horsepower [illegible] wheels being employed [illegible] to the axles. The motors are arranged with [illegible] sets of coils, and when [illegible] three-phase current may be made to [illegible] train at a speed of 34 kilometers [illegible] higher speed of 68 kilometers an hour. [illegible] Each of these locomotives has a [illegible] of 31 tons at the high speed and six tons at the slow speed, while the total weight of the locomotive is 62 tons, the weight on the driving wheels being 42 tons.

When the trains arrive at the Brigue station end of the Simplon Tunnel from Lausanne the steam locomotives will be removed, and the electric locomotives will haul them through the tunnel to Iselle. At this point the steam locomotives will haul the trains the remainder of the journey, the electric locomotives being held at the south end to haul other trains through the tunnel to Brigue.

From the center of the tunnel to the Iselle end there is a down grade of about seven per cent., while only two per cent. is the maximum grade on the northern end from Brigue to the center of the tunnel.

The official opening will probably not be earlier than June, although reports have been made that trains would be operating before this time. The Milan Exposition is scheduled to be opened on April 1, 1906, and undoubtedly trial trips may be made during April and May; but it is stated, on excellent authority, that the tunnel will not be ready for regular service before June.

The electric locomotives will haul passenger trains from Brigue to Iselle in about 20 minutes, while at least a half hour will be taken in the reverse direction. The freight trains will be operated at a still slower speed. Freight trains weighing 465 tons will require about 40 minutes to make the trip through the tunnel. It is expected that passenger trains weighing 465 tons can be handled on the regular schedule time above mentioned without difficulty.

APPROACH TO SIMPLON TUNNEL AT BRIGUE, SWITZERLAND.

Space-telegraph Stations in Canada.

Canada, says a correspondent of the Western Electrician, possibly leads the world in the utilization of space telegraphy as applied to signaling ships at sea. The marine department has now in operation 10 high-power and three low-power Marconi stations. The high-power stations "cover" the entire Gulf of St. Lawrence and the Atlantic Coast waters far seaward from Newfoundland to the Bay of Fundy. Stations are situated at Fame Point, Que.; Heath Point, Anticosti; Whittle Point, Labrador; Point Amour, Forteau; Belle Isle, Point Rich, Cape Race and Cape Ray, Newfoundland; Sable Island, Camperdown and Cape Sable Island, Nova Scotia; Partridge Island, New Brunswick, and Cape Bear, Prince Edward Island. The high-power stations cost the government $8,800 each and the stations of lesser power $5,000.

The Hammetschwand Electric Lift on the Buergenstock Summit in the Alps.

By Dr. Alfred Gradenwitz.

In order to make the Hammetschwand, which is the most remarkable point of view and the highest summit of the Bürgenstock (towering in a practically vertical direction up to 1,122 meters above the level of the sea, and from which the whole of the northwestern portion of the Lake of Lucerne is inspected), an electrically driven lift has recently been installed to the top of this mountain wall.

This lift, as may be judged by Fig. 1, is remarkable for the bold vertical arrangement of its tower, which readily strikes the eye of those visiting the Lake. Both this building and the lift supported by it are illustrated and described in the following, from data kindly furnished by C. Wüst & Co. of Seebach, Zurich, the contractors for the undertaking.

The tower has been fixed by means of iron ties to the central part of the rock, while being connected to the upper part of the latter by anchorages of up to 10.5 meters in length. The lowermost part of the rock finally includes a vertical shaft,

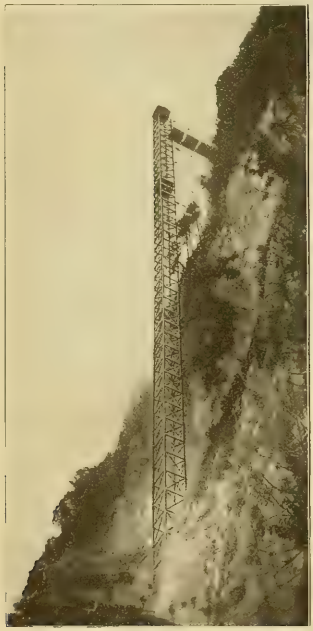


FIG. 1. HAMMETSCHWAND ELECTRIC LIFT IN THE ALPS.

at the bottom of which is a lateral connection, the arrangement being shown in Fig. 2, in which the dimensions are given in meters.

The car and counterweights are guided and supported up to a height of 43.50 meters by the walls of the shaft and farther up by the structure of the iron tower. The platform of the upper admission footpath, 10.5 meters in length, which at the same time serves as top tie (Fig. 3), is situated at 150.85 meters, the tower thus being 118.15 meters in height, including the upper cabin and roof.

Owing to the possibility of tying the structure to the rock, the tower could be given a cross-section of two by two meters throughout its length. The maximum distance of each two ties is 20-24 meters, corresponding to 10-12 times the breadth of the tower. The foot of the latter rests on a substantial iron frame, which has been laterally introduced into the wall of the rock to such a depth as to work as a tightened supporting structure in case the portion of the rock supporting the front wall of the tower should lose its bearing power.

The walls of the tower have been designed as double-stay framework structures, the stays being free from any tension in the case of calm weather (when the four supports will in each cross-section be submitted to thrusts corresponding to the weight of the cabin plus the counterpoise and the part of the tower surmounting the cross-section), while in the case of wind pressure the tower will be submitted to inflection thrusts. The ties have been so constructed as laterally to maintain all of the four supports. Each of them has been provided

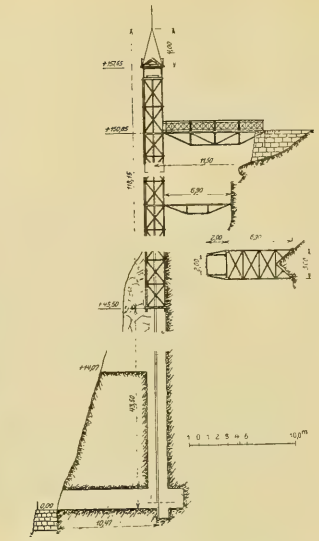


FIG. 2. DETAILS OF HAMMETSCHWAND ELECTRIC LIFT IN THE ALPS.

with two pairs of joints, in order not to interfere with the expansion of the tower. The construction of the later did not meet with any difficulties worth speaking of, and the same method of construction might be applied to much higher towers.

The lift or elevator has been calculated for eight passengers, or for a live load of about 600 kilograms. The car has been made of pine wood and is lined with an outside coating of sheet zinc, to protect against atmospheric influences. Its floor is 1.55 by 1.80 meters in area and it contains two upholstered benches. With a lifting speed of 60 meters per minute, the time of traveling, inclusive of the starting and stopping, is two minutes 50 seconds to three minutes, according to the pressure of the current feeding the driving motor.

The lift is operated by a 15-horsepower two-pole direct-current shunt motor, susceptible of overload up to 25 horsepower in starting, and turning at 900 revolutions per minute. This motor is provided with annular windings and cast-steel inductor; the rotor is 380 millimeters in diameter, the breadth of the iron being 200 millimeters. To an extension of the motor shaft is mounted a double-screw piston of the Wüst patent, including 16 teeth that gear with an intermediate wheel of 115 teeth. To the stationary shaft of this intermediate gearing is fitted a loosely running piston with 14 teeth gearing with the toothed rim of the rope drum having 181 teeth. (See Fig. 4). The rope drum, which is made of oak, is two meters in diameter and about 1,700 kilograms in weight. From the drum start

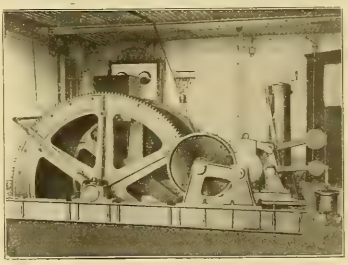


FIG. 4. PLANT OPERATING HAMMETSCHWAND ELECTRIC LIFT.

two ropes, 16 millimeters in diameter each, running across double-grooved guiding rollers one meter in diameter, which are fixed to the upper part of the tower below the cupola and to the car. The rope of the counterpoise, which is likewise 16 millimeters in diameter, leads from the rope drum across a guiding roller only 900 millimeters in diameter, to the counterpoise.

The ropes, which are made of the best plow-steel wire, include six strands of 19 one-millimeter wires each. The rope thus possesses a breaking strength of 16,000 kilograms in the case of a strain of 180 kilograms per square millimeter. The car, inclusive of the rope, is about 1,600 kilograms in weight, so as to afford a 24-fold factor of safety in the case of two ropes, which is amply sufficient for a lift of such dimensions.

The whole of the driving mechanism rests on a cast-iron base plate, being screwed to a substantially reinforced wrought-iron frame of U-shaped iron, cast into the concrete of the foundation.

The operating plant (Fig. 4) has been located in a room blasted into the rock at the foot of the pit. In the immediate neighborhood of the lever and brakes operated by the attendant there is the switchboard. A number of safety devices have been provided, with a view of the extremely considerable lifting height and abnormal conditions of the tension (which oscillates between 900-1,200 volts, the current being supplied from the power station of the Bürgenstock and Stanserhorn Railways). These include the following:

1. A speed regulator serving in the event of the speed, for some reason or other, rising up to 80 meters. This works on the catch fitted to the car, forcing the catching wedges against the wooden guides of the car. At the very moment the catching wedges are operated, the ropes will be slackened, and what is called the "slack-rope switchout" will be actuated, interrupting the main circuit, thus operating a jaw-brake and smoothly stopping the whole of the winch mechanism.

2. Another speed regulator has been provided, disengaging the main current switch-out at the speed of 70 meters, when the braking magnet being also thrown out of the circuit, the jaw brake referred

FIG. 3. UPPER PLATFORM OF HAMMETSCHWAND LIFT.

to will be made to work on the brake disk mounted to the extension of the motor shaft. This second speed regulator has been arranged in order that on exceeding the normal speed, the catching mechanism might not have each time to be worked; in fact, it is more convenient to disengage the main current switch-out, before the catching wedges are clamped fast on exceeding the normal speed.

3. In order to prevent the car running too far, there has been provided a mechanism by means of which the starting controller is reduced to zero, as soon as the car has reached the point limiting the run that corresponds to its actual acceleration. This device has been provided only for the event of the operator meeting with some accident.

4. There is further a horn lightning arrester terminal switch-out, being operated on one hand by the car and on the other by counterweights, as soon as the car runs beyond its normal terminal position. This terminal switch again cuts the current out of the motor and braking magnet, thus producing the effect mentioned under (1).

5. To the rope drum has been fixed a substantial band brake, by means of which, in the case of a fracture to some tooth, the rope drum, and accordingly the car, may be immediately stopped by hand, while the band-brake lever at the same time switches out the switch-out referred to under (4), thus interrupting the main current.

6. In order accurately to inform the operator of the moment at which he should reduce the starting controller by hand to zero, giving the car a travel corresponding to its acceleration, so as to

have it stop at accurately the proper height, an indicator has been arranged close to the machine stand, which accurately records the actual position of the car.

7. When the catching wedges of the car have been clamped fast, the elevator can be conveyed to the top by means of a hand-driven crank, even without any current being available.

8. For the case of failure in the current coming from the central station, a special no-current relay switchout has been arranged, actuating the car brake at the moment the current is discontinued, and thus stopping the elevator.

9. In case all of the safety devices referred to should fail to work, and the operator meet with an accident, a lever arranged in the car itself, and which is connected to the catch, would enable the man in the car at any moment immediately to stop the lift. Outside of the tower has been arranged a safety ladder, on which the operator may get to the winding mechanism, there to carry out any necessary operations and to convey the car to the top by means of a hand-driven crank.

Chicago City Railway Changes.

Radical changes were made by the directors of the Chicago City Railway Company in election of officers on February 16th, and President T. E. Mitten was given practically a new working staff. General Manager Mason B. Starring was the only member of the old executive force to be retained. Mr. Starring was promoted to be first vice-president and general solicitor, and for the present will also perform the duties of general manager.

Lawrence A. Young retired from the first vice-

T. C. PENINGTON.

presidency, but remains in the directorate. J. B. Hogarth was elected secretary and auditor, C. N. Duffy having severed his connection with the company. Mr. Hogarth was formerly auditor of the Denver City Tramway Company.

T. C. Penington, treasurer, was succeeded by J. P. Burke. Mr. Penington has served the company long and faithfully, his work as treasurer extending over a period of 32 years. In recognition of his loyalty and the efficiency of his past service he was retired on half pay. Mr. Penington is very widely and favorably known to traction men, having been for many years secretary of the American Street Railway Association.

The stockholders re-elected last year's board of directors, which consisted of the following-named gentlemen: John A. Spoor, A. J. Earling, Robert M. Fair, T. E. Mitten, Edward Morris, P. A. Valentine and Lawrence A. Young. Mr. Spoor and Mr. Morris were made the executive committee of the board.

Resolutions were passed by the board of directors directing President Mitten to continue his past policy in making improvements to the service. It was decided to add 50 new cars and to make improvements to the Vincennes Avenue and Seventy-seventh Street station.

President Mitten submitted his annual report, from which the following statistics are taken:

Gross earnings for the year were $7,322,080.18—an increase over 1904 of $653,100.87, or 9.79 per cent. With an increase of 9.52 per cent. in passengers paying fare, there was an increase of 13.09 per cent. in transfer passengers. The average fare was 3.10 cents per passenger carried.

The total expenses were $5,642,666.67—an increase of $720,486.49, or 14.64 per cent. This increase is due principally to the additional number of cars operated, the additional expense incurred in improving the heating facilities and sanitary condition of the cars, together with the increased amount necessarily charged to depreciation to cover the value of a number of the older cars which have been retired from service and destroyed. The net income [illegible] or 3.89 per cent. [illegible]

After carrying [illegible] short type of [illegible] which [illegible] the decrepit [illegible] These [illegible] now operated on Western [illegible] Western Electric [illegible] Street are being [illegible] modern electric [illegible] as possible [illegible] cost [illegible] will permit. [illegible] type of [illegible] with electric heaters, thoroughly [illegible] repainted, and are [illegible]

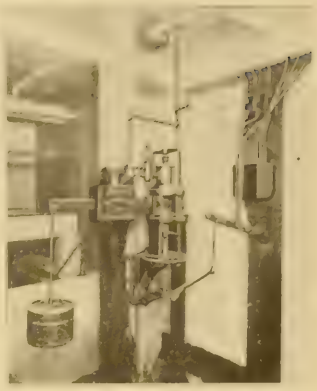
Other improvement included the [illegible] equipment of two [illegible] of approximately 15,000 horsepower [illegible] Commonwealth Electric Company, the [illegible] portions of the trackage and the [illegible] ment of the fire risk in the [illegible]

During the year of 1905 there were 145,700,457 fare passengers carried and 87,911,785 transfer passengers. There were in operation 963 electric cars, 767 cable cars and seven horse cars. There were 184.30 miles of electric tracks operated and 14.57 miles of cable tracks.

Hydro-electric Elevator in Tudor Apartment Building, Chicago.

The accompanying views illustrate the electrically-driven hydraulic machinery for operating the passenger elevator of the Tudor Building, a five-story apartment house situated at the corner of Forty-third Street and Ellis Avenue, Chicago. The plant constitutes an interesting application of the induction motor to the operation of hydraulic passenger elevators.

Referring to the accompanying illustration (Fig. 1), the motor shown is a 15-horsepower 220-volt General Electric form-K induction motor, taking current from the mains of the Commonwealth Electric Company, and is provided with a special high-resistance rotor in order that the starting current may not attain a high enough value to interfere with the voltage regulation of the supply circuit. The motor is belted to an eight by 10 vertical single-acting triplex pump which discharges into a compression tank against an average pressure of 80 pounds to the square inch, thereby providing the necessary hydraulic power for operating the elevator.



[illegible]

brought the passenger to the [illegible] makes three average trips before the [illegible] to the point at which the [illegible] start the motor. It takes about three minutes after the motor is started to bring the pressure back to the maximum, and the motor delivers its full power when operating against the maximum pressure.

Notable features of this installation are its simplicity and the fact that it utilizes standard apparatus, the only special features being the omission of the quick-break spring from the oil switch and the substitution of a high-resistance rotor in the otherwise standard induction motor.

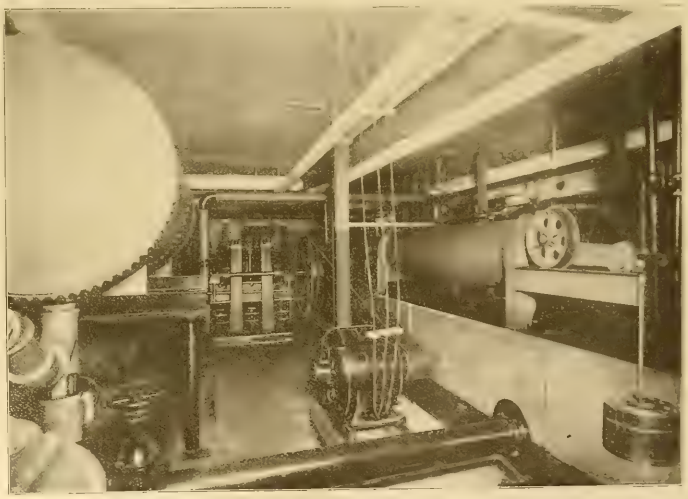


FIG. 1. INDUCTION MOTOR DRIVING TRIPLEX PUMP FOR OPERATING HYDRO-ELECTRIC ELEVATOR.

At the right in Fig. 1 may be seen the weight lever and weight of a Mason regulator which starts and stops the motor through the instrumentality of a form I oil switch. Fig. 2 clearly shows this controlling apparatus. It will be seen that the operating lever of the regulator is connected to the lever of the oil switch. The spring attachment, with which the oil switch is ordinarily equipped in order to give a quick break, was removed, as the motion of the Mason regulator is positive and gives a speed of about eight inches per second at the operating lever.

The installation was put into service about the first of June of last year and has been operated continuously ever since, with very little attention and with no expense, save for current, which is costing the owner $40 a month at 10 cents a kilowatt-hour. The previous cost of operating (with steam) was $95 a month for fuel and $45 a month for night engineer, a total of $130 a month.

There are undoubtedly many similar cases where elevators can be operated economically and satisfactorily by the method described, that is, an induction motor driving hydraulic elevator machinery.

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CONTENTS OF THIS NUMBER.

Transmission Line from Niagara Falls to Syracuse. By Orrin E. Dunlap. Illustrated 151, 152
A Canadian View of the Niagara Power Situation 152
Armstrong's Method for the Control of Induction Motors for Railway Purposes. Illustrated 153
New Simplon Tunnel Electrical Equipment. By Frank C. Perkins. Illustrated 153
Space-telegraph Stations in Canada 153
The Hasenclever-Wand Electric Lift on the Buergenstock Summit in the Alps. By Dr. Alfred Gradenwitz. Illustrated 154, 155
Chicago City Railway Changes 155
T. C. Pennington. Portrait 155
Hydro-electric Elevator in Tudor Apartment Building, Chicago. Illustrated 155
Editorial 156
Chicago Drainage Canal Power to be Ready in a Year 157
Electric-light Rate Inquiry in Chicago 157
Hogan Engineering Club of La Crosse 157
The Electrical Trades Exposition 157
H. E. Niese. Portrait 157
Municipal Accounting a Minus Quantity 157
Warren and Jamestown Single-phase Railway. Illustrated 158, 159
Iowa Electrical Convention 159
The Preservation of Niagara Falls. By Terry T. King. Communication 159
Mr. Rice's Candidacy 159
Selling Electricity 160, 161
Proper Handling of the New-business Department 160, 161
Are You Power wise? 161
Co-operative Development 161
A Binghamton Idea 161
The First Electric Sign 161
Electric Motors in New York City 161
The Problems of Illuminating Engineering 162
French Carbons in the United States 162, 163
Alfred Landau. Portrait 162
Westinghouse Variable-speed Motor with Auxiliary Poles Illustrated 163
Stanley-G. I. Revolving-field Inductor Generator. Illustrated 163
Benjamin Two-part Lamp Guard. Illustrated 163
Chicago Gets 85-cent Gas 163
Proposed Detroit River Tunnel 163
Finances of International Electrical Congress 164
Attack the "Electric Mule" 164
Metropolitan Elevated Road to Buy Current 164
Indiana Telephone Items 164
Southeastern Telephone Developments 164
Telephone News from the Northwest 164
Ohio Telephone Notes 164
New Companies 164
State Telephone Rate Illegal in Chicago 165
Bell Telephone Finances 165
Telephone Men 165
Resonant-circuit Telephony. Illustrated 165
Ohio Independent Telephone Association 165
Canadian Bell Telephone Improvements 165
Work of the National-Interstate Telephone Association 165
General Telephone News 165

DEPARTMENTS.

Correspondence 166, 167, 168
Great Britain 166
New York 166
Dominion of Canada 166
New England 166, 167
Ohio 167
Indiana 167
Michigan 167
Pacific Slope 167, 168
Personal 168
Electric Lighting 168
Electric Railways 168
Power Transmission 168
Publications 168, 169
Societies and Schools 169
Telegraph 169
Space Telegraphy 169
Miscellaneous 169
Trade News 169
Business 169
Illustrated Electrical Patent Record 169, 170

DATES AHEAD.

Iowa Telephone Association (annual convention), Chamberlain Hotel, Des Moines, March 13th, 14th and 15th.

Central Electric Railway Association (next meeting), Indianapolis, Ind., March 22d.

Ohio Independent Telephone Association (annual meeting), Columbus, Ohio, March 30th.

Iowa Electrical Association (annual convention), Kirkwood Hotel, Des Moines, April 18th and 19th.

Indiana Independent Telephone Association (annual meeting), Indianapolis, Ind., May 17th.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.

AT A RECENT meeting of the Faraday Society in London a demonstration was given by Dr. J. A. Harker of a solid electrolyte-tube furnace, which in construction is not unlike a Nernst lamp. The furnace was designed for uses in which the presence of hydrocarbons or other reducing gases, inseparable from a carbon-tube furnace, is undesirable. One of the uses to which the furnace may be adapted is the calibration of thermo-couples and also for the determination of the melting point of platinum, which Mr. Harker gave as 1,703-1,713° C. The furnace consists of a tube made of a mixture of zirconia and 10 per cent. yttria, which is squirted through a die and then baked. The small type shown in operation was 2½ inches long between the contacts. When taking one ampere at about 120 volts a temperature of 1,600° C. was attained. The tube is made conducting either by heating direct, or else by surrounding it with an external nickel heating coil, separated from it by a layer of pure zirconia, the combination forming a "cascade" type of furnace. Special attention has to be paid to the contact of the platinum leading-in wires and the tube.

UTILIZATION of the power of the Chicago Drainage Canal for the benefit of citizens of Chicago and of the Sanitary District is now an assured fact. The price at which this power is offered seems from all points a fair and equitable one. The trustees of the Sanitary District offer, in a direct and businesslike manner, to furnish some 15,000 horsepower to those municipalities in the District which care to take it from the sub-station at Forty-eighth Avenue and the canal, and that, too, by January 1, 1907. Power will be furnished at what it actually costs to deliver it at the sub-station, and careful estimates have placed the price at $26.40 a horsepower a year on the basis of 24-hour load. It is probable that those municipalities that cannot make use of a 24-hour load will be given a special price. In this event a 12-hour service will probably be given at the rate of $20 a horsepower a year. It is gratifying to note, also that the United States Supreme Court in the litigation between the city of St. Louis and the Sanitary District has been decided in favor of the latter, and that apparently there is no hindrance in view for the full development of the power scheme.

RATES and methods of charging are always important and interesting to purveyors and users of electricity. It is not easy for electric-light companies to hit on an equitable rate or to convince consumers that it is equitable when decided upon. Therefore, any intelligent and earnest effort to explain and defend the practice of any particular company is of interest not alone in the field of that company but to all engaged in the central-station business as well. Such an attempt was made, or, rather is making, by Mr. William G. Beale, counsel for the Chicago Edison and Commonwealth Electric companies in the pending inquiry into electric-light rates by a standing committee of the Chicago City Council. Mr. Beale exhibited much candor and skill in addressing the committee on behalf of the companies and undoubtedly made a favorable impression. Indeed, it is one of the pleasing features of the investigation that it is instigated by no special hostility to the companies, which stand well in the community. This reputation for fairness is an asset of the utmost value. For instance, Mr. Beale frankly stated his belief that it is the right of the public, through some properly constituted authority, to regulate public-service corporations. "All these companies really wish is a fair regulation and a just regulation. We have no objection to make to the principle of regulation, which is right and just, and undoubtedly lawful when the Legislature authorizes it." Further, speaking of the municipal electric street-lighting plant in Chicago, "The management of the city plants seems to have been good. The men who have managed them have managed them honestly, I believe. They have reported what they spent, but what they may have spent does not indicate the true cost of the plants and of their operation, from a business standpoint." Mr. Beale then went on to show how the official statements were misleading, and added: "No human being knows the real cost of municipal lighting, nor ever has known. It is not possible for anybody to know." This is undoubtedly true, as the Western Electrician has repeatedly shown.

The statement was made that the company can produce current at the Fisk Street station at "as low a figure as three cents a kilowatt-hour," but current is furnished to some customers that costs the company 25 cents a kilowatt-hour. "Over half of our lighting customers take current which costs the company upwards of 13½ cents a kilowatt-hour." Marshall Field & Co., who get a very low rate, took as much current, at the time the contract with them was executed, as the company supplied to the whole of Chicago south of Thirty-ninth Street. "Now, could we fairly be expected to charge the same price for supplying the wide territory south of Thirty-ninth Street, where there are many people, where we had to have an extensive distribution system, a large number of employes, etc., that we could charge for supplying Marshall Field & Co.? Of course that would be absurd."

The average cost (and also the average income, taking account of interest charges, depreciation, reserve and profits) is 7.24 cents a kilowatt-hour for the entire output. This figure was 10½ cents in 1896. A voluntary reduction of 20 per cent. in the high rates was made within a year. Net rates range now, substantially, between four and 16 cents a kilowatt-hour. "There has been a constant reduction going on in the business—that is the tendency. We have to reduce rates in order to get large volume and long-hour business, and then, having taken large business at a close rate, the smaller businesses go down in the same way."

In relation to alleged discrimination—that is, charging differing net prices to different classes of customers—Mr. Beale made an acute and forceful argument which station managers will read with attention. This is the gist of it:

What is discrimination? The law does not forbid discrimination; the law forbids an unjust discrimination; just discrimination is right and proper, as the absence of it would be unjust. I would be a bold man to stand up here and say that there is not any unjust discrimination in the Chicago Edison Company (I never have yet seen any enterprise where things did not once in a while go wrong). I am justified in saying that the effort of the management is to have no unjust discrimination, and they say there isn't any so far as they know—that their discrimination is a fair discrimination due to differences in conditions. The law permits it. You haven't anything to do with it. You cannot touch it. Nothing that you can do will prevent just discrimination, and it never will be stopped by the Edison and Commonwealth companies until the highest legal tribunal to which it is possible to go says that it has got to be stopped, and that never will occur. It never will be stopped.

This is well put. And in another place the practical result of a uniform rate is shown.

Suppose, gentlemen, that you were to fix as a maximum rate 15 cents a kilowatt-hour, and a would-be customer were to come along and ask us to supply him with current under conditions where we could see at once that it would cost us 17 cents to do it. We would refuse to supply him, and he would take it into court, and what would happen I do not need to argue.

Counsel made one interesting statement, practically in the nature of a promise, and that was this: "As far as the Commonwealth company is concerned I want to say that it will never be a laggard whenever the city of Chicago wants to remove all the poles from the city streets. Whenever you want all the others to go underground, we will go, and we will not raise any legal questions."

Many apt illustrations were made in the course of Mr. Beale's argument. Here is one:

Let us suppose that a man owns a livery stable in which he has saddle horses for rent. Now, we will suppose that the keep, maintenance, board and care of a saddle horse is $2 a day, including fair interest on the investment. If he lets that horse out for one hour at $1.50 and no more during the day, he has lost 50 cents. If he rents him out for two hours at $1.25 an hour, he has made 50 cents. That is perfectly obvious. If he rents the horse out at 75 cents an hour, for four hours, he gets $3, and is ahead $1. That is an excellent illustration of our system of lighting rates.

The inquiry is still on, and the Western Electrician will give the conclusions arrived at in a future issue. In the meantime we remark with pleasure that the electric-light companies of Chicago have been happy in their choice of counsel and the lawyer is fortunate in the standing and reputation of his clients.

Chicago Drainage Canal Power to be Ready in a Year.

Developments in the Chicago Drainage Canal power undertaking are rapidly taking form, and it is now announced that by the beginning of 1907 power will be available in Chicago and other municipalities within the Sanitary District. Municipalities within the District are to have the first right as consumers, and accordingly the Board of Trustees of the Sanitary District has addressed to each a communication announcing the price and setting forth the plans for the distribution of the power. The most important parts of the communication are here given, as it contains some interesting information concerning this important power development:

"The development of waterpower created by the drainage channel has reached a point that enables the trustees of the Sanitary District to state a time when delivery of the electrical energy will be made to the sub-station located at the city [Chicago] limits and the canal. The date will be January 1, 1907, and the trustees are prepared to enter into contracts with any and all municipalities within the limits of the Sanitary District for such electrical energy as may be required for municipal purposes at a cost price of $26.40 per horsepower per year on a basis of 24 hour service.

"It is probable that some of the municipalities cannot make use of power 24 hours a day, and in such event a service of 12 hours will be furnished at a price of $20 a horsepower a year, and the trustees of the Sanitary District will endeavor to dispose of the power for the remaining 12 hours.

"The price of $26.40 per horsepower for 24 hour service represents the true cost to the Sanitary District, as shown in the following itemized statement:

Total cost of development and transmission		$3,500,000.00
ESTIMATE OF COST.		
Interest on investment at 4 per cent	$140,000.00	
Taxes on real estate, buildings, etc	7,620.00	
Depreciation on buildings, at 1 per cent	3,650.00	
Depreciation on waterwheels, at 2 per cent	2,027.12	
Depreciation on generators, at 2 per cent	1,824.60	
Depreciation on pole line, at 3 per cent	2,020.50	
Depreciation on other electrical apparatus, at 3 per cent	3,995.52	
Total fixed charges		161,137.94
OPERATING EXPENSES.		
For power and substation labor	$ 63,240.00	
For repairs to machinery and buildings	3,700.00	
For incidental expenses	1,200.00	
Operating Lawrence avenue pumping station	43,660.00	
Operating Thirty-ninth street pumping station	120,380.00	
Interest on investment, Thirty-ninth street station, 4 per cent	15,590.76	
Total operating expenses		248,079.76
Total cost per year to Sanitary District		$ 409,217.70

"With 15,500 horsepower delivered at the sub-station the cost per horsepower will therefore be $26.40.

"To avoid delays in considering the application of electrical power the following data is given:

"Power will be delivered to purchasers at the sub-station located at West Forty-eighth Avenue and the canal. The responsibility and cost of transmission from that point must be assumed by purchasers. Power will be measured at the sub-station switchboard, assuming 746 watts as a horsepower. Alternating current of 60 cycles at either 6,600, 9,000 or 11,000 volts will be furnished. The current will be suitable for alternating-current motors and arc and incandescent lighting. If used for street-lighting purposes an ordinary arc lamp will require about one horsepower, measured at the station.

"The cash cost involved in maintaining an arc lamp for street-lighting purposes should not exceed the following amounts in small cities:

AVERAGE YEARLY COST	
Carbons	$ 3.75
Globes	.75
Repairs to lamps	1.25
Repairs to circuits	.50
Labor	11.00
Power	20.00
Total cash cost	$37.25

Add to the above for other charges, as circumstances warrant:	
Depreciation on cedar pole lines	5 per cent
Depreciation on lamps	5 per cent
Depreciation on station switchboard	2 per cent
Depreciation on station transformers	3 per cent
Interest on investment.	

"When the full flow of water is available in the canal, which will probably be within six or seven years, the power can be increased to 31,000 horsepower with an additional outlay of $450,000. The true cost will then be reduced to $14.97, and it is the intention of making a provisional reduction to this figure in all contracts made at this time, to the effect that all municipalities entitled thereto may secure the benefit of the power at cost to the Sanitary District.

"The interests of the taxpayers demand that practical use be made of the power from the date it will be ready for delivery, and such power as may not be contracted for by municipalities, for their own use, will be advertised for sale. Should the aggregate power required by municipalities exceed that available the supply to each will be prorated on an equitable basis.

"If a municipality leases power for a 12-hour period, paying therefor the $20 rate, the trustees of the Sanitary District will make an equitable reduction in the [illegible] [illegible]

By a decision of the [illegible] Court on [illegible] [illegible] of St. Louis [illegible] [illegible] Mississippi River by the [illegible] [illegible] was dismissed [illegible] was virtually a complete [illegible] contention of the [illegible] trict was sustained. [illegible] portant bearing on the [illegible] canal power, as obviously [illegible] won all the plans [illegible] great waterpower development [illegible] for naught.

Electric-light Rate Inquiry in Chicago.

The inquiry which has been going on before the Chicago Council committee on gas, oil and electric light, relative to the cost of generating and distributing electric current in Chicago, has been characterized by a disposition on both the part of the Chicago Edison and Commonwealth companies and the council committee to deal fairly with each other. The power, if valid, to fix maximum rates for the public supply of electric current was given to the city of Chicago by a statute recently passed by the Illinois Legislature. With this authority the committee on gas, oil and electric light was instructed to proceed to an investigation to determine the cost of production with a view to lowering the price of electric current to consumers.

William G. Beale, counsel for the Chicago Edison Company and Commonwealth Electric Company, has been the principal speaker before the committee. He has given the aldermen all information asked of him and has convinced them, apparently, that the fixing of rates to a large variety of consumers, some large and some small, and under varying conditions, is a difficult problem. The maximum net rate to any consumer at present is 16 cents a kilowatt-hour. But Mr. Beale showed that to supply some customers it actually costs the company as high as 24 cents. One large consumer (Marshall Field & Co.) gets current at less than four cents a kilowatt-hour. This customer employs its own electrician to keep the distribution systems in shape and furnishes its own lamps and apparatus. All the Edison company has to do is to deliver the current to the customer's switchboards.

Wishing to be fair with the city, the two companies mentioned have signified their intention of making a reduction in rates wherever possible. At a meeting of the council committee scheduled to be held at the time the Western Electrician goes to press the companies will no doubt submit a schedule of reduced rates to the committee as a basis for an agreement and understanding with the city. The reduction is made voluntarily by the companies. Mr. Beale said frankly that it was his opinion that the city cannot do much, if anything, under the statutes, in the way of effecting a reduction of rates if the companies should not be disposed to concede it. He said the companies believe their rates to be fair and reasonable but are willing voluntarily to make reductions wherever possible.

Hogan Engineering Club of La Crosse.

The idea of maintaining social or technical clubs among the employes of manufacturing or operating companies is spreading rapidly. Employes and employers alike see the advantage of such organizations. A recent case is that of the employes of the Wisconsin Light and Power Company of LaCrosse, Wis., who have organized the J. J. Hogan Engineering Club, the principal object of which is of an educational nature. The name of J. J. Hogan was chosen because of the prominence for many years of Mr. Hogan in engineering circles in LaCrosse and the Northwest.

The following-named gentlemen, associated with the Wisconsin Light and Power Company, were in attendance and became charter members of the new club: L. Alexander, T. Allen, J. F. Barry, W. D. Burford, R. B. Carter, O. B. Cahoon, C. A. Van Degrift, L. W. Dickson, V. Downey, W. W. Ferris, Frank Hanifl, Paul Donald, G. F. Mueller, August Meyers, W. S. Pope, G. W. Pitman, C. W. Reed, M. A. Rybold, J. Russell, Clarence Stocks, S. A. Stage, T. Thiele, L. J. Weldy, Charles P. Williams, W. M. Woods, C. H. Williams. The last mentioned is manager of the company.

The club will meet in the company's clubrooms on the first and third Monday evenings of each month. Matters of general engineering interest will be discussed and papers will be prepared and read by members as designated by a committee. A feature will be a "question box," wherein a member may ask questions on subjects not clear to him. There will also be occasional talks by outside technical, professional and business men. It is proposed to have each member, whether from the office, the [illegible]

The Electrical Trades Exposition.

[illegible]

HOMER E. NIESZ.

[illegible] unanimous [illegible] electrical [illegible] [illegible]

At a meeting of the [illegible] Electrical Trades Exposition Company [illegible] organization [illegible] company [illegible] preparation for the [illegible] to be held January [illegible] 1907.

It was decided [illegible] manager" [illegible] managing director." An [illegible] pointed, consisting of Messrs. [illegible] chairman; Charles E. Gregory and [illegible] ing.

Homer E. Niesz of the Chicago Edison Company was made managing director. The appointment of Mr. Niesz to this position, which in fact makes him virtually manager of the next electrical show in 1907, is a [illegible] the executive ability of Mr. Niesz. As is well known, Mr. Niesz is assistant to Vice-president Ferguson of the Chicago Edison Company. During the "growing period" of several months of the recent electrical show, although an exceedingly busy man in connection with his regular duties, Mr. Niesz nevertheless devoted a great amount of energy and practically all his spare time to furthering the interests of the Chicago electrical exhibition. Mr. Niesz is highly thought of as an officer of the Chicago Edison Company and deservedly popular not only with his associates but with all with whom he comes in contact in the general round of business. Added to a high executive ability he possesses, too, the qualifications of frankness and genuineness that win and hold firm a host of business friends. The new managing director, backed as he will be by so energetic an executive committee as Messrs. Overshiner, Gregory and Spalding, whose work for the last show did them such great credit, cannot fail to produce next year an exposition that will be in many respects a revelation to the Chicago public. It is a fact not generally known, too, that already over one-half of the floor space of the Coliseum has been applied for for next year's show, and it is the purpose of the management to take applications for the remaining space at once. The allotment of space will be made at a date to be announced later.

Municipal Accounting a Minus Quantity.

At a meeting a few days ago in Washington, D. C., of city controllers, auditors, treasurers and other city officials interested in uniform classifications of municipal accounts and municipal statistics, S. N. D. North, director of the Census Bureau, said: "The most prolific source of municipal graft, its securest hiding place, its most effective instrument in seeking immunity, is the chaos which exists in the classification of municipal accounts and the absence of uniformity in municipal bookkeeping." Mr. North referred to the question of municipal ownership of public utilities and said that definite standards by which the comparative results of private and public management can be obtained are impossible in the existing chaos of municipal accounting. He said that the cities of the United States with a population of 30,000 or more collect and disburse annually a sum greater than the annual cost of all the state governments and more than the annual cost of maintaining the national government.

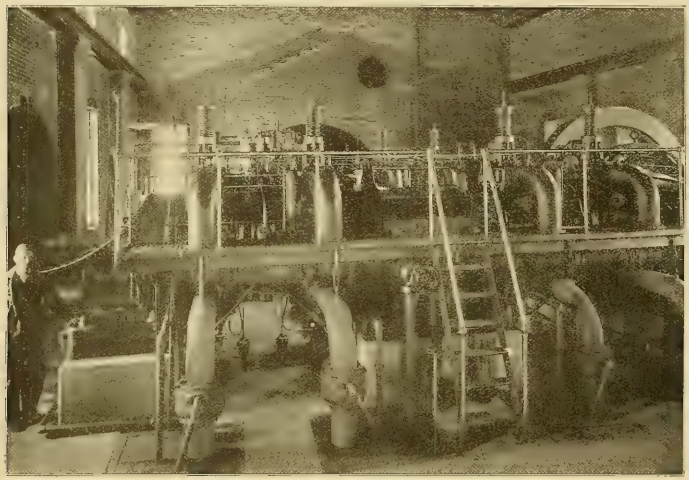
Purdue University has established an automobile-testing plant for testing pleasure and commercial vehicles. It is similar in principle to the locomotive-testing plant installed some years ago.

Warren and Jamestown Single-phase Railway.

The electric railway which has recently been opened between Warren, Pa., and Jamestown, N. Y., serves a total permanent population in adjacent territory of upward of 65,000 inhabitants. The equipment is thoroughly modern, comprising horizontal gas engines as prime sources of driving power, and the single-phase alternating-current system of the Westinghouse company. It is believed to be the first instance of a single-phase electric railway operated by gas engines. The current is generated in a power house without a boiler plant, transmitted at a potential of 22,000 volts over bare copper wires to transformer stations operated without attendants, fed to the central trolley section at 3,300 volts, to the terminal sections within the city limits at 550 volts, and is utilized most effectively in cars of handsome design.

Track.

The track is well constructed. The 70-pound rails are laid on ties of oak and chestnut and ballasted with gravel. They are connected by the type-G form 2 soldered bonds of the Ohio Brass Company, and are cross-bonded at frequent intervals. As the line follows the winding course of the Conewango it possesses many curves, which,



GAS ENGINE DRIVING GENERATOR FOR WARREN-JAMESTOWN SINGLE-PHASE RAILWAY.

together with the grades—one of which is three-fourths of a mile long, with an average of 3½ per cent. and a short stretch of seven per cent.—combine to bring out the qualities of the operating equipment. The sharpest curve has a radius of 65 feet. Four turnouts are now in use, but this number will soon be increased to five.

The car barns are at Warren, Pa., and Frewsburg, N. Y., the repair shop being in the former.

Power Plant.

The power house is located at Stoneham, five miles south of Warren, that site having been selected by reason of its proximity to the natural-gas pipe lines, from which its fuel supply is obtained. The equipment includes two 260-kilowatt 380-volt 25-cycle alternating-current generators of the revolving-field type, which are direct-connected to horizontal gas engines operating at a speed of 150 revolutions per minute. The two units are connected in parallel and run together with remarkable smoothness. The engines were constructed and erected by the Westinghouse Machine Company, and the electrical machinery was furnished and installed by the Westinghouse Electric and Manufacturing Company.

Gas Engines.

In the new type of horizontal double-acting gas engine the first representative of which is now operating at Warren, the builders have especially sought to construct a prime mover best suited from all standpoints to the American market—uncomplicated in design, simple to operate, substantial and permanent in construction, reliable in its working and possessing the best economy compatible with the more necessary elements of simplicity. The resemblance to approved steam-engine practice is strong; in fact, the engine stands not as an example of radical change in structure, but as an adaptation to gas working of the ample steam experience of the builders in Corliss engines. Symmetrical design has been adopted wherever possible, notably in the cylinder casting, with its symmetrical valve chambers, and in the pistons.

A relay governing system has been devised which has proven entirely adequate in respect to both regulation and parallel working and which places this type of gas engine upon the same plane with large Corliss practice.

The absolute necessity of accessible parts has largely influenced the design of the engine and resulted in its elevation to such height that all parts are above floor level. Inspection and cleaning, especially of cylinders, is possible without dismantling the engine.

Possibility of injury from neglect has been avoided by providing automatic auxiliaries, both oil and cooling water being delivered under gravity head, cylinder oil by positive pressure and compressed air for starting from storage reservoirs. The starting arrangement has proven particularly efficient, and with only two operations, viz., opening of gas and air valves, the engine automatically starts and comes up to speed under its own ignition without further attention. On large engines considerably less than a minute is required to bring the engine up to speed, and, if desirable, a number of engines in a station may be simultaneously started from one point within this period of time.

To insure the greatest degree of reliability a duplicate system of igniters is employed, with four different combinations in each combustion chamber. Any igniter may be replaced while the engine is in service, and in case of necessity any cylinder may be isolated for repairs during operation.

There are two main generating units at present installed at Warren, with space for a third of equal size—that is, 260 kilowatts, or 500 nominal horsepower. Single-crank tandem units were employed in place of twin tandem units in order to give greater flexibility of operation, the former representing the standard adopted by the builders. The units have solid couplings between engine and generator and operate in parallel on the station load in precisely the same manner as ordinary steam-driven units. The familiar Beau de Rochas, or four-stroke cycle, is used, which, with the tandem arrangement, gives a power impulse with each successive stroke of the engine. Cylinders are 21 inches in diameter by 30-inch stroke, the unit running at a nominal speed of 150 revolutions per minute. For this particular service the engine is rated at 470 brake horsepower, with a maximum of 520 brake horsepower, giving a 35 per cent. overload capacity on the generator.

Operation.

The Warren plant was started on October 19, 1905, and has since been in continuous service, averaging 17½ to 18 hours a day without developing the least trouble of a serious nature. Daily observations of the gas consumption of the plant furnish a striking indication of its extremely high economy. During the month of December, 1905, the cost of gas consumed by the interurban system averaged less than 50 cents an hour, or about 16 cents a car-hour for 35-ton interurban single-phase cars. At present the large gas engines operate both interurban and city systems, totaling 10 cars. During the week ended January 12th the cost of gas averaged less than 75 cents per hour, or 7½ cents per car-hour for three interurban and seven city cars. With this combined operation there has been realized a saving of approximately 20 per cent. in cost of gas over the independent operation of the interurban and urban plants, the former by the new horizontal and the latter by vertical-type engines.

Fuel gas is available from several different points and is clean and uniform in quality, averaging from 1,000 to 1,100 British thermal units total per cubic foot. Gas is obtained at a straight rate of 15 cents per thousand cubic feet, which places the cost of power so far below the usual figure that any other source of motive power is out of the question.

Electrical Apparatus.

From the generators the current passes through a switchboard of blue Vermont marble panels, completely equipped with apparatus and controlling devices, to raising transformers of the Westinghouse oil-immersed self-cooling type, which transform the potential from 380 to 22,000 volts. The two feeders which leave the station are adequately protected by circuit-breakers of the fuse type, disconnecting switches, low-equivalent lightning arresters and choke coils.

The high-potential lines, of No. 6 bare copper wire, are carried on porcelain insulators of the Ohio Brass Company, known by the trade name of Locke No. 406, which are supported on chestnut poles. Each feeder connects with a transforming station, one of which is located 1¼ miles from the Warren terminal and the other 1½ miles from the end of the line in Jamestown.

Transformer Stations.

The transformer stations are made of concrete blocks and are of suitable size to permit a wise arrangement of the apparatus. They are similarly equipped, each containing two 150-kilowatt 22,000-3,300-volt lowering transformers of the oil-immersed self-cooling type, which are controlled and protected by fuse-type circuit-breakers and disconnecting switches in the high-potential circuits and by oil switches and enclosed fuses in the secondary lines, one of which taps the 3,300-volt trolley section, while the other feeds the city section of the trolley line through auto-transformers along the track, which reduce the potential from 3,300 to 550 volts. Both high and low-potential feeder circuits are protected by choke coils and low-equivalent lightning arresters, which are mounted in the transformer stations. The apparatus is symmetrically arranged, that mounted on one side of the station being exactly duplicated on the other. The two transformers are connected in parallel. Each has sufficient capacity to carry the entire normal load and either may be readily cut out of service.

The transformer stations are operated entirely without attendants, and require only occasional inspection. The building is fireproof. It contains no moving machinery or apparatus and has adequate automatic protection, so that there is no likelihood of trouble other than the opening of a circuit-breaker because of excessive load.

Trolley Line.

As has been indicated, the trolley line is divided into a central and two terminal sections. The central section is connected direct to the transformer stations receiving alternating current at 3,300 volts. A No. 0000 figure-8 trolley wire is swung by catenary suspension from a seven-sixteenths-inch messenger cable, which is carried on heavy porcelain insulators mounted on angle-iron brackets supported on the chestnut poles. The poles measure seven inches at the top and are 35 feet long. They are painted white and black, and present an attractive appearance. The white upper portions serve as useful guides to the line of the track during the darkness of night. All poles will be numbered to facilitate the location of line faults and other troubles.

TRACK AND CATENARY OVERHEAD CONSTRUCTION OF WARREN-JAMESTOWN SINGLE-PHASE RAILWAY.

The overhead construction is particularly fine, as may be seen by reference to the illustration. A nice detail is the slight raising of one trolley wire at switch turnouts, as indicated in the illustration, so that the bow trolley easily passes from one

wire to the other without impairment of contact. At frequent intervals the messenger cables are anchored, and steady-strain brackets are used at curves and turnouts. A few of the curves are constructed with pull-offs.

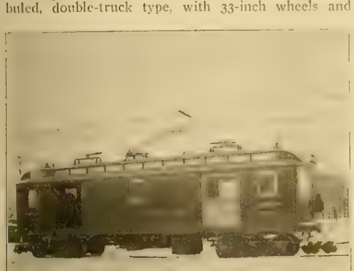
The catenary overhead line construction is thoroughly substantial and reliable, and has not given the slightest trouble since erection. With such a line 3,300 volts is as easily handled as the lower potential of direct current [illegible] with the usual overhead construction.

Within the limits of the terminal cities, the trolley lines are supplied with alternating current at the low potential of 550 volts. A feeder from each transformer station leads to three 75-kilowatt auto-transformers, which are located along the track, and connected to a No. 0000 secondary feeder which supplies the trolley. The auto-transformers reduce the potential from 3,300 to 550 volts. They are swung between pairs of poles.

The low-potential trolley line is supported from span wires by insulating hangers, in accordance with the practice standard for direct-current work. In Warren the new cars run over the tracks of the Warren Street Railway Company, which is equipped with the direct-current system. The two trolley wires, alternating-current and direct-current, are suspended side by side from the same spans without appreciably complicating the structure or in any way impairing the service of either system.

CARS.

The passenger cars are of the double-end, vestibuled, double-truck type, with 33-inch wheels and



BAGGAGE AND EXPRESS CAR ON WARREN-JAMESTOWN SINGLE-PHASE RAILWAY.

$5\frac{1}{2}$-inch axles. They measure 52 feet over all by nine feet in width, and seat 59 people. The seats are set crosswise along either side of a center aisle. They have high backs and are upholstered in green plush. The cars are supplied with baggage racks, signal circuits and many other modern features. A smoking compartment is provided at one end and on the side. They are finished in mahogany and are decorated in excellent taste.

The operating company has at present five passenger cars and one baggage car, all of which were furnished by the St. Louis Car Company. Each is equipped with four Westinghouse No. 108 50-horsepower motors of the single-phase alternating-current, compensating, series type, mounted one on each axle, and connected by single-reduction gears. The motors are connected permanently in multiple and are operated by the hand-control system by means of taps from an auto-transformer, which supplies a varying electromotive force at the motor terminals. The controllers are of the drum type and closely resemble those of direct-current practice, though they occupy somewhat less space. They are mounted upon the platform at each end, so that the car may be operated in either direction.

A feature of this installation is its great simplicity and the small space required by the electrical apparatus. It consists only of one bow trolley, two standard wheel trolleys, two controllers, two canopy switches, one auto-transformer, two preventive coils with resistance, two fuse boxes, one change-over switch and the necessary connecting cable.

The bow trolley is used on the 3,300-volt section, the wheel trolleys on the terminal sections of the line. The change-over switch is arranged to cut out the bow trolley and transfer the connections of the wheel trolleys from the low to the high-voltage service taps of the auto-transformer, so that, in case of accident to the bow trolley, the wheel trolleys, which are mounted on heavy insulators, may be used on the 3,300-volt section of the line. The bow trolley is pneumatically operated, the controlling valve being mounted on the platform within easy reach of the motorman. The wheel trolleys are handled in the ordinary way with ropes, in which suitable insulators have been inserted to guard against the possibility of ground when used on a high-voltage circuit.

The preventive coils and resistances eliminate arcing at the controller contacts, when passing from one transformer connection to another.

The cars are equipped with Westinghouse straight air brakes, operated by means of an air compressor which is driven by a single-phase series wound motor of a construction similar to that employed for the main driving motors. Hand brakes are also supplied.

The car [illegible] complete and equipped [illegible] [illegible].

The [illegible] [illegible] readily, and, all in [illegible]

[illegible] either end of the line [illegible] minutes [illegible] There are 5[illegible] stations along the line at which stops may be made [illegible] includes about [illegible] stops. The [illegible] switch near [illegible] the center of the line. The maximum running speed [illegible] miles per hour. The complete run from terminal to terminal, without stops, has been made in 47 minutes.

The change from the high to the low-voltage trolley is easily accomplished. As the car approaches the terminal section, the motorman releases an air valve, thereby lowering the bow trolley, which automatically closes down and locks in place. After passing the section insulator the conductor places the wheel trolley on the line in the ordinary way. The change-over may be made without stopping.

Under present arrangements the car is run two days, with a mileage of 246, and is then brought in for inspection. The bow-trolley shoes are found to give a life of approximately 10,000 miles. So far there has been no indication of undue wear of the trolley wire, nor has there been any trouble with the overhead structure.

The baggage car makes three trips per day, on regular schedule, leaving Warren at 7:25 a. m., 11:40 a. m. and 4:15 p. m., and leaving Jamestown at 9:50 p. m., 2:30 p. m. and 7 p. m.

The present service of the Warren and Jamestown Street Railway Company requires a total of but eight employes, outside of the general offices and the car crews. It is made up of four men in the car barns, three power-house attendants, and one lineman. An additional lineman is occasionally borrowed from the Warren Street Railway Company. There are no attendants in the transformer stations.

PERSONNEL.

The officers of the company are: President, D. H. Siggins; vice-president, H. M. Preston; secretary, S. Q. Smith. Mr. Siggins is assisted in the management of the property by his son, H. A. Siggins, a director of the company and general manager of the Warren street railway. To President Siggins the community in which he lives is indebted for exceptional transportation facilities. His clear mind early recognized the possibilities of electric traction, and to his commercial courage and untiring energy is due the organization and success of the Warren Street Railway Company, whose lines were constructed and have since been operated under his personal supervision.

Iowa Electrical Convention.

The sixth annual convention of the Iowa Electrical Association will be held in the Kirkwood Hotel, Des Moines, on April 18th and 19th. A large attendance is anticipated, and manufacturers and supply men are cordially invited to be present and display their goods. Austin Burt of Waterloo is president of the association. The programme is an ambitious one. The list of contributors and subjects is as follows:

J. R. Cravath, Chicago—"Report on Progress."

D. F. McGee, Red Oak—Report on "Facts and Factors."

Frank B. Rae, Jr., Detroit—Subject, to be announced.

C. F. Freehauf, Cresco, Iowa—"Economy of Mechanical Stokers and Ash Machinery in Small Stations."

W. A. Mall, Belle Plaine, Iowa—"Economy of Condensing plant in Small Stations."

L. W. Gill, Manchester, Iowa—"Effect of Boiler Compounds on Engine Lubrication."

J. A. Innes, Eagle Grove, Iowa—"Line Losses and Economical Distribution."

A. W. Zahm, Mason City, Iowa; H. G. Gorr, Dubuque, Iowa—"Care and Maintenance of Meters."

C. E. Stanton, Dubuque, Iowa; Niels Christensen, Waterloo, Iowa—"Some Practical Experiences with Steam Turbines."

H. G. Gorr, Dubuque, Iowa; Thomas Sloss, Cedar Rapids, Iowa; W. P. Caspar, Keokuk, Iowa—"Experiences with Grounded Secondaries."

J. P. Jones, Cedar Falls, Iowa; F. H. Richardson, Boone, Iowa; W. J. Greene, Cedar Rapids, Iowa; J. Walsh, Davenport, Iowa—"Effect of a Day Load on Station Economy."

Prof. George D. Shepardson, Minneapolis—Subject to be announced.

W. S. Mead, Parkersburg, Iowa; O. E. Brownell, [illegible]

COMMUNICATION.

The Preservation of Niagara Falls.

[illegible] the argument in [illegible] waterfall belong[illegible] people [illegible]

[illegible] Niagara [illegible] inspiration of its grandeur, an[illegible] plants n[illegible] from the [illegible] great [illegible] trust and [illegible] of modern commercialism.

The argument that [illegible] is useless will never appeal to the American [illegible]. As well declare all [illegible] less and recommend [illegible] once, into factories for the [illegible] soda crackers. Soda crackers [illegible] soda crackers are to be desired, but [illegible] pense of the inspiration [illegible] appreciation and [illegible].

The American people are rapidly [illegible] that the great falls, which belong to them as a people, have fallen into the hands of those who are interested only in the dividends [illegible] from their waters. A proper and satisfactory solution of the problem seems possible only by combining the sentimental and utility features of the question in equal parts.

A large part of the water which now wastes its energy in the swift current of the river could be diverted for power-producing purposes without materially affecting the sublimity of the picture. It is possible that the depth of the water at the falls might be decreased to a minimum during certain periods of the year, and increased to its normal depth again, by shutting off some of the larger users, for periods corresponding to increased pleasure travel. In this way it would be possible "to eat our cake and have it too," and while preserving the great natural beauty of the spectacle from the grasp of dividend-hungry monopoly to utilize its immense resources for the cheaper production of common necessities.

With the appointment of a responsible commission having full authority to enforce regulations for the preservation of the falls the wave of popular indignation which is spreading throughout the country would speedily subside. TERRY T. KING.

Fort Wayne, Ind., February 17, 1906.

Mr. Rice's Candidacy.

Mr. E. Wilbur Rice, Jr., of Schenectady, N. Y., technical director of the General Electric Company, has consented to the use of his name as a candidate for the presidency of the American Institute of Electrical Engineers. He did not seek the honor—which, however, he appreciates—but was persuaded to stand for the nomination at the earnest solicitation of many of his friends and fellow members. Mr. Rice was admitted to the Institute in 1887 and has been a full member since 1888. His engineering qualifications are of the highest, and he is specifically recommended for the place in a circular signed by Thomas A. Edison, Elihu Thomson and F. P. Fish. John J. Carty, chief engineer of the New York Telephone Company, likewise announces that he is not himself a candidate, but a supporter of Mr. Rice, convinced that the election of the latter "would make for the best interests of the Institute and would be fully appreciated by the membership of the Institute at large."

A New York dispatch dated February 10th states that "the combination of the leading street-car building concerns which has been hanging fire since last summer, being a project of combining the J. G. Brill Company, the Barney & Smith Company, and several other street-car building concerns in a $50,000,000 corporation, has reached a point where a final agreement is possible. It is understood that the financing of the concern is assured."

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Proper Handling of the New-business Department.

Profits to be realized from the added output, together with the methods to be devised and put into operation in the getting of new business, certainly make this part of central-station work attractive and interesting to the manager who enters into the work with the right spirit. Much discussion of this important subject was brought forth at the Chicago meeting of the Northwestern Electrical Association.

One of the papers read was by John S. Allen on the "Proper Handling of the New-business Department." Mr. Allen in treating the subject divided it up under three general heads: Salesmen or solicitors, advertising or publicity, and rates.

Requirements in a solicitor consist primarily in a love for the business, loyalty to the company, and an inborn and inbred taste for hard work. With any one of these qualifications missing, the company had better get a new solicitor. Given these three qualities, and almost any young man can make a decided success at soliciting. The field, from the standpoint of a solicitor, is an exceedingly inviting one. In the case of a solicitor, it is his duty only to inform a prospective customer of the facts regarding the goods which he has to sell. A plain, straightforward statement of facts is much more effective than any kind of oratory or dramatic effect. A solicitor is always telling his prospective customer of facts regarding which the customer has very little or no knowledge. In almost no case is it necessary to talk to anyone but an interested and attentive listener.

Public-utility salesmen should give much attention to local affairs, should study carefully the best trade journals, and should have on hand, in the office of the company, several advertising magazines and trade journals, generally read by prospective customers. Where but one solicitor is employed, and this solicitor is expected to take care of the new business in a town of about 10,000 inhabitants it is deemed essential by Mr. Allen that the company furnish for his use an annual subscription to at least six of the leading magazines.

Concerning advertising, Mr. Allen said that a fundamental essential of a successful new-business department consists in expending judiciously a certain amount of money in advertising. In his opinion, a large part of this should go to the local newspaper. Advertising in its various forms must, of course, be of great value, but in the opinion of the writer, there is no way of bringing a subject to so many people for the money as by the means of newspapers. That the public naturally looks kindly upon large advertisers is true in a general way.

It was recommended that no ad. appear more than one day. Let the copy be pointed, effective, and composed only of interesting facts. Use no exclamations or other expressions intended to "catch," but lacking in thought. Resourcefulness of the ad. writers can be exercised with great freedom in making copy for the ads. A certain "copy" man used this expression in a half-page ad, "A Bunch of Bright Bulbs Will Boom Your Business Better than a Brass Band." Such a statement, used in connection with a thoughtful and well-rounded half-page ad, was decidedly effective.

It is a good plan for any company in organizing a promotion department to select some expression which shall be used very generally throughout all its advertising matter, and which the public shall come to know as well as it knows the company's name. In illustration of this, one company uses "Electric Light Talks." Another company used "Electro Illuminated."

When central-station service first assumed commercial proportions, flat rates were naturally made. As business grew it was soon learned that this method of charging was unprofitable, and unsatisfactory to the consumer. From this extreme the tendency went to the opposite, and a few years ago it was the general opinion that nothing should be allowed of any kind except a meter rate. More recently, however, it has been learned that the purely meter rate is almost as unsatisfactory as the old flat rate. The middle ground is now generally taken, and a combination rate made which has various forms, and the instance is now very common where central stations are making flat rates on various well-defined kinds of lighting, and upon some kinds of power. This middle ground has become of great value to the central station in allowing it an income on certain kinds of lighting, which was utterly impossible to get under a meter system.

Discussion on Mr. Allen's paper was abundant and to the point. Frank B. Rae, Jr., took exception to the statement that the advertising space in a newspaper should be changed from one insertion to another. As bearing out his belief, he pointed to the policy of advertisers in the large dailies. To this Mr. Allen answered that the case is different in the small cities, even in towns of the size of Rockford, Ill., of 40,000 inhabitants. The papers are small daily papers, and the space devoted to actual news and to prominent advertisements is so small that much better service is obtained from the advertisement by changing the space and the location, that is, allowing the publishers the utmost freedom in the location of the new ads.

Regarding the question of a solicitor, P. H. Korst of Janesville, Wis., said that his company paid a salary and commission on new business obtained. As to getting a start with a new customer, he said that his company has adopted one little plan which is of service, and that is in trying to get house lighting, particularly houses that are already equipped with gas. They find it rather difficult, owing to the first cost of installing. People say they would like to use electric light, and will some day, but they do not care just at the present time to equip their houses. Mr. Korst's way of getting at them is this: His solicitors say: "We will put a porch light in for you at 50 cents a month flat." This has been found something that almost everybody wants; and it is very easy to get them. After they are started with a porch light, pretty soon they want a light inside the hall, and then the meter goes in. When they are started once, it is just a question of time till the whole house is electrically lighted. For the porch light a 16-candlepower lamp is used, burned till 11 o'clock at night.

Mr. Jewett of Albert Lea, Minn., and Chicago said: A great many of the small towns cannot afford to put a man on by the year and all the year around. They might secure temporary solicitors to canvass towns, say of 5,000 inhabitants and under for a period of from two to three months. A new man can get new business that the local manager cannot get. This outside man going into the town could interest people that the local manager could not. Such a man worked in a town 60 days, and secured 75 customers for the company. They paid him $75 a month, which was considered merely enough to pay for his living expenses, and $3 a customer secured, besides. That worked out very satisfactorily.

Harold Almert of Chicago said that his company used a report which is found very valuable. On the right-hand margin is left a column for the name of the agent who has secured the business. Of course that is not necessary in a great many cases, but subordinates like occasionally to get into the limelight. By placing the employe's name on that report he has an opportunity to show what he is able to do; and at the end of a year's time, in looking over these weekly reports, just what a man has done in that line can be ascertained. On the bottom of this report are several places in which are entered the connected load at the beginning of the week, the amount disconnected in 16-candlepower equivalents, the net for the week and what has been added. There are similar columns for horsepower of motors, etc.

R. N. Kimball of Kenosha, Wis., remarked that he had tried both ways of paying solicitors—at one time on a fixed salary and then on percentage of sales. He found that if he sent a solicitor out on a percentage of sales he often sold things a customer should not have. Then came up the question of salary. There are certain times of the year when soliciting is profitable and at other times not. He found it the best plan to employ a solicitor all the year round. The soliciting that a man does one year may not be of benefit for some time, but very often the solicitor starts a train of thought that will be of benefit afterward. In Madison, Wis., there has been introduced a scheme of paying solicitors and grading the amounts paid on different classes of business, more particularly in the gas line. Mr. Kimball asked President C. H. Williams, who had been superintendent of the Madison company, how it had worked out.

Mr. Williams said that the town of Madison is divided into different territories, with a solicitor and assistant to each territory. The gross revenue of each month as compared with the gross revenue of the month of a year ago, and 7½ per cent. gross increase in the revenue, has been given to the new business department over and above a payment of $30 a month to the solicitor. This 7½ per cent. has been apportioned to the different solicitors by means of a point system. It is just as advantageous for a solicitor or representative to retain business in his territory as it is to get new business. The kind of business that he would get the greatest returns for would be going out and getting a man that is already a consumer to increase his consumption without increasing his demand. Now, residence business, for which an extension would have to be made and new meter set, would count only one point. There is some business that he can take on only at an actual loss on points to himself. Twelve-o'clock window lighting or sign lighting counts 7½ points, where there is no expense on the part of the company for a meter and no expense on the part of the company for running a service; and that scheme is followed not only in the gas line but for electrical lines also. Mr. Williams believed that the result of that system has shown a very marked increase in consumption of gas and electricity.

The electrical output at Madison increased some 32 per cent. during last year, with practically no increase of demand. He believes that it is due very largely to this system of paying the solicitors, for the solicitor is placed in exactly the same position as the company. If the business that comes in nets the company something, the solicitor gets his proportion; if it is business the company does not want, it is up to the solicitor to either make a good consumer out of an unprofitable one, or at least get the consumer into some position where the company will not lose any money on the installation.

Organization and Development of the New-business Department.

A paper which aroused much discussion at the convention on the general subject of business-getting for the central station was that of George Williams. A written report on this paper was handed in by Harold Almert of Chicago, which contained many excellent points. Mr. Almert said in part:

"Much is said and little is done toward suggestions for the organization of a new-business department. Let me therefore suggest a plan simple enough and cheap enough for even the smallest central station.

"First of all, procure and maintain a respectable office, be it ever so small; light it well, maintain at all times a modest and attractive window display. Change it frequently, invite people to come to your office, and when they do, receive them as they should be received.

"Secure a good map, of suitable scale, so that you can mark on it approximately the correct location of each and every building in town; lay out your present distributing system by pins and twine of different colors, designate primaries, secondaries, etc. Take a duplicate copy of this map and cut it into sections suitable for tacking on to a piece of cardboard.

"Get some slips printed about four by six inches on which to record date, name, address, location (whether house, flat or store, etc.), kind of illumination used, whether house is wired or not; if so, if it is equipped with fixtures, together with space for remarks regarding distance from your lines, etc.

"Take a section of your map and a bunch of these slips and start up one street collecting information. Mark the location on the map and fill out the information carefully on each slip. When one street is completed, tackle the next, and so on until the whole town is covered.

"Don't get frightened at the size of the task; the information is absolutely essential, and when completed you will be surprised at how little of the available business you really have.

"For keeping records of this sort a card-filing tray or cabinet, preferably for cards four by six inches, seems desirable. An open card tray, as a rule, has a capacity of about 1,000 cards, together with index and follow block. You can then have a number of cards printed, call them Form 1. We are now ready to describe the method of getting after these prospects.

"In filling out the card particular stress should be laid on getting not only complete but absolutely correct records. Don't be satisfied with putting down the name Mr. Clark when the man's name is James B. Clark. In writing a man, if you address him incorrectly by getting his initials wrong, or spelling his name improperly, you are storing up trouble for yourself in many forms. The letter may not reach him; someone else may get it; or, if it does reach him, he is very apt to feel distant and look upon your letter as a haphazard circularizing scheme. Getting his name and address absolutely correct generally gives your matter an audience at once. Equal care should be given to the other details of the record. A complete and correct record is always valuable. A partial one oftentimes is worse than none at all.

"Let us assume now that you have your record of James B. Clark complete; he has a comfortable residence located on or near your service, but his house is not wired, and he is using oil lamps.

"There are at least four elements to each and every sale:

"First—The introduction either for a personal interview or by letter.

"Second—The creating of a desire in the prospective customer for that which you have to sell.

"Third—The selecting and adjusting of that which you have to sell to his particular needs and working him up to the point where he will be ready to sign.

"Fourth—The sale.

"The first can be cared for by a carefully drawn form letter, general in character, calling his attention to the fact of your existence, and the general advantages and conveniences of what you have to sell. The second by more form letters, giving more details, perhaps, and a personal interview looking into his particular requirements; then special letters giving estimates of cost to fill his requirements. Third, another personal call, reviewing what has been gone over before, adding desirable features, and cutting out the objectionable ones, and fourth, during the above interview, when the ground has been carefully covered and you feel that you have worked him up to the psycho-

logical point where his mind is made up, clinch the bargain by handing him a pen and getting his signature to your proposition.

"Let us return to the beginning of the transaction and see how we known when the individual is to be given attention, and with a great many of these prospects on hand how we can be sure that some are overlooked. We have the suitable file above mentioned and a record of all the prospects filed alphabetically, using card Form 1. An alphabetical index of about 80 divisions is desirable, thereby reducing the number of cards per guide to 10 or less. When you have more than 10 cards for each guide, considerable time is wasted. We will say that we pick up James B. Clark's card and send him some printed matter and your first form letter designed "A." Notation is made in the proper column with a date stamp on Form 2, which is printed on the back of the card. At the same time a clip or marker is placed over the date at the top of Form 1 a few days ahead, or about the time when you feel that he should again be given attention. At the back end of the file you place a guide card, printed the same as all the rest, but projecting to about the height of the alphabetical index so that the dates from 1 to 31 are visible at all times. Say that today is the 17th and that you think your prospects should be given attention again on the 21st. The clip is then put over 21 on this card and the card again filed in its proper place, according to the alphabetical index. When the 21st arrives you look down the files in line with the 21st day, and wherever you see a marker projecting above the top of the cards you know that that prospect needs attention. Looking on the back of his card you see immediately what form or special letters has been sent him, and for special letters you refer to your letter file. You then send whatever his requirements, in your estimation, call for, and the clip is moved ahead to the date when he should again be given attention. If a personal call should be made the results of the interview are noted on the sheet of thin paper the same size as the card and printed with the same Form 1. One of these slips filled out for each interview is filed in back of the card. In this way you have a record of each interview and, in brief, what transpired. Each of these slips is signed by the person making the call, and from this file you know immediately the status of each case, whether you or your solicitor has been handling the prospect. When the deal is closed, the details, such as are desired to be retained, are transferred to another card printed with the same Form 1, but of a different color, say salmon or canary. Then in looking over your file you will know immediately by the color whether he is a customer or a prospect. Some advertising you may send out wants to go to consumers and the prospects as well, or to either of the two only; hence by the colored designation feature only one file is necessary for both.

"In all systems of this kind it is important to keep track of your results. If you therefore mark down on the monthly report in the proper columns together with the totals at the bottom the amount of printed matter sent out, the number of form letters, the number of special letters, the number of personal interviews and the number of customers secured, together with an estimate of the cost, you will then have a record showing the results from month to month and year to year. A comparison of the results obtained this month with that of last month, or a year ago this month, will prove valuable data indeed. This together with a careful estimate of the time and material required will soon give you the cost required for securing consumers by this method.

"I realize how hard it is to break away from your daily routine and give matters of this kind your attention; but, as already stated in the beginning, much has been said and little done. Discussion is valuable only when it works hand in hand with accomplishment. A single plan put into operation is worth 100 "mind's-eye" schemes. The thing in hand is the most important now. Tomorrow will take care of tomorrow's tasks if today's are done today. On the clock of time there is but one word—now. Now is the time to begin. By the sweet bye-and-bye one arrives at the house of never. Putting off means leaving off, and going to do becomes undone. So begin now."

Frank B. Rae, Jr., said that when it comes to personal solicitation, such solicitation is absolutely essential to gettng business for central stations. Advertising will do nothing more than bring an inquiry, and in sending out solicitors it is absolutely essential that those solicitors shall not only be salesmen but be educated along electrical lines.

When sending out a solicitor he should be sent out to do something. It is not enough that a man should be put on the street as a mixer. The mixer does not sell goods. A man must be put out to sell a specific thing to a specific person, and he has got to be sent there. The point simply is that when a customer has been lined up and interested the solicitor must know exactly what the man should have, not what he wants particularly, and what is sold him ought not to be necessarily the thing that is going to bring the company the biggest revenue, but what will do the customer the most good. The central-station man, if he is going out for new business, should economize [illegible] fountain [illegible] well appointed [illegible]

Are You Power-wise?

[illegible] Portland (Ore.) General [illegible] central station [illegible] 20 points of superiority being [illegible] follow:

Economy of floor space.

Great saving in machinery and material cost of installation of plant.

Variable speed with constant control.

Simple controllers.

Constant speed independent of load.

Increased output over belt driven machine.

Standard designs of motors with replaceable parts.

Power consumed in exact ratio to amount of work done.

Unlimited capacity as compared with the limited resources of a private plant.

Saving of time and money in absence of belt repairs.

Location of tools independent of the source of power.

Friction, noise, wear and attention reduced to a minimum.

No slip, grind or jar; a positive drive.

Fifty per cent. lost in shafting and belting saved.

All labor incidental to a steam plant is saved; no labor required for operation of an electric motor.

Absolutely no waste you pay only for what power you use.

Freedom from danger and obstruction of shafting.

Maintenance and repairs reduced a minimum.

Reliability of service.

Power available on your premises 24 hours a day, 365 days in the year.

Instantaneous availability of light and power.

Space required for storage of fuel saved for other purposes.

Unquestioned superiority in the quality of service.

Immunity from total interruption because one section is out of order.

Cost of each operation in manufacturing may be figured to a certainty. An indispensable attainment where competition is keen.

No boiler insurance necessary.

Absence of vibration.

A degree of cleanliness not possible on premises where power is made.

Advantages in the cost of producing power in Portland, in comparison with other cities of the country, enable us to make lowest rates and give unexampled facilities to manufacturers.

Co-operative Development.

That energetic herald of a new electrical era, Mr. J. Robert Crouse of Cleveland, the moving spirit of the Co-operative Electrical Development Association of Cleveland, is sending to 9,762 electrical manufacturers, jobbers, dealers, salesmen, contractors, central stations, publishers, societies, etc., a brief statement of the aims of the association, whose motto is "All together all the time for everything electrical." The opening paragraphs of this brochure are as follows:

"The Co-operative Electrical Development Association has been organized for the purpose of banding together—to such degree as may be found practicable—the varied interests represented in the electrical industries as a whole.

"These interests may conflict in many regards, but there is, undoubtedly, one common ground of agreement. That is the desire on the part of all of us to see electric current increasingly used by more of the people for every purpose for which it is qualified. If we can all agree on a practical way of working together, even in a slight degree, for what we all desire, should not the resultant effect be well worth while?

"The association will look to the manufacturers of electrical apparatus and supplies for the working funds, as being the logical interests to initiate and maintain such a movement.

"It contemplates, however, securing the hearty indorsement and moral co-operation of all other interests, societies and associations in the electrical fraternity, particularly the central stations.

"This means you.

A Binghamton Idea.

[illegible]

"M. S[illegible]

[illegible] quickly [illegible] window [illegible] Mr. [illegible] does not confine himself to this style of advertising. He also seeks business by [illegible] appeals. For example:

"When it comes to power there is [illegible] no question that we can run [illegible] money than by any other means. This isn't its only good feature, but it is the one that counts in business. Ask any manufacturer who uses our power."

All the ads are given generous spaces, from half pages down.

The First Electric Sign.

As the observant walk about the streets of any city and note the number of electric signs displayed, in all their variety and usefulness, it must seem almost incredible that the first electric sign in this country was erected so recently as about 15 years ago.

It was, however, about 1890 that the Long Island Railroad Company, to advertise Manhattan Beach, and to attract visitors to that seaside resort, determined to erect a huge electric sign at the junction of Broadway and Fifth Avenue, New York, where now stands the Flatiron Building. This enterprise deserved credit and brought due reward.

It was about this time, or shortly afterward, that the first electric sign was displayed in Chicago. This was in Clark Street, and bore the single word, "Museum." Thereafter the business began to grow.

In Boston the first electric sign was that of the Columbia Theater, erected in 1892. Thus Boston was a little behind these other cities; but Boston today is foremost in the ranks of American cities in electric-sign development. At least that's what Edison Light of that city says.

Electric Motors in New York City.

The motor installations now supplied by the New York Edison Company aggregate 106,126 horsepower. This means probably that there are more than 40,000—perhaps 50,000—individual motors on Manhattan Island. They vary in size from one-eighth horsepower, or even one-sixteenth horsepower, to single motors of several hundred horsepower. The service capacity of some single buildings reaches as high as 3,000 and 4,000 horsepower, with the usual factors of reserve, which, on the Edison mains are seldom less than 100 or 200 per cent.

President Blood of the National Electric Light Association spent several days in New York last week, in consultation with other officers of the association, regarding the development of plans for the Atlantic City convention, to be held in June. A number of applications for associate membership have been received in the last week or two, owing to the desire of manufacturers and supply companies to secure good locations for their exhibits.

The Problems of Illuminating Engineering.

New York, February 15.—A meeting of the Illuminating Engineering Society was held at the Hotel Astor, New York city, February 13th, when the president, L. B. Marks, read an inaugural address. After outlining the facts connected with the organization of the society last December and mentioning that 150 members had been enrolled, Mr. Marks went on to speak of the objects of the society, which were to bring together those interested in the use, as distinguished from the production, of artificial light. He said in part:

The electrical engineer has concerned himself with improving the efficiency of the generating apparatus and cutting down losses in the transmission of power, but when his wires reach the point at which the electric current is to be transformed into light his engineering skill has not, as a rule, been applied. The lighting layout has been left largely to the architect, who usually prescribes the number and location of the outlets, specifies the number and candlepower of the lamps and designs or selects the fixtures. Very often the specifications are completed before the color scheme of the interior has been decided upon, with the result that the degree of illumination obtained may fall far short of what is needed in cases of dark-colored interiors, or be excessive in the case of light-tinted rooms. The natural tendency of the architect is to make the economical side of illumination subservient to the aesthetic, while on the other hand the tendency of the engineer is to consider only the question of economy. It is an encouraging sign of the times that the architect and the engineer are gradually drawing closer together in dealing with problems involving both the scientific and the artistic sides of illumination.

Though much attention has recently been given to the subject of globes and reflectors, the fact still remains that unshaded or inadequately shaded lamps are the rule rather than the exception. The practice of placing lights of excessive intrinsic brightness within the ordinary field of vision is so common that our eyesight is suffering permanent injury.

From an economical standpoint the correct disposition of the light sources and the use of the most suitable reflectors are of commanding importance. It is not uncommon to find instances in which the adequate consideration of these two questions would result in largely increasing, and often more than doubling useful illumination.

Both electric and gas-supply companies are alert to this situation. The far-sighted manager of the supply company sees that it is to his ultimate advantage to assist the consumer in obtaining the very best illumination at the least expenditure. In view of the above, it is extremely desirable that complete and authoritative data be obtained as to the amount and character of illumination for individual conditions. The performance of lamps for street lighting and large open spaces has not been adequately recorded. In view of the lack of complete data upon this subject there is a wide difference of opinion today as to which of several illuminants is best suited for certain cases of street and country-road lighting, illumination and economy being considered.

The progress of invention in lamps and lighting apparatus has been so rapid that engineers have found it difficult to keep abreast of the times in the question of illumination. Only a comparatively few years ago the carbon-filament incandescent electric lamp, the arc lamp (open or enclosed) and the ordinary gas flame were the only illuminants with which we had to deal. Today we have besides these, among electric lamps, the incandescent lamp of the Nernst type, the mercury-arc of the Cooper Hewitt type, the vacuum tube lamp of the Moore type, the tantalum lamp, the impregnated carbon or flame arc, the magnetite arc, etc. The amount of light, and especially of electric light, used in the United States has grown by leaps and bounds. The consumption of gas for illumination purposes has also largely increased, the introduction of the mantle burner having given a great stimulus to the gas-lighting industry. The place of the acetylene light has been firmly established and the extended introduction of acetylene plants in the last few years is worthy of special note. The approximate amount of money spent by the consumer annually in the United States (according to a census report) for illumination by electric light, gas and oil is as follows:

Electric light, between	$100,000,000 and $120,000,000
Coal and water gas, between	35,000,000 and 40,000,000
Natural gas	1,700,000
Acetylene, between	2,500,000 and 3,000,000
Oil	60,000,000

At a conservative estimate the consumer is spending a total of over $200,000,000 for lighting in the United States. Of this amount I venture to say that fully $20,000,000 is absolutely wasted so far as the amount of useful illumination delivered for the money is concerned. No one who has made a study of the subject can fail to see glaring examples of this waste on every hand. It is not at all uncommon to find in electric lighting that 25 per cent. of the light that is furnished is lost, so far as any useful purpose is concerned, by reason of improper disposition of the light sources or unsuitable lamps, globes, shades or reflectors. In gas lighting, though the conditions are quite different, the same criticism in a measure holds true.

Dr. Clayton H. Sharp, New York Electrical Testing Laboratory, opened the discussion. He did not think much more economy could be gained with existing types of electric-lighting machinery without a radical change in the prime mover. The problems of the illumination engineer were far easier because he could take hold of the bad conditions of the present day and produce considerable improvement. There was some prospect of an improvement in the lamp. He suggested that the society should settle questions of nomenclature. At present they had such cumbersome expressions as candle-feet, feet-candles and candles-feet, where they might have a unit of illumination with a consistent plural.

Dr. Arthur H. Elliot, New York Consolidated Gas Company, did not quite agree with the president's figures as to the annual cost of illuminants in the United States. He thought that the total gas consumption very nearly equalled that of electric light. The society would help gas men by educating the householder how to get the best results from his illuminant. Speaking of the past, he said that the introduction of electric light into New York city had a bad effect on gas at first, but when people got used to the brighter illumination of the streets they were forced to go home and light more burners. The Consolidated Gas Company had gained 150 per cent. total consumption since the introduction of electricity. Nevertheless people were no longer satisfied with the gas, though it was good. The candlepower had been raised from 16 or 17 to about 20.

Arthur Williams, contract department, New York Edison Company, also differed with the president's statements as to the total cost of electric light, which was perhaps more nearly $400,000,000 per annum. Electric illumination could be considerably improved by the use of suitable reflectors. Referring to the electrical signs on Broadway, he said that some were deficient because the lamps used were of too low a power or were designed for too long a life. As to the Edison plant, they had from the very first all the best features called for now—water-tube boilers, underground circuits, feeding systems and meters. The only essential change had been from the open to the closed street arc lamp. After speaking of the various kinds of lamps used commercially, he said he often found it difficult to advise the best for any given purpose. This was a practical question which the society should consider. He advocated that the scope of the society should be national and the issuance of a diploma or certificate to qualified illuminating engineers.

Prof. C. F. Chandler, Columbia University, New York, indulged in reminiscences covering the last half century. He said there was a time when sperm oil was the best illuminant that could be had, and sold at $1.80 a gallon. Then came camphene, or refined spirits of turpentine, but it frequently exploded and had to be used with a chimney. The next development was to mix camphene with alcohol, this combination being called "burning fluid," requiring no chimney and giving no smoke. While studying in Germany Dr. Chandler studied photogen, then a newly discovered hydrocarbon distilled from Scotch cannel coal. When he returned to America he was told that no such oil would ever interest the American public; yet within three years there were coal-oil factories from Portland, Me., to Wilmington, Del., and the price of sperm oil went down to 50 cents a gallon. Then a couple of Yankees in New Haven saw in a museum a small bottle of a liquid labeled "naphtha," and Prof. Silliman told them that the Seneca Indians collected it for medicinal purposes, but that the oil had an illuminating value. The enterprising New Haven men went down to Pennsylvania and ultimately struck oil by boring. Forty years ago in New York they had a 16-candlepower gas at $3.75 a thousand cubic feet, and now the public complained of a 25-candlepower gas at a dollar.

In 1878 Charles F. Brush, with his new dynamo, made the arc light practical, the first experiments being witnessed by Mr. Edison, Prof. Barker and himself at Ansonia, Conn. At that time Mr. Edison had devoted no thought to electric lighting, having been mainly occupied with telegraphy. Mr. Edison then said: "What we want is not an arc light suitable for out of doors, but a little light—a 10-candlepower light," and in less than one year he had completed his invention of the incandescent lamp and evolved a dynamo, a meter and a distribution system. This was at the very time that an English parliamentary committee was hearing evidence from Sir William Thomson and Mr. Preece that it was impossible to divide the electric light, and that even it were, there was no possible way to distribute the current, and all the time Mr. Edison's applications were in the English patent office. Dr. Chandler concluded by referring to the invention of the Wellsbach mantle.

T. C. Martin referred to the late Luther Stieringer and the first illumination engineer on record.

E. C. Brown thought that the gas consumption in eight large American cities amounted to nearly as much as the total given by Mr. Marks.

R. W. Searle spoke from the architectural point of view of the difficulty of pleasing people who had green, pink, and blue rooms to illuminate.

Prof. W. d'A. Ryan, General Electric Company, Lynn, Mass., said that the architects were beginning to appreciate the need of the work of the illuminating engineer.

C. L. Elliott, secretary of the association, said that one of the objects of the society would be to unify the various interests. The position of the illuminating engineer was becoming rapidly recognized.

H. M. Lauritzen, Holophane Glass Company, said that it had been their endeavor to take the light from the direction in which it had been useless and to bring it to a point where it was needed. By a system of horizontal prisms the light was distributed, and by another system of vertical prisms it was diffused.

William J. Clarke, president of the National Commercial Gas Associations, New York, spoke of the advantages of the incandescent mantle. On the East Side of the city they found people using flame burners consuming 15 feet an hour. In order to introduce their cooking plates they gave away Welsbach burners, with the result that the people saved enough on their lighting to pay the entire cost of their cooking.

John Campbell, president of the Electric Auditing Company, Boston, Mass., recommended that a part of the society's work should be to collect definite information about the cost of public lighting. Public ignorance of these facts often led to misunderstanding.

C. H. Codman, Boston, Mass., had a suggestion referred to committee, as to the possibility of founding local branches and of holding meetings in other cities.

The other speakers were W. J. Stirling, lighting expert, Standard Oil Company, and F. N. Alcott of the Black & Boyd Fixture Company. George H. Guy was appointed corresponding secretary.

D. W. W.

French Carbons in the United States.

The desire of the leading French carbon makers to introduce their carbons in the United States has found fruition in the establishment of the French Battery Company, which was incorporated recently, with headquarters at 69-75 Wells Street, Chicago.

ALFRED LANDAU.

French carbon is universally acknowledged throughout Europe, as being of high class, and is employed upon the Continent for all purposes requiring strongest and longest life with the least deterioration. In addition, a new process has been introduced, with success, in the manufacture of dry batteries, enabling the manufacturers to produce an article which meets all exacting requirements upon an economical basis, and which prevents rapid deterioration.

In choosing a field for their operations in the United States, the gentlemen who project this enterprise have recognized the fact that the consumption of dry batteries in the Mississippi Valley and the great western field is very large, and they have selected Chicago as being a natural commercial center of this great field in which batteries are employed in large quantities. Chicago also offers them exceptional advantages because of its shipping facilities and accommodations, not only in regard to procuring raw material and manufacturing the finished article in rapid and satisfactory style, but also as regards the receipt and prompt shipment of orders to all sections of the country.

The French Battery Company is said to be backed by leading French carbon manufacturers and capitalists, and is personally managed and operated by men of high-class European education and experience. Mr. Alfred Landau, who has supervision of the new establishment, gained his knowledge of all the essential details entering into the battery business by years of study and practice in Europe. Since then he has spent considerable time in various portions of the United States, familiarizing himself with the conditions of trade in this country before opening the factory. He announces that his factory will be conducted absolutely independent of any combination. The batteries will be manufactured out of the best French material by the new French process, the merit of which is declared to have been thoroughly proven. The English and German automobile trade, as well as the French dealers, have had gratifying experiences with these new-style batteries.

In regard to the operation of the new factory at Chicago, it is stated that no expensive salesmen are to be placed on the road, and that the factory will sell direct to consumers, giving them the benefit of this economy.

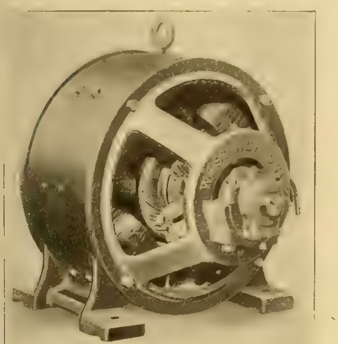
The French Battery Company asserts that its batteries have the highest amperage, the longest

and strongest life and the most recuperative powers, and are the most economical to handle. The company also handles globular carbon in all sizes. These carbons are manufactured with special care, and are said to give better satisfaction than any product made in America. Flashlight batteries of every description will also be manufactured by the concern.

Westinghouse Variable-speed Motor with Auxiliary Poles.

In many classes of work a wide speed variation is required, and to meet the demands of such service the Westinghouse Electric and Manufacturing Company has developed a line of direct-current motors having a speed range of four to one on a single voltage. This variation is obtained by field control, and the type SA motors, one of which is here shown, are said to compare favorably with the best direct current constant speed machines.

The new motors are exactly similar mechanically and electrically to the Westinghouse type S motors, except for the addition of auxiliary poles and coils. These are introduced in order to control the field form during the variation of field strength necessary to obtain so wide a range of speed. The



WESTINGHOUSE MOTOR WITH AUXILIARY POLES.

cast-steel poles with machine-formed coils are placed midway between the main poles and securely bolted to the frame. The construction is very simple and introduces no complications whatever, nor does it make difficult the removal of the main poles and field coils, as is shown by the fact that an auxiliary pole and coil can easily be taken out without in any way disturbing the main field winding by simply disconnecting the coil connections, withdrawing the bolts which hold the pole to the frame and sliding the pole and coil out parallel to the shaft.

The auxiliary field winding is connected in series with the armature and therefore produces a magnetizing effect which is proportional to the armature current. The auxiliary coils are placed as close to the armature surface as mechanical considerations will permit, and their turns are concentrated at that point. This arrangement adds materially to the performance of the motor, as it applies the corrective influences of the auxiliary winding directly at the points where the distorting effect of the armature current is strongest. This arrangement is much more effective than the distribution of the ampere turns along the length of the auxiliary poles. The magnetic field of the auxiliary winding acts in direct opposition to that produced by the armature current. The resultant field is made up of three components—that due to the shunt winding, that due to armature reaction and that due to the auxiliary windings. The field distortion usually produced by armature reaction is therefore overcome and the shape of the magnetic field at the point of commutation is maintained as formed by the main poles, and good commutation is possible over a wide range of speed.

Type-SA motors are shunt wound, which gives a definite speed for each point of the controller, which is nearly constant for all loads. Heavy overloads may be momentarily developed without injurious sparking. The motors are reversible without danger and without readjustment of the brushes, and, as the armature and auxiliary windings are connected permanently in series, it is only necessary to change the external armature connections to reverse the direction of rotation.

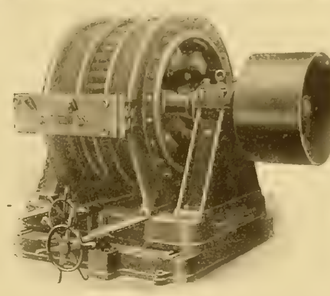
These motors develop their full-rated output throughout their entire range of speed. They will carry full rated load at any speed within their range for six hours, with a temperature rise not exceeding 40° C. in armature and field, and not exceeding 45° C. on the commutator, as measured by thermometer. At all loads and all speeds commutation is excellent, and an overload of 25 per cent. may be carried for one hour without injurious sparking. All motors are thoroughly ventilated, running cool and at a uniform temperature. Their efficiency is high and speed regulation exact.

Stanley-G. I. Revolving-field Inductor Generator.

When the company [illegible] to develop the [illegible] recognized the [illegible] demand for [illegible] apparatus [illegible] of the machine [illegible] multiphase [illegible] its simplicity [illegible] operated [illegible] that what [illegible] to be the first commercially [illegible] multiphase [illegible] was of this type and the machine [illegible] after over 14 years of practically [illegible] service upon a motor load.

This type of machine has become known as the inductor alternator. It [illegible] of design, however, a revolving-field generator, for although the field winding remains stationary, the magnetic field, generated by the stationary field coil, is rotated, and in passing across the stationary armature conductors generates in the armature coil an alternating current, which is so controlled by the design that the wave generated is almost identical with the true sine wave.

Although this was the first multiphase machine to be commercially introduced in this country, the design has been steadily improved since its inception, and it is [illegible] thoroughly modern today, [illegible]



STANLEY G. I. REVOLVING FIELD INDUCTOR GENERATOR.

its more recent and more generally known competitor of the so-called revolving field type.

The Stanley-G. I. Company has recognized the demand for this latter mentioned type, which is shown in the accompanying illustration, and which has its particular advantages for certain classes of work, notably low frequencies and engine-type machines of large capacity. It is, therefore, prepared to build the commonly termed revolving-field type in all commercial sizes, but unhesitatingly recommends its inductor generator as a thoroughly modern, efficient and commercial revolving-field alternator, of the simplest construction, and of superior design for certain classes of lighting and power work, notably for hydro-electric transmission and high-speed belted or coupled units.

To substantiate the position which it takes, the company refers to the situation in California, where the brunt of the lighting and power load throughout a large portion of the state is carried on inductor generators installed on the mountain streams, supplying power to San Francisco, Oakland, San Jose, Stockton, Sacramento, Los Angeles and the surrounding towns, which comprise the commercial center of the Pacific Coast; also to the towns of Anderson, S. C.; Columbus, Ga.; Montgomery, Ala.; York Haven, Pa.; Kokomo, Ind.; Joplin, Mo.; Paris, Ill., and elsewhere.

The company says that a prospective user of electrical machinery wrote to the general manager of a large power plant in the South, and in reply to his inquiry he received advice that the power company was using five Stanley generators of a thousand kilowatts capacity each. Three of the machines had been in use about three years. The other two had been recently installed. None had ever given a particle of trouble, and nothing had ever been paid out for repairs, and he voluntarily expressed the opinion that they are the best generators made. This is only one instance out of several.

As further proof of the contention that the inductor generator is exceptionally rugged, the Stanley company cites the following instance, taken from a number on record:

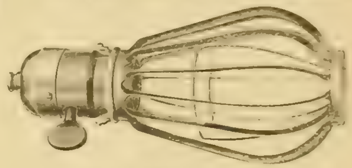
A power house containing four 875-kilowatt waterwheel-driven inductor alternators was entirely demolished by an unprecedented ice flow, the walls of the building being razed to the foundations. In looking at the site of the power house after the ice had stopped moving, slight bumps in the ice field were the only indications of the generators beneath. Several weeks passed before the ice could be removed and the machines cleared of wreckage. However, when the waterwheels were again in shape to drive them, it was found that but one armature coil in all these machines had been seriously damaged, and the remainder, after

[illegible]

efficient

Benjamin Two-part Lamp Guard.

[illegible]



BENJAMIN [illegible]

of a lamp guard by offering [illegible] which is complete[illegible]

The "Can't Break" guard is simple and strong, with few parts. It consists of two halves [illegible] pressed up from sheet steel, so that there is no solder to break or wire to give way. It has comparatively few joints, there being but two hinge joints at the top and two locking joints at the bottom.

The two parts with hinge joints at the top grip the bead on the socket firmly, thus securing fixedness and stability, and rendering all refractory unsteadiness impossible. This precludes grounding the lamp. An auxiliary spring wire centers the lamp, cushioning it gently, and keeping it from striking the main body of the guard. The sheet steel forming the guard is pressed up edgewise radially, and is tinned and bright. There is consequently little shadow, and the loss of light is thus reduced to a minimum. The guard protects the whole lamp, including the tip; no part is left exposed to breakage. It is easily removed and easily readjusted.

The Benjamin company asserts that the "Can't Break" is one of the simplest, most stable and most practical lamp guards on the market.

Chicago Gets 85-cent Gas.

The ordinance fixing the price of gas to consumers in Chicago at 85 cents a thousand cubic feet was passed by the City Council last week over the mayor's veto by a vote of 57 to 10. The companies affected had previously agreed to accept the measure, and the new rate will be in force for five years, dating from February 1, [illegible]. The mayor's principal objection was the price which he thinks should be 75 cents. Briefly stated, the ordinance authorizes gas companies to buy or sell gas from or to each other, or lease each other's mains, plants or appliances; repeals sections of Ogden and Universal companies' ordinances prohibiting them entering into combination with any other company and dismisses suit against Ogden company for forfeiture of its charter under this section; repeals the 75 cent gas ordinance, but continues the litigation to test its validity; wipes out $1,300,000 in gas bills the city owes the People's company, and settles all disputed claims between them; releases the People's Gas Light and Coke Company from all obligations to pay the city compensation and repeals the compensation provision of the Ogden company's ordinance; provides that the People's company shall continue to pay five per cent compensation on natural-gas sales; requires the Ogden company to pay $117,000 compensation now due the city, and reserves to the city the right to fix the price of gas again at the end of five years.

Proposed Detroit River Tunnel.

Bids have been asked upon four alternative plans for the construction of a tunnel under the Detroit River connecting Detroit, Mich., and Windsor, Ont. The Michigan Central railroad at present crosses the Detroit River by means of a ferry. To avoid delays, however, the tunnel has been planned and a company known as the Detroit River Tunnel Company formed to carry out the work. Plans and specifications have been issued under the direction of an advisory board of directors consisting of W. J. Wilgus, chairman, H. A. Carson and W. S. Kinnear. Proposals for the work will be received until March 8th.

The tunnel, which will connect the two cities, will consist of two single-track tubes. The subaqueous portion will be 2,625 feet long, the easterly approach tunnel 3,100 feet long, and the westerly approach tunnel 2,130 feet long. Open cuts will lead to the approach tunnels. The total tunnel length will be 7,855 feet, and the length, including the cuts, will be 12,800 feet.

It is proposed to draw the trains through the tunnel electrically and the electrical zone will make about four miles of electrically operated road.

The maximum depth of the river at the proposed site is 45 feet and the clearance of the tunnel will not be less than 41 feet below the surface where the depth of water now equals that amount. The interior diameter of the tubes is to be 18 feet, giving a height above the top of the rail of 16 feet. Power conduits will be located on one side of the tube interior and telephone, telegraph light and signal wires on the other side, with a clearance of 11 feet six inches between them.

As stated above, there are four designs proposed, known as "A," "B," "C" and "D." Design "A" provides for filling the tunnel trench to a depth of five feet, with concrete above the shell of the tunnel tube, which is itself of concrete two feet thick and reinforced with steel rods. Design "B" provides for a filling of concrete only up to a short distance from the center line of the tubes, the balance being back filling. Design "C" provides for outer and inner shells of three-eighths-inch steel, the outer supported by rings of 10-inch I-beams of 30-pound section spaced four feet, center to center. Design "D" provides for a tube of cast-iron rings composed of segmental sections.

The cost of the tunnel is estimated at from $7,000,000 to $8,000,000 and it is expected to have a capacity for handling 4,000,000 cars a year.

Finances of International Congress.

Mr. W. D. Weaver, the treasurer of the International Electrical Congress held in St. Louis in 1904, has presented an audited report. The total receipts were $13,438.90 and the total disbursements $11,392.53, leaving a balance in bank on January 16, 1906, of $2,046.37. The executive committee of the Congress has decided to offer this sum to the library of the American Institute of Electrical Engineers as a fund commemorating the Congress, the annual proceeds to be applied to the purchase of international electrical literature.

This pleasing result was brought about despite the fact that the amount realized from the membership fees was less than the total expenses. When the probability of a deficit became evident a canvass was instituted for the sale of copies of the Transactions at $10 a set, and the result was the unexpended balance now reported of over $2,000. The record is one which is creditable to all concerned in it.

Attack the "Electric Mule."

Cleveland stockholders of the Miami and Erie Canal Transportation Company ridicule the charges of fraud and corruption made against them in a suit filed in the United States court at Cincinnati by Rudolph Kleybolte of Cincinnati, Ohio. Mr. Kleybolte alleged that the Cleveland men floated $2,000,000 bonds and $3,000,000 stock on the strength of a paid-up stock of $10,000. The defendants, he alleges, presented themselves with $990,000 of the stock and made no payment for it. He asks the court to require the men to pay par for this stock and that the money be used to pay the debts of the corporation. Nearly all the traction men in Cleveland are named in the petition.

The company was organized in 1900 to run boats by an electrically operated towing device on the canal between Cincinnati and Toledo.

Metropolitan Elevated Road to Buy Current.

Directors of the Metropolitan Elevated Railway of Chicago have given up the idea of building a power house of their own to supply the additional electric power to operate the cars. At a meeting of the directors of the railway company a contract with the Chicago Edison Company was ratified, whereby the latter will furnish the railway the extra current needed. The Metropolitan, in taking current from the Edison company, has followed the example of the Chicago and Oak Park Elevated and the Chicago City Railway Company.

Indiana Telephone Items.

The Citizens' Independent Telephone Company of Terre Haute has been reorganized. A bond issue of $1,000,000 was ordered, of which $200,000 will be used in paying for the West Terre Haute telephone plant and completing the central-station building.

There is an apparent hitch in the reported Independent telephone merger so far as it concerns plants in Northern Indiana. Experts have been at work for the last two weeks examining plants on which options were taken at the meeting of telephone interests at St. Louis. Notices have been sent to the 10 or 12 exchanges and toll companies that the prices are too high and that the properties cannot be taken over at the figures quoted.

The situation in Evansville is becoming more and more strenuous. The Retail Merchants' Association attended the council meeting Monday night in a body and entered a vigorous protest against ratifying the grant by the Board of Public Works of a franchise to the Cumberland Telephone Company. A. W. Funkhauser, former city attorney, said the Citizens' Telephone Company filed an application for a franchise three weeks before the Cumberland filed its application and that nothing had been done with it. He also said that the Citizens' franchise paralleled the Cumberland's franchise in every respect, except that it offered a lower rate to subscribers. Mayor Boehne is said to favor the Cumberland franchise, and it is thought the City Council will pass the franchise over the protests and then grant a similar franchise to the Independents.

The Indianapolis Telephone Company will make its application in a few days for an extended franchise containing a provision which will enable the company to increase present rates. The officers of the company argue that they never contemplated giving service outside the city limits for the price in vogue, whereas they are giving free service to all the suburbs and many of the towns of the county. As an example they charge $40 a year for city service and $6 additional for outside service; but frequently the subscriber refuses to pay the extra $6 and gets the service just the same. It has not been deemed necessary to contest the matter in the courts and there will be less inclination to do so since the Illinois Supreme Court has decided that an agreement not to increase rates for service incorporated in an ordinance will be enforced.

The Citizens' Telephone Company of Kokomo will remove its offices and exchange from the Kennedy Building to the Courtland Building. Secretary Jay says the company will make improvements, install some new apparatus and long-distance booths and extend the lines and better the service generally.

W. T. Blythe, in charge of the weather bureau of Indianapolis, has been ordered to send out over the telephone lines the weather reports at a given hour every forenoon. It is thought that 60,000 people in Indiana will receive the weather report simultaneously every day. S.

Southeastern Telephone Developments.

The Piedmont Telephone Company of Gastonia, N. C., will build an exchange at Grover and rebuild those at Blacksburg and at Yorkville, S. C. Several toll lines are also to be built giving a rural service to a number of counties.

The Southern Bell Telephone Company has bought the Independent exchange at Rockingham, N. C., and will improve the plant. J. B. Maxwell, in charge of the exchanges at Laurinburg, Hamlet and Maxton, will be in charge of the Rockingham exchange.

The Bryson City (N. C.) Telephone Company has been chartered with a capital of $5,000. R. L. Sandridge is one of the incorporators.

Material for the underground system of telephones at Asheville, N. C., has been shipped. Work is also being done in preparation for the handsome new telephone building for the Asheville company.

The Homeville Telephone Company of Homeville, Va., has been incorporated with a capital stock of $5,000. B. R. Birdsong of Homeville is president of the company.

The Southern Bell Telephone Company is installing a new system at Gadsden, Ala., where new telephones, cables, etc., are being put in and the system generally overhauled.

M. A. Floyd has purchased the Berkley telephone system at St. Stephens, S. C.

The Southern Bell Telephone Company, it is announced, will install an underground system in Columbus, Ga., and will build a handsome new exchange building in that town.

The stockholders of the Cumberland Telephone and Telegraph Company, at a meeting in Hopkinsville, Ky., voted to increase the capital stock from $13,500,000 to $17,000,000. The proceeds of the new stock will be used for extensions and improvements.

James E. Caldwell is president and general manager of the company. L.

Telephone News from the Northwest.

The Twin City Telephone Company has reported to the state auditor of Minnesota earnings for the year ended November 30, 1905, of $506,210.62. On this the company pays a gross-earnings tax of three per cent.

The City Council at Anoka, Minn., has finally granted permission to the Tri-state Telephone Company to construct a line into that city and establish pay stations.

A Kellogg switchboard has been purchased and will be installed at the exchange at Franklin, Minn.

The Hample-Crete Telephone Company has been incorporated near Oakes, N. D., with $50,000 capital.

The Minnesota Central Telephone Company will rebuild the local exchange at Sleepy Eye, Minn. Cable work will be installed as well as a central-energy switchboard.

A council committee in Minneapolis is considering the best basis of proceeding in the matter of requiring conduits for wires.

The Pingree (N. D.) Telephone Company has been incorporated with $50,000 capital.

The local telephone company at Mt. Vernon, Iowa, is planning on rebuilding its lines throughout.

The Farmers' Mutual Telephone Company of Vinton, Iowa, may sell its system to the Corn Belt Telephone Company of Waterloo.

The Bedford (Iowa) Telephone Company has bought all the toll lines running out of Bedford.

The Henry (S. D.) Union Telephone Company has been organized with J. T. Belk as president and E. Reineke secretary and manager.

The Northwestern Telephone Exchange Company will put in a central-energy system at Grafton, N. D. R.

Ohio Telephone Notes.

A few days ago a syndicate headed by James S. Brailey of Toledo secured a controlling interest in the Sandusky Telephone Company, which has an excellent system in Sandusky and some good lines to the surrounding country. It is supposed this is only a part of the plan of grouping the companies in Ohio.

Reports of the officers of the Columbus Citizens' Telephone Company at the annual meeting a few days ago showed the earnings have made a splendid increase since the exchange was completed in the new building, and the gain in subscribers has been very satisfactory. The announcement was made that the company had leased the properties of the Franklin County Telephone Company as of January 1, 1906. This company has a capital stock of $150,000 and five per cent. annual dividends are guaranteed on this.

The Cincinnati and Suburban Bell Telephone Company has sent out return postal cards to all its subscribers, asking if they desire another telephone system in the city.

Earnings of the subsidiary companies of the Federal Telephone Company show good increases over 1904, in every instance. Gross and net earnings, respectively, of the various companies named for 1905, are as follows: Stark County Telephone Company, $81,842 and $40,697; Citizens' Company of Fostoria, $13,520 and $5,054; Columbiana County Company, $50,738 and $17,372; Lancaster Company, $20,475 and $7,533; Massillon Company, $20,560 and $6,797; Findlay Home Company, $22,200 and $8,288; Zanesville Company, $31,872 and $11,542; Youngstown Company, $55,658 and $29,088; United States Company, $479,463 and $168,858.

Officers of the Citizens' Independent Telephone Company of New Lexington have been elected. A modern plant is to be built at New Lexington, which will supply the town and the entire territory of Perry County with service. C.

NEW COMPANIES.

H. P. Stumpf and associates of Waterloo, Ill., have incorporated as the Farmers' Fountain Telephone Company with a capital of $10,000.

The Floraville Rural Telephone Company of Floraville, Ill., has been incorporated by L. I. Zimbelmann, Philip Worth and Louis Eckert.

A new telephone company has been organized in Fulton, Ky., to operate a telephone system. J. D. Kennady is president and G. Browder secretary.

The Chester Telephone Company of Armour, S. D., has been incorporated with a capital stock of $1,000 by G. Funlendorf, Frank Groesbeck and others.

A. J. Davis, W. H. Ames and S. A. Hayward have incorporated as the Peoria, Pekin and Tremont Telephone Company, with headquarters at Tremont, Ill.

The Reeves County Telephone Company of Pecos, Texas, has been incorporated with a capital of $25,000 for the purpose of conducting a telephone business in the counties of Reeves, Pecos, Ward, Loving, El Paso and Winkler. W. C. Kelley, R. S. Johnson and R. D. Cage are among the incorporators.

Among the recently incorporated telephone companies are the following: Sedan Telephone Company, Sedan, Minn.; Citizens' Economic Telephone Company, Fedora, S. D.; Langford Telephone Company, Langford, S. D.; Centerville Rural Telephone Company, Excelsior, Kan.; High Line Telephone Company, Long Island, Kan.

$175 Telephone Rate Illegal in Chicago.

A decision by the Illinois Supreme Court, handed down last week, holds that the Chicago Telephone Company cannot increase rates above those named in the ordinance of 1889, under which it holds its franchise. It also holds that all territory which has been annexed to the city since the adoption of the ordinance is subject to the condition of the ordinance. The maximum rate in the ordinance is $125 a year. Several years ago the company began charging $175 where metallic circuits were installed to take the place of the grounded return system, the higher cost of the improved service being the reason given for the increase. During this time many suits have been brought against the company for relief from the high rate, most of them through the Illinois Manufacturers' Association. The city of Chicago also asserts that the company owes it something like $500,000 compensation, this amount being equivalent to three per cent. of gross receipts in the outlying districts which have been added to the city since the adoption of the ordinance, but in which territory the company contends that it is not required by the ordinance to pay compensation. The Supreme Court also rules against the charging of tolls to points beyond the old city limits but now within city.

The decision of the Supreme Court is the outcome of quo-warranto proceedings started in Judge Mack's court to oust the corporation from the streets for its failure to carry out the provisions of its franchise in the matter of rates.

In view of the fact that the Chicago Telephone Company recently began negotiations with the city for an extension of its franchise (which expires in three years), it is likely that this decision, adverse to the company, will have a bearing on the rates to be named in any future franchise grant.

Bell Telephone Finances.

President Fish of the American Telephone and Telegraph Company has announced the sale of the company's four per cent. convertible debenture bonds, amounting to $100,000,000, to a syndicate composed of J. P. Morgan & Co. and Kuhn, Loeb & Co. of New York, Baring Brothers of London and Kidder, Peabody & Co. of Boston. It is understood that the bonds were sold at about 92. The issue was necessitated by the company's need of funds with which to expand and develop its business. The bonds will be convertible into stock at 140, after three years, and will mature in 30 years. This sale will provide for the company's requirements for at least three years, including the payment of the five per cent. coupon notes, amounting to $25,000,000, which mature May 2, 1907, and the American Bell company's debentures, amounting to $10,000,000, which mature July 1, 1908. The construction requirements for the Bell companies of the United States call for about $40,000,000 annually, of which the parent company supplies $25,000,000 and the subsidiary companies supply the remainder.

TELEPHONE MEN.

John C. Woodbury of Rochester, N. Y., has been elected president of the Stromberg-Carlson Telephone Manufacturing Company, succeeding Alfred Stromberg.

Officers and a few employes of the Cuyahoga Telephone Company of Cleveland, Ohio, met a few evenings ago and presented to W. B. Woodbury, the retiring assistant general manager, a handsome gold watch, chain and locket and a leather upholstered chair. Mr. Woodbury will be able to use the watch to good advantage, but his work shows that he has not worn out many chairs during the last few years. He goes to Detroit to superintend the construction of a large Independent system, as stated in the Western Electrician recently.

It is reported that Mr. F. S. Dickson is to retire from the presidency of the Federal Telephone Company of Cleveland and of all the affiliated companies. Mr. Dickson is to become Cleveland manager for a firm of brokers and will have charge of the business of the office, while his son will look after the stock-exchange end. Mr. Dickson is well fitted for such a position, as he is posted on stocks. R. W. Judd will also retire as treasurer of the Federal Telephone Company and will later on be connected with the Guardian Savings and Trust Company.

A new telephone company, the Ohio and Missisippi Valley Telephone Company, has been formed and proposes to take over and consolidate the properties of the Carbondale, Anna, Marion and Du Quoin (Ill.) telephone companies. The new company will have a capital of $100,000, and headquarters will be at Carbondale. William H. Warder of Marion, Dr. F. W. Willard of Anna, H. C. Miller of Du Quoin and J. B. Burdy of Carbondale are the men interested.

Resonant-circuit Telephony.

[illegible] gradually and [illegible] ing," the [illegible] of speech.

It is known that when [illegible] electromotive force is applied [illegible]

[illegible]

stant resistance the current flowing will be a function of the self-induction and the capacity. There are certain values of self-induction and capacity with which, for a given frequency, the circuit becomes "resonant" and a current flows greatly in excess of the current which would flow in either the self-induction or the condenser alone. On either side of this critical point—that is to say, if the self-induction, the capacity or the frequency be varied—the current falls off rapidly; but the rate of fall depends, other things being equal, on the resistance of the circuit.

In practicing the invention, a simple form of which is shown in the accompanying illustration, it is preferable to tune the transmitter circuit so that the current is a little below its maximum value—that is, so that the circuit is nearly but not quite resonant, and to vary the constants of the circuit by the action of the transmitter, so as to cause variations in the current corresponding more or less exactly to the air vibrations to be reproduced. These variations may be caused to produce sound in any suitable receiver. This involves the use of a source of alternating current, and it is obvious that with any commercial frequency the currents produced by that source would be heard in the receiver. If the frequency were badly chosen the sounds thus produced would be very annoying, and it is therefore preferable to use a generator of a rather low or rather high frequency. Though it is in some respects preferable, it is not necessary that this frequency should be either above or below the audible limit. The invention also contemplates multiplexing the system thus constituted and also comprises various other features.

Ohio Independent Telephone Association.

At a meeting of the executive commitee of the Ohio Independent Telephone Association in Columbus a few days ago the members spent the greater portion of the time in discussing legislation. At the instance of the Independent people, bills will be introduced in the General Assembly which, besides other benefits anticipated, will clear the way for the Independents to build a system in Cincinnati and Hamilton County, a point they have never been able to enter because of the opposition of the City Council and the fight made by the Bell company.

The annual meeting of the Ohio Independent Telephone Association will be held in Columbus on March 30th. It is thought this meeting will be of more importance than any in the past. A year ago a movement was started at the annual meeting for a closer union of the Independent companies, and this has developed into a national affair, with a splendid financial backing.

Canadian Bell Telephone Improvements.

The management of the Canadian Bell Telephone Company has completed arrangement for the expenditure, this year, of about $2,000,000 in general improvements to its system throughout the Dominion. The building of the Uptown Exchange in Montreal is being proceeded with, and an order has been placed for a new switchboard costing over $200,000. A new building is to be erected in Westmount. In Toronto another large exchange [illegible]

Work of the National Interstate Telephone Association.

[illegible] H. W. [illegible] The compilation and publication of statistics with [illegible] all Independent operators.

[illegible] headquarters.

GENERAL TELEPHONE NEWS

R. E. Moore of Decatur, Texas, has [illegible] a franchise to operate a telephone system in [illegible], Indian Territory.

The Pingree (N. D.) Telephone Company has been incorporated with a capital of $50,000. James Price is interested.

The Southwestern Telephone and Telegraph Company will establish a telephone exchange in South Dallas, Texas, next year.

The Cleo, Cimarron Valley and Western Telephone Company of Clarion, Okla., has been incorporated with a capital of $5,000. The incorporators are James E. Ely and others of Clarion.

The name of the Eastern Telephone Company of Rockland, Mass., has been changed to the Maine Telegraph and Telephone Company and the capital stock has been increased to $250,000.

Negotiations are in progress for the absorption at Anderson, S. C., of the Anderson Telephone Company by the Bell company. The Bell interests will operate under the franchise of the local company, it is stated.

With headquarters at Mattoon, Ill., the Coles County Telephone and Telegraph Company has been incorporated, capitalized at $100,000. I. A. Lumpkin, W. C. Lumpkin and John McNutt, Jr., are the incorporators.

According to statistics compiled by Frank L. Beam, manager of the Ohio Independent Telephone Association, six months after the annual meeting in 1905 there were 227,277 subscribers, 605 exchanges, [illegible] toll stations and 18,239 stockholders in the Independent ranks in Ohio. The great growth of the movement is shown by the fact that reports at the last annual meeting showed that there were 196,937 subscribers, 608 exchanges, 1,004 toll stations and 17,029 stockholders. At that time it is claimed the Bell companies had 104,318 subscribers, and six months later the number was 108,991.

The Pacific States Telephone and Telegraph Company which held its annual meeting at Portland, Ore., recently, and elected Henry T. Scott president, has re-elected Louis Glass as vice-president and general manager and F. W. Eaton, secretary. The old board was re-elected and the number increased to 15 by the addition of Henry T. Scott and Frank G. Drum, both of San Francisco. The company spent over $4,000,000 on improvements on the Coast last year, the greater part of which was expended on the five new buildings and new switchboards throughout the city of San Francisco. The offices of the engineering department and several other branches have been moved from 216 Bush Street to the fine new executive office building on New Montgomery Street.

CORRESPONDENCE.

Great Britain.

London, February 7.—The campaign by a local firm of parcels and goods carriers in Manchester against the position taken up by the Manchester corporation that it was entitled to carry on the business of goods carriers in all its branches has been brought to the courts and a decision given. The facts are these: Under various acts of Parliament, ancient and modern, the Manchester corporation was without doubt authorized to collect and deliver parcels by its tramway system en route. To this extent no opposition could be taken, but quite recently a complete carriers' organization has been developed for the general distribution of goods throughout the area served by the tramways, which is much greater than the Manchester area for rateable purposes. It follows that vans and other conveyances were used having no connection whatsoever with the tramways, and a large firm of goods carriers in Manchester, being also large taxpayers, questioned the action of the corporation. The decision of the courts is a somewhat curious one, inasmuch as it would appear to offer the corporation a loophole. The courts uphold the case for the corporation in so far as the carriage of goods by tramways is concerned, but any business independent of the tramways is restrained. In other words, every parcel must be carried part of its journey by tram car, and then it may quite legally be transferred to a cart or van. Some restriction is placed upon the funds which may be applied for the purposes of this undertaking, but it may be said that in effect the carriers and ratepayers have lost their case. On the face of it such a competition appears distinctly unfair, and if municipal trading of such a character is to be indulged in to any considerable extent throughout the country, as it may very well be done under this decision, then the sooner some modification of the rating laws, as applied to persons whose business is competed with, is made, the better will justice be meted out.

An interesting proposal has been made to construct a private right-of-way between London and Brighton—the fashionable South Coast watering place, 50 miles away—for the sole use, on the payment of a toll, of mechanically propelled vehicles.

Probably no tramway promoter has met with more obstruction than Sir Clifton Robinson, who is one of the pioneers in the introduction of electric tramways in this country. He is head of the company which was the first to commence electrical working in and near London, and his fight against prejudice and wilful obstruction led him to make some very strong remarks before the traffic commission. Since then his every proposal has been beset with difficulty, culminating in a long inquiry with regard to the effect of his tramways upon the delicate instruments at the Kew Magnetic Observatory. The latest move against the London United Tramways was a petition to the Board of Trade on the ground that the tram cars were too noisy, and after a long inspection it was said that the cause of the trouble was in part loose brake gear and also loose rail joints. The Board of Trade has drawn the attention of the company to this matter, and it will be remedied. Of course the company is to blame; but it is an incident which demonstrates the state of feeling in these matters in some districts.

Prof. Silvanus Thompson has just completed a course of lectures before the Society of Arts on the design of high-speed electrical machinery with special reference to dynamos for turbine drive. Special attention is being devoted to this subject here just now, and the lectures have indicated that several important improvements are in hand.

The action of municipalities here in engaging in the electric-wiring business, more or less illegally, has been reported from time to time. The Electrical Contractors' Association is now becoming very vigilant in regard to cases of this kind, and quite a number of local authorities have discontinued the practice under a threat of legal proceedings. The latest case is that of Barking, a suburb of London, where apparently the business has been so unremunerative that the council has dropped it of its own free will.

Under the terms of most of the "electric-power" acts in the United Kingdom the power companies are precluded from supplying in certain specified towns unless by the special request of a customer, and may even then only do so by the consent of the local authority. From the commencement the suggestion that a local authority would yield in the circumstances was never entertained, and this view has been borne out in fact. During the past 12 months power companies in all parts of the country have been requested to give a supply in certain "precluded" towns, but have met with a point-blank refusal from the local authorities, who, of course, own electricity works. If all the companies take advantage of their right to appeal to the Board of Trade there seems a good deal of hard work in store for that department.

At its last meeting the London County Council decided to oppose every bill in Parliament this year relating to electric power supply or tube railways, and also the bill which proposes to install the Batcheler system of parcel delivery by pnuematic tubes. C.

New York.

New York city, February 17.—The report of the Interborough Rapid Transit Company for the quarter ended December 31st, filed at Albany on Monday, shows an increase of $708,747 in gross earnings and of $123,711 in net income over the corresponding period in 1904. On the subway division the gross earnings were $1,887,317, equivalent to a passenger-total of over 37,000,000 for the three months, or more than 410,000 a day. The net income on the elevated lines was $150,000, which was about $88,000 less than for the corresponding period of 1904. An analysis of the figures, however, does not place the dividend possibilities of the recent merger of the Interborough-Metropolitan interests in a favorable light.

The Brooklyn Rapid Transit Company will soon extend its old "City" line to Middle Village, Queens Borough. This is part of a general plan to utilize the Blackwell's Island Bridge when built. The Brooklyn Rapid Transit is also to have a new car barn in Queens Borough, its present yards at East New York being now deemed too valuable for storing purposes.

Following the action of Borough President Ahearn, President H. H. Vreeland of the New York City Street Railway Company has promised to do something in the way of providing cleaner cars, and possibly a better service on the East Side. Several East Side educational bodies have been assisting in the agitation.

The Pennsylvania Railroad has filed plans for a four-story power house, to be located directly opposite the Manhattan terminal. The designers of the generating station are Westinghouse, Church, Kerr & Co., who estimate its cost at $300,000. The building will be of granite, to match the terminal.

At Poughkeepsie, N. Y., last Sunday morning, a fire destroyed the power plant of the Poughkeepsie City and Wappinger's Falls Electric Railway Company. All local trolley traffic was suspended, but pending the rebuilding of the station power will be obtained from the Poughkeepsie Light, Heat and Power Company.

August Belmont attended this week's meeting of the Civic Federation and spoke on Welfare work among traction employes. He outlined a plan for housing the men in suburban homes. President H. H. Vreeland of the New York City Street Railway Company, told of what had already been done in the way of reading and recreation rooms for the men on his line. Several labor representatives spoke at the meeting.

The first annual report of the state Commission on Gas and Electricity shows that the city of New York has 3,250 open arc lamps, as against 2,045 in the rest of the state. The city lighting industry represents 71 per cent. of the light capitalization and 77 per cent. of the incandescent lamps of the state.

A bill to compel the establishment of a general 10-cent telephone rate for New York city has been introduced at Albany by Assemblyman Alfred E. Smith.

The New York Telephone Company has filed plans for a new exchange building on One-hundred-and-forty-sixth Street, to cost $110,000.

Laborers of the Orange (N. J.) street department are removing telephone wires from the trees, the New York and New Jersey Telephone Company having, it is said, violated the terms of its agreement with the Common Council.

The Rochester, Scottsville and Caledeonia Electric Railroad has been incorporated with a capital of $500,000, by Rochester men, to operate an electric railroad in Livingston County, New York.

A. F. Gole and associates have organized the Suttepec Electric Light and Power Company of Brooklyn with a capital of $200,000.

The Mercer Electrical Company has been incorporated at Trenton, N. J., with a capital of $100,000.

The Hertlein Silk Mills of East One-hundred-and-forty-eighth Street has abandoned its private generating plant, and now takes the service of the Edison company for each of its many individual motors. The Century Club has likewise abandoned its private installation.

L. K. Comstock, formerly of Chicago, has the contract for the electrical equipment of a large new building at the corner of Forty-fourth Street and Seventh Avenue.

New electrical work is to be put in at Public School No. 89, Brooklyn. Tenders for additional electrical equipment, to the probable amount of about $5,000, at the Manual Training High School, Brooklyn, are returnable at 11 a. m. February 26th. D. W. W.

Dominion of Canada.

Ottawa, Ont., February 17th.—The Railway Commission of Canada is considering the applications of the Ontario Power Company and the Niagara Power Company for authority to cross the Grand Trunk, Michigan Central and other railways with their transmission lines. The railways opposed the application on the ground that the safety of the public is not sufficiently guaranteed. It is probable that a cradlework to protect the tracks will be agreed upon.

The Canada Southern Railway Company has applied to the Railway Commission for authority to expropriate certain lands for new terminals in view of the tunnel being built under the Detroit River at Windsor, Ont. The improvements contemplated by the railway company will cost upward of $5,000,000. The tubes through which trains will run either way at the same time will be laid in specially prepared trenches and will be lighted by electricity. The Canada Southern road is under control of the New York Central.

The new power house of the Montreal Street Railway Company to be erected in the east end of the city and upon which work will begin soon will cost, it is estimated, about $1,000,000. A like sum will be expended on new lines outside the city. For the latter an order for 6,000 tons of T rails has been placed, sufficient to lay 50 miles of track. These rails are all for May delivery and will weigh 86½ pounds to the yard. The company has also under construction 100 new cars, which are to be nine feet longer than any now in use in Montreal. Rubber tiling is to be utilized for the floors and the cars will be lighted from the sides and heated by electricity.

A bill is now before the Legislature of Quebec to charter the Southern Electric Company for the construction through and in the counties of Nicolet, Yamaska, Arthabaska, Drummond, St. Hyacinthe, Bagot, Megantic, Wolfe, Beauce, Richmond and Sherbrooke of various electric lines and works for light, heat and power. The powers asked for are considered most extraordinary, as they practically cover the absolute grant of valuable franchises and control of streets and highways within the counties. W.

Winnipeg, Man., February 17.—The Winnipeg City Council has awarded a contract to Jackes & Co. (agents for Crossley & Co. of Manchester, England) for a gas-producing plant. The price was $114,000. There was only one other bid.

The Western Counties Power Company has acquired the plant and stock of the Brantford (Ont.) Electric and Operating Company and will operate it. The company's franchise expires in three years and application will then be made for a 25-year competitive franchise. The company proposes to bring Niagara power to Brantford and make Brantford a great distributing center. The head offices will be located in Brantford.

The Dominion government is making arrangements for the installation of an electric-light plant for the supply of electric light in the Parliament buildings. At present the government is paying one of the Ottawa lighting companies $4,000 a year for light. Minister of Public Works Reaume is inquiring as to cost.

The Toronto Electric Street Railway Company is preparing to order from the Loraine Steel Company 5,000 tons of girder steel rails to relay the tracks of main lines in the central part of the city. These are of a heavier construction than has ever been used in Toronto on the company's lines.

The Winnipeg Electric Street Railway Company has agreed to the terms of the Winnipeg, Selkirk and Lake Winnipeg Railway Company, and the charter has been drawn up for the transfer to the Winnipeg Electric Company. This transfer has been on the tapis for some months past, but there has been some difficulty in arriving at the terms. The transfer will be submitted to the shareholders on February 27th for ratification.

The Ottawa Electric Street Railway Company's net profit for the last year was $143,000, or 14.3 per cent. on the capital stock of the company ($1,000,000). During the last year the number of passengers carried was 9,891,000 and the receipts $449,833.

A power dam to generate 2,575 horsepower is to be built on the Maitland River about four miles from Goderich on Lake Huron. J. T. Goldthorpe has completed all the financial arrangements. The power generated will be used for lighting the streets and for a system of radial electric railways.

The Grand Falls Power Company of St. John, N. B., has deposited with the minister of public works of Canada plans of a dam and other works to be built in River St. John at Grand Falls, N. B. Work on the big power dam at Fort Frances, Ont., is being pushed rapidly, the large cable being now in operation. E. G. Penniman, Sr., of Fort Francis and E. W. Backus, the president of the company, have been giving the work personal attention. H.

New England.

Boston, Mass., February 17.—In the Massachusetts Legislature petitions from the following-named for incorporation have been referred to the next Legislature: Boston-Lowell Interurban Street Railway Company, Boston and Rhode Island Electric Railway Company and the Fitchburg, Ashburnham and Winchendon Electric Railway Company.

The Edison Electric Illuminating Company of Boston has bought the block numbered 416 to 430 Atlantic Avenue, now occupied by a number of tenants engaged in various lines of business. The property's assessed valuation is $355,900. It consists of 24,176 square feet of land, situated over a block away from the company's Atlantic Avenue Station.

The Consolidated Railway Company has been

considering the advisability of building an electric railway between Manchester and Coventry, Conn. and many owners of land along the proposed route have offered to give private right of way to the company.

The citizens of Winchester, Mass., have petitioned the State Gas and Electric Light Commissioners to hold a hearing on the matter of prices charged for electricity by the Edison Electric Illuminating Company which lights that town. It has been proposed that the town buy its electricity at wholesale from the Edison or the Malden company and do its own distributing. There is some talk of the town installing and operating its own electric light plant.

The Massachusetts railroad commissioners have approved the Springfield Street Railway Company's petition for authority to act as common carrier of baggage and freight. This company is controlled by the New York, New Haven and Hartford Railroad Company.

Municipal ownership of the Chicopee (Mass.) electric-light plant has not been a financial success during the last year. The expenditures have been much greater than the receipts, and the official report makes no account of depreciation because this "has been cared for by payments for repairs."

The Boston Transit Commission has advertised for bids for the construction of the section of the Washington Street subway between a point about 150 feet north of State Street and Hanover Street. The bids will be opened at noon on March 6th.

The Old Colony Street Railway Company has petitioned for the Massachusetts railroad commissioners' approval of its right to carry freight in Fall River, the municipal authorities having granted permission. The board is still considering the company's petition for approval of a similar right in Brockton, Taunton, Easton, Dighton, Raynham, Rehoboth and Seekonk.

The New York, New Haven and Hartford Railroad Company is considering plans for a tunnel between the Union Station in Providence, R. I., and the company's tracks in East Providence, a distance of two miles. The company will probably use electric power in the tunnel.

Notwithstanding its recent acquisition of the Hartford, Manchester and Rockville Tramway Company, the Consolidated Railway Company is proceeding with its arrangements for an additional electric line between Hartford and Rockville, Conn. The New York, New Haven and Hartford railroad tracks between Burnside and Rockville will be equipped with an overhead trolley system and will be used for electric cars. The Hartford Electric Light Company is under contract to furnish the power and it has erected the poles for the transmission wires.

The documents completing the consolidation of the Rutland Street Railway, the Chittenden Power and the Vermont Internal Improvement companies have been filed with the Vermont secretary of state. The company has a capital of $2,400,000 and it proposes to establish a direct trunk line of electric railway through Southern Vermont, south of Essex Junction.

The DeForest Occidental and Oriental Wireless Company has filed its certificate of incorporation with the secretary of state of Maine. It is a subsidiary of the American De Forest Wireless Telegraph Company and it proposes to operate between Kittery, Me., and any part of the United States.

The Johns-Pratt Company of Hartford, Conn., manufacturer of electric insulations and supplies, has voted to increase its capital from $150,000 to $300,000. Of the company's surplus $150,000 will be capitalized in the form of a stock dividend. The company's stock is quoted at 575 bid, and it will continue to pay its regular dividends of 20 per cent.

The Bryant Electric Company has awarded the contract for the erection of an addition to its Bridgeport (Conn.) plant, to cost $25,000. The addition will be brick, three stories and basement, 60 by 122 feet. It will be electrically equipped.

The Norwich and Westerly Street Railway Company has made a contract for electrical equipment costing $100,000, with the Westinghouse company. The equipment is to be delivered in time for the company to begin running its road on July 1st.

Municipal ownership of gas and electric-light plants was defeated a second time in the Boston Common Council by a vote of 44 to 15, with 16 absent or not voting. It required 50 votes to pass the order. This measure is now killed unless it is taken up by the aldermen and sent by them to the Common Council. B.

Ohio.

Cleveland, February 17.—Judge S. W. Smith has decided that the Cincinnati Gas and Electric Company has a valid contract with the city of Cincinnati to furnish natural gas. Suit was brought for an injunction to prevent the consummation of the contract, but the position of the company was upheld by the court.

Senator Howe has introduced his tax measure in the General Assembly. It provides for taxing the franchises of all public-service corporations and the abolishment of the levy for state purposes. His plan is to tax the corporations, as at [illegible]

[illegible]

The proposed [illegible] from Sandusky to [illegible] incorporated to build [illegible] about $200,000 [illegible] Sandusky and Toledo [illegible]

A resolution has been introduced [illegible] Council at Akron [illegible] the Northern Ohio Traction Company [illegible] building the Mill Street bridge [illegible] to be returned to the city by the [illegible]

Reports are current that the operating departments of the local electric [illegible] and the Fort Wayne, Van Wert and Lima [illegible] merged within a few days and that [illegible] of Fort Wayne will have jurisdiction over [illegible] including the line that is being built to connect Lima and Toledo. These are all Schoepf roads.

A bill has been introduced in the General Assembly which will provide for the appropriation of $25,000 for installing an electric-light plant in the statehouse.

All the directors and officers were re-elected at the annual meeting of the stockholders of the Miller Anchor Company of Norwalk. It was decided to increase the capital stock from $20,000 to $40,000.

The Henry C. Jackson Electric Company of Parkersburg, W. Va., has been incorporated with a capital stock of $50,000 to conduct a general electric business. Henry C. Jackson, C. L. Williams and others are interested in the company.

It is announced that the Canton and New Philadelphia Traction Company will rebuild the car barns that were burned some time ago, and that they will be much larger than the old ones. In connection with this a line is being promoted from Canal Dover to Coshocton and Zanesville, and this will increase the needs of the company in the way of car barns and power property. O. M. C.

Indiana.

Indianapolis, February 17.—The Columbus and Seymour Traction Company has filed articles of incorporation, capitalized at $20,000, and proposes to build an interurban line between Columbus & Seymour. The directors are Frank P. Smith, C. S. Baker, R. O. Boyer, H. P. Hughes and M. M. Campbell. It is said the Indianapolis, Columbus and Southern Traction Company may operate the road when completed.

According to reports made by the various officials of traction lines centering at Indianapolis the amount of freight handled during the month of January exceeded that of any previous month in the history of the roads. The strides made in the number of passengers carried have been almost as great. The net gain of the Consolidated company lines was over 100 per cent. in advance of that of the same roads in January, 1905. The gross gains of the Indiana Union Traction Company's freight department amounted to 100 per cent., while the net gains were 65 per cent.

Accidents, fatal and otherwise, on the Indiana interurban roads have become so prevalent as to attract considerable attention and will likely lead up to additional and far more stringent legislation.

The Central Manufacturing Company of Connersville has just opened its new building, a one-story structure 540 feet long. The building is equipped with the finest machinery, driven by electric power. Seventeen electric motors ranging from three to 30 horsepower and having a total capacity of 195 horsepower have been installed.

The use of electric current from a traction wire for heating and lighting his house and barn and running his farm machinery is being experimented with by W. H. Smith, a farmer, who has built a handsome home on the Indianapolis and Northwestern electric railway. Mr. Smith has erected a power house near his home and tapped the wires of the company. The current is conducted along underground wires. Motors of various sizes and kinds have been placed for the purpose of driving light and power machinery. In the spring Mr. Smith will add equipment to run his plows and other field implements. He thinks that the electric service will not be very expensive after the first cost. Farmers of Indiana are deeply interested in the question of electric motive power for farms. Representatives of supply houses that make a specialty of motors for handling the current from traction wires have been in the state for some time endeavoring to persuade wealthy farmers to try the experiment.

Prof. H. G. Robinson, representing Munroe & Munroe of New York, managers of the Marconi Wireless Telephone Company of America, is in Indianapolis with a complete equipment of wireless instruments and is giving some interesting exhibitions. He makes the positive statement that [illegible]

Michigan.

[illegible] William [illegible] will raise the [illegible]

The Grand Haven [illegible] waiting with interest the [illegible] regard to furnishing the power [illegible] electric-light plant [illegible] run their machinery.

By request of the president of the Board of Trade at Big Rapids, the [illegible] ing was instructed to [illegible] lighting for another term [illegible]

The suit of the Bay City Traction and [illegible] Company against the city to determine the right of the city to engage in commercial lighting [illegible] west side of the river has been [illegible] Court. The company asserts that [illegible] in its action by the fact that [illegible] entitled to rights possessed by [illegible] that, aside from any [illegible] city has no authority to engage in [illegible] mercial lighting. The company says [illegible] subject to taxes for improper purposes, the explanation being that if the city spent money for commercial lighting it would do so by incurring indebtedness for the cost thereof, and, as the [illegible] would be improper, the taxation would be improper.

The track of the new electric railway from Kalamazoo to South Haven is completed between Paw Paw and Kalamazoo, although no trains have yet been run. Until the power houses can be erected, the motive power will be steam. When the road is completed and in full operation it will form the last link in an interurban line across the state from Detroit to South Haven.

Several thousand dollars will be expended in Pontiac shortly in telephone construction. Linemen for the Peninsular Telephone Company are stringing three copper circuits as a part of the Independent toll line of that company. Next week linemen for the Michigan State Telephone Company will begin work and will string five copper circuits to Detroit. L. W. B.

Pacific Slope.

San Francisco, February 16.—The Snow Mountain Water and Power Company, which was recently incorporated here with a capital stock of $5,000,000 by W. R. Van Arsdale, George V. Scott, Charles M. Felton and associates, will take over the interests of the Eel River Power and Irrigation Company. The latter company is constructing an electric power system 18 miles from Ukiah and will transmit power to Ukiah and elsewhere. A 10,000-horsepower plant is under way and is expected to be in operation by November. The new company will increase the scope of the original plans and will eventually serve a large territory by its transmission lines.

The Inland Power and Electric Company has been incorporated at Spokane, Wash., to develop waterpower and build electric-railway systems. The company has a capital stock of $1,000,000, the incorporators being Arthur Phillips, F. M. Waters and C. E. Lunceford of Spokane.

Thomas McCusker of the Belt Line Railway Company has asked for a franchise for a broad-gauge electric railway on Front Street and other thoroughfares of Portland. The purpose of the company is to furnish terminal facilities in Portland for other railway companies.

At a special meeting of the Board of Trustees of Benicia last week a franchise was granted to the San Francisco, Vallejo and Vaca Valley Railway Company along the streets of Benicia.

George D. Moffat, of Moffat & White, New York, is now in Portland, Ore., looking over the situation as regards the proposed railway lines of the Willamette Valley Electric Company. He states that the company proposes to build a broad-gauge ballasted railway between Portland and Salem, 70-pound rails being used. The plans contemplate the expenditure of $1,500,000.

The Cache Creek Electric Company has been incorporated at Napa, Cal., with a capital stock of $1,000,000 for the purpose of generating and distributing electricity for lighting and power purposes in Lake County and in other counties north of San Francisco Bay. The directors of the company are G. H. Winship, R. Raymond and F. W. Williams.

H. G. Aylsworth, formerly San Francisco manager of the Kilbourne & Clark Company of Seattle, which recently discontinued its electrical business in San Francisco, has leased the third floor of the Shields Building, 571 Mission Street. He has organized the H. G. Aylsworth Company, which will have the Pacific Coast agency for the Electric Goods Manufacturing Company's products, Simplex wire and a number of other lines.

Pacific Coast Manager Oakes of the American Electrical Novelty and Manufacturing Company, which has leased the upper floors of the large new building at 572-576 Mission Street, San Francisco, is preparing to engage in manufacturing electrical goods here as well as carrying a large line of supplies. Salesmen will be sent out to travel over the coast for the Ever Ready battery and other specialties of this company. A.

PERSONAL.

Lee De Forest, the well-known space-telegraph inventor, was married to Miss Lucile Sheardown at the St. Regis Hotel in New York on February 17th. Mr. and Mrs. De Forest immediately boarded the Cunarder Lucania for a trip to Europe.

George Westinghouse has been awarded the John Fritz medal for the invention and development of the air brake. The award was made not only in recognition of the rare mechanical ability exemplified in its construction but also from the humanitarian aspect of the invention as a direct means of saving life.

Harry Young, assistant passenger agent of the Rock Island Railroad, located in Cleveland, has been appointed general passenger agent of the Lake Shore Electric Railway Company, with headquarters in Norwalk, Ohio. Mr. Young will organize his department and devote his time to building up the passenger business of the road.

Arthur W. Warnock has been appointed general passenger agent of the Twin City Rapid Transit Company of Minneapolis, Minn., a new office just created by the company. This is in line with the new policy of the company to build up suburban traffic. Efforts will be made to foster the picnic and excursion business as a revenue producer.

Mrs. James J. Wood, wife of the well-known technical director of the Fort Wayne Electric Works, died very suddenly at the Hotel Astor, New York city, Saturday evening, February 17th, while she and her husband were on a visit to that city. The body was brought to Fort Wayne, Ind., her home, for burial, and the funeral took place on February 21st. Mrs. Wood was devoted to her family and home, but her quiet, elevating influence was nevertheless felt throughout a wide circle. She was highly esteemed by all who knew her. Her husband has the sincere sympathy of electrical and other friends.

P. A. Bertrand of the Springfield (Mo.) Gas and Electric Company has gone to Jefferson, Mo., where he has secured an interest in the Jefferson City Light, Heat and Power Company, also becoming the manager of the plant. The Springfield company will be under the management of W. A. Bixby of Quincy, Ill., Mr. Bixby has been connected at Quincy for several years with George E. Macomber, who has recently, with his associates, purchased the traction company and from F. W. Little of Peoria, secured a controlling interest in the gas company. Mr. Bertrand has been manager of the Springfield Gas and Electric Company for three years.

Clarence H. Mackay, president of the Postal Telegraph-cable Company, who is a member of the New York Racquet and Tennis Club, a few days ago defeated his clubmate, Payne Whitney, in the final round for the Gold Racquet Championship in three straight sets, by scores of 15—12, 15—7, 15—8. By his victory Mr. Mackay adds a second win for the prize, valued at $500, and needs to capture it but once more for it to become his permanent property. Mr. Mackay, in addition to being the holder of the gold racquet, is a former national champion. Mr. Whitney also held premier national honors a couple of years ago, which placed the two experts on a comparatively even basis.

ELECTRIC LIGHTING.

Osage City, Kan., is figuring on installing a $15,000 electric-light plant.

An electric-light plant will be installed in Peru, Neb. The city clerk can give information.

The Kenmare (N. D.) Light and Power Company will install new machinery in its plant.

H. G. Uumversagt of Omaha, Neb., is to install an electric-light plant and waterworks in Yellville, Ark.

Bids will be received until March 5th for lighting the streets and avenues and public buildings of the city of Orange, N. J., by electricity for terms of three and five years from December 1, 1906. Edward Cheetham is chairman of the committee on lighting.

A franchise has been granted to W. Martin and W. C. Bill to operate an electric-light plant in Ozark, Ark.

The Wisconsin Light and Power Company of La Crosse, Wis., has been granted a franchise at Onalaska, Wis.

The city of Cumberland, Wis., contemplates the issue of bonds to the amount of $10,000, to install an electric-light plant.

The city of Punta Gorda, Fla., is considering issuing bonds for constructing a wharf, waterworks and electric-light plant.

The Hutchinson Water, Light and Gas Company of Hutchinson, Kan., is improving its electric-light plant, spending about $75,000.

G. B. Ortman and associates contemplate developing the waterpower of the White River near Cotter, Ark., for transmitting electricity to furnish light and power.

A committee has been appointed by the city of Phœnix, Ala., to investigate and obtain estimates on the cost of installing an electric-light plant to serve a population of 5,000.

J. L. Breathwit and associates of Shreveport, La., have applied for electric-light franchises in Marshall and Mineral Wells, Texas. These interests are identified with several other industries in Texas.

The Davis County Electric Light and Power Company of Farmington, Utah, has been incorporated with a capital stock of $40,000. The company proposes to produce electricity from waterpower.

The citizens of Albia, Iowa, at a municipal election a few days ago voted a franchise to A. R. Jackson to install a light, heat and power plant in Albia. The proposition that the city issue bonds to establish a municipal waterworks system was also approved.

ELECTRIC RAILWAYS

The Chippewa Valley Electric Railway Company is planning on extending its line from Eau Claire, Wis., to Osseo, via Altoona.

The Cheyenne Summit Scenic Railway Company of Colorado Springs, Colo., has been incorporated with a capital stock of $300,000 by R. A. Handy and others. It is proposed to build a railway to the summit of Cheyenne Mountain.

A few days ago the car barns of the International Railway Company, located on the Canadian side of Niagara Falls at the Whirlpool, were totally destroyed by fire. There were 27 summer cars in the barns. The damage is estimated at about $75,000.

The Central Idaho Development Company has been incorporated at Lewiston, Ida., as a holding company for the Lewiston and Southwestern Electric Railway Company and the Salmon River Power Company. G. W. Thompson, one of the heaviest stockholders in the new company, states that construction work on the Lewiston and southwestern line will begin at once. It is understood that Naylor & Norlin will be the contractors for a portion of the work.

The Chicago, Kenosha, Milwaukee and Lake Geneva Electric Railway Company has been incorporated, with James Cavanaugh, John L. Wattles and Benjamin O. Sturgis of Kenosha, Wis., as its promoters. It is stated that the principal property of the company at present is a right-of-way between Waukegan and Kenosha running through Zion City. The company is now seeking a franchise in Kenosha and plans to run a line westward to the small inland lakes and later to Lake Geneva.

Edward H. Harriman has just completed arrangements for the construction of a 10-mile private trolley line to his new mansion at Forest Lake, N. J. The line will run from Newburg Junction, on the Erie Railroad, through Tuxedo, and thence to Arden and the mountains above Greenwood Lake, where Mr. Harriman's summer home is. The road is to have but two passenger cars, one of these a luxuriously furnished parlor car. It is expected that work on the line will be begun in the spring.

POWER TRANSMISSION.

The Salmon River Power Company of Lewiston, Idaho, has been incorporated to furnish power for the Lewiston-Grangerville electric railway. The company is capitalized at $2,000,000. G. W. Thompson and T. S. Ward are interested.

M. H. Pierce and P. B. Jackson of Plains, Mont., have filed an appropriation of 300 inches of water from Clark Creek, from which they propose to operate a power plant to generate electricity. The water from the creek will be conducted in a flume, 48 by 16 inches in size, along the bank a distance of 150 rods to a steep incline. Down this incline it will be carried in the same manner for 1,200 feet to the power plant, where it will be used on a turbine directly connected to the dynamos. The electric power generated will, for the present, be used in pumping water from the river near Plains for irrigation purposes.

The California Gas and Electric Corporation is hauling supplies and material to its site on Little Deer Creek, near Nevada City, Cal., where a large power house for generating electricity will be erected. The development includes the building of a big concrete dam.

The United Missouri River Power Company has filed a certificate of incorporation in the office of the secretary of state at Trenton, N. J. The authorized capital stock is $5,000,000. The incorporators are B. R. Higgins, Samuel Hartman and E. G. Graves, all of New York. The company is to purchase, improve, sell, supply and convey water and water power and electricity.

The Albertville (Ala.) Light and Water Company will develop the waterpower of Drum Creek Falls and furnish the city with electric light and water. Waterwheels and electrical equipment will be installed and a water tower and concrete dam will be built. About $40,000 will be expended. Edgar B. Kay, Tuscaloosa, Ala., is engineer and architect in charge.

The Michigan Power Company of Lansing, Mich., has been organized with a capital of $2,500,000 to develop several water powers along Grand River. The company will take over the property of the Piatt Heating and Power Company in Lansing, which owns the privileges also at Dimondale, Grand Ledge and Eagle. It is announced that a big central heating plant will be built in Lansing during the coming year to replace the present one. It is proposed to generate upward of 15,000 horsepower by means of the dams already built and to be hereafter constructed. The officers of the new company are: President, A. A. Piatt; vice-presidents, F. B. Piatt and C. C. Carnahan; secretary, D. O. Watson; treasurer, M. A. Devitt.

Development of the waterpower of the Wisconsin River at the Dells, near Kilbourn, is once more attracting much local interest. A project which has been on foot for some time to connect Kilbourn and Devils Lake by an electric railway resulted in the formation of the Kilbourn-Devils Lake Electric Railway Company. This company, it is said, has consolidated with the Wisconsin Dells Company, promoted by Philip Spooner, Mr. Spooner and President Wetzel of the Dells company being at the head of the movement. It is expected that this consolidation will result in the early construction of an electric line from the Dells to Devils Lake, the improvement including a large dam at Kilbourn. These two resorts are popular with tourists and they possess some of the finest scenery in the state—the Dells particularly having a national reputation. There are at present, however, no transportation facilities between the two places, which are 20 miles apart, they being on different steam roads.

PUBLICATIONS.

Petroleum lubricating oils which are extensively used around an electrical generating plant are manufactured by the A. W. Harris Oil Company of Providence, R. I., which has recently issued an attractive booklet describing its product. On the front cover is a realistic representation of a "gushing" oil well. Inside is descriptive matter concerning the merits of the various kinds of lubricating compounds for different classes of machinery.

Another of the Allis-Chalmers Company's tasteful bulletins describes Bullock railway generators for direct-current systems. Along with the descriptive matter and illustrations relative to the constructional details of these machines, there are given several fine pictures showing actual installations, notable among which are two generators in the Thirty-second and Dauphin streets station of the Philadelphia Rapid Transit Company and a generator installed in the power house of the Oakland (Cal.) Transit Company.

Wireless clusters and lighting specialties of numerous designs are made the subject of catalogue B-16 issued by the Benjamin Electric Manufacturing Company of Chicago. The catalogue is comprehensive in its scope and well illustrated. It will be noticed that to the descriptive matter and list price of each article there has been added the standard package quantities, a feature which commends itself to those ordering from the catalogue. Care has been taken in compiling this catalogue to give full information relating to each device shown, giving a separate catalogue number for each part or combination of parts.

Three bulletins from the General Electric Company are descriptive, respectively, of "General Electric Switchboard Instruments, type R," "Variable-speed Motors" and "Arc Lighting Apparatus." The last-mentioned bulletin is the most complete of the three and contains, besides descriptions of the company's product in this line, some very good general information on the subject of illuminating in general, both interior and outdoor lighting. At this time the company is also sending out a number

of circulars and leaflets on its various lines of electrical fittings and accessories; also a little booklet entitled "Household Electric Devices," which goes quite thoroughly into the subject of electricity for the home.

SOCIETIES AND SCHOOLS.

The Iowa Street and Interurban Railway Association, of which L. D. Mathes of the Union Electric Company of Dubuque is secretary, has issued, neatly printed and bound, the proceedings of its second annual convention, held in Dubuque, April 20 and 21, 1905. The next convention will be held in Des Moines in April next.

Officers of the International Brotherhood of Electrical Workers have been in Springfield, Ill., recently preparatory to moving the national headquarters from Washington, D. C., to Springfield. Grand President McNulty gave out the statement that it was not improbable that the national organization would erect an office building in Springfield suitable for its own use and large enough to accommodate other tenants. Others at the meeting were Vice-presidents J. J. Reed of Erie, Pa., M. J. Sullivan of San Francisco and J. P. Noonan of St. Louis.

The committee on special schools of Philadelphia has adopted a resolution asking the board of education to appoint three of its members to cooperate with the superintendent of instruction and the property committee for the purpose of considering the advisability of establishing trade schools. Murrell Dobbins, who introduced the proposition, said that the New York Trade School had been a great success. It teaches bricklaying, plastering, plumbing, electrical work, patternmaking, house painting, steam fitting, fresco painting, blacksmiths' work, printing, sign painting and sheet-metal work.

TELEGRAPH.

The Washington correspondent of the Chicago Tribune is responsible for the statement that the attention of General Greely was called to a report that all the cables the government had planted during the Spanish war, when taken up, were found to be practically worthless on account of deterioration. "When the Spanish war broke out," General Greely is said to have answered, "there was only one officer in the army who knew enough about submarine cables to prepare a scheme for their use. This was Col. James Allen, my principal assistant. A great many of the cables for mining and other purposes for the Spanish war were altogether worthless. The officer in command of Fort Totten, who received these cables from the Corps of Engineers, told me he had 800 miles of cable that was utterly worthless when taken up and that he did not know what to do with it."

SPACE TELEGRAPHY.

By the use of high-potential high-frequency currents, the human body may be used as the antenna of a space-telegraph apparatus. This interesting phenomenon was recently demonstrated by Professor Ovington and an assistant at the Madison Square Garden Electrical Show. The current from the machine was passed through the assistant's body, from whence the waves were radiated as wireless waves in the ether. Messages were sent from one part of the hall to another, and as the potential and frequency of the oscillations were [illegible] very high the resulting wave lengths were [illegible] short.

Articles of incorporation of the [illegible] Clark Wireless Telegraph Company, organized in Augusta, Me., by residents of Detroit, Mich., with an authorized capitalization of [illegible], have been filed in Augusta. The purposes are stated to be the construction, operating and [illegible] of systems of space telegraphy. The stockholders are F. W. Parsons, Thomas E. Clark, W. J. Rogers and others, all of Detroit.

MISCELLANEOUS

It is reported that the Board of Construction of the United States Navy has about decided to recommend the installation of turbine machinery on board either the South Carolina or the Michigan, the two battleships now being designed.

The Supreme Court of Illinois has made a decision sustaining the Chicago charter amendment to the state constitution. The legislative acts which the last General Assembly passed by the authority of this constitutional amendment are therefore declared valid. It follows, apparently, that the giving of the right to the city to regulate gas and electric-light rates and authority to sell surplus electricity is upheld as constitutional.

By the aid of electricity large hides are said to have been completely tanned (although not so well as by the ordinary process) in five or six days. A current is passed through the hides which are contained within a revolving drum partially filled with the tanning solution. A current of 10 amperes is passed under a pressure of 70 volts between plates projecting radially from the axle within the drum acting as electrodes. The hides play the part of porous electrodes within which gas, liberated by electrolysis, inflates the hides and facilitates the absorption of the tanning solution. The rapidity of the action is attributed to the continual agitation of the hides, with the presence in the solution of certain salts affected by the current.

TRADE NEWS.

Hunter, Brewer & Co., incorporated with an authorized capital of $10,000, will engage in a general electrical business in Roanoke, Va. J. R. Heim is president and G. D. Hunter secretary and treasurer.

The Durling Electric Company of Baltimore, Md., incorporated with a capital of $10,000, proposes to deal in and install electrical machinery. W. B. Turner, J. E. Henderson, E. W. McIntyre, E. A. Craig and Charles R. Durling are the incorporators.

The Calvert Electric Company has been incorporated to manufacture and deal in electric supplies in Baltimore, Md. John A. Christ, 614 South Patterson Park Avenue, A. J. Bramble, G. H. Wilkins, N. P. Newman and C. D. Doyle are interested in the company.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 14th, for the installation of a conduit and electric wiring system for the postoffice and courthouse at Ogden, Utah, in accordance with drawings and specification, [illegible]

[illegible]

The [illegible] Company [illegible]

The P[illegible] [illegible] inquiries [illegible] lamp [illegible]

Directors of the [illegible] Company [illegible] authorized the [illegible] increased from [illegible] at the discretion of the directors. The company reports a rapidly [illegible] capital [illegible] meet the demand might be had.

Mr. George H. [illegible] the Central Electric Company [illegible] one with the Zenco Electrical Supply Company. Mr. [illegible], who is [illegible] and secretary and treasurer of the [illegible] men's Association, will spend part of his time at the Chicago office of the Zenco Electrical Supply Company and part of the time on the road.

Mr. J. D. Kearney, for some years past on the staff of the Central Electric Company, Chicago, has accepted the position of manager of the New Zenco Electrical Supply Company, Chicago. Mr. Kearney's wide acquaintance with the electrical supply trade of the West, both wholesale and retail, and his experience in the other branches of the electrical business, make him a valuable acquisition for his new employers. The Zenco Electrical Supply Company was only recently organized, but it already carries an extensive new stock, and it is located on one of the best known electrical trade corners in Chicago—the corner of Van Buren and Jefferson streets. Mr. Kearney announces that it is his policy to start with a fine line of specially selected stock to meet the requirements of contractors in central station, isolated plant and telephone construction, with a view of the importance—in fact, necessity—of the very quickest shipments from stock. The Zenco Electrical Supply Company will not only do a jobbing business, but will manufacture as well.

BUSINESS.

The Davis Electric Manufacturing Company, manufacturer of electric-railway and station switches, invites the trade to send for its attractive pricelist. The Chicago office of this company is located at 1501 Monadnock Block, in charge of H. E. Cobb.

The Electric Cable Company of 42 Broadway, New York, has just received an order from the New York and Long Island Railroad Company for 15 miles of cable insulated with Voltax, the new high-potential insulating compound. This order follows within a week upon that of the Interborough Rapid Transit Company, which recently ordered from the same company an equal amount of material.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 13, 1906.

812,183. Telegraph Key. William O. Coffe, Cleveland, Ohio, assignor to Benjamin F. Bellows, Cleveland, Ohio. Application filed January 11, 1904.

A gravity vibrator is adapted to swing by its own tendency and thereby make and break the circuit. A finger key releases the vibrator and an adjacent finger key opens and closes the circuit independently of the vibrator.

812,192. Locomotive Headlight. Edgar A. Edwards, Cincinnati, Ohio, assignor to the Metropolitan Trust and Savings Bank, trustee. Application filed November 25, 1901.

Rays from an electric arc are concentrated by two intersecting parabolic reflectors, having a common focus.

812,196. Apparatus for Measuring Electric Resistances. Sydney Evershed, Streatley, England, assignor to himself and Evershed & Vignoles, Limited, Chiswick, England. Application filed February 27, 1904.

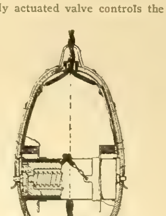
Combined with a hand-operated dynamo are a direct-reading, moving-coil ohmeter, duplex flexible conductors to the moving coils of the ohmeter, fixed clamps adapted to alternately clamp and release the conductors, means for actuating the clamps and a portable box inclosing the apparatus.

812,236. Jack-cord Distributer. Benno Salzmann, Berlin, Germany. Application filed November 16, 1905.

A jack-cord distributer comprises two rows of binding posts and a number of cords shiftably connecting the hearing plugs in distribution switchboards with the binding posts in one row of the jack-cord distributer. A number of jack-cords shiftably connect the jacks in the connection switchboards with the binding posts in the other row of jack-cord distributer. Shiftable cords connect at will the several binding posts of one row with those of the other row in the distributer, and means are supplied for fastening the ends of the shiftable cords on the binding posts.

812,279. Automatic Engine Stop. Nathaniel C. Locke, Salem, Mass., assignor to the Locke Regulator Company, Kittery, Maine. Application filed April 10, 1905.

An electrically actuated valve controls the main shut-off valve.



NO. 812,355.—INCANDESCENT LAMP HANGER.

812,355. Incandescent-light Hanger. Robert D. McIntyre, Mansfield, Ohio, assignor of one-half to Sherman Harter, Mansfield, Ohio. Application filed March 6, 1905.

The device is made up of two sections of a casing, inside of which is a drum upon which the conductors are automatically wound and unwound as the light is raised or lowered. Slip rings on the drum bring circuit to the cord terminals. (See cut.)

812,433. Electrical Railway Signaling System. Charles Mitchell and Harry Millingar, East St. Louis, Ill., assignors of one-half to Harry E. Dickinson, East St. Louis, Ill. Application filed August 8, 1903.

With a block of a railway system are associated a signaling system having a semaphore mounted at each end of the block, an eccentric connected to each semaphore provided with a catch, oppositely arranged electromagnets for moving the eccentrics in opposite directions and latching it for operating the semaphore and electrical circuits for operating the electromagnets by the train as the train enters or leaves the block.

812,445. Multipolar Electromagnet. Hermann G. Pape, New York, N. Y. Application filed May 17, 1904.

An electromagnetic device includes separate and distinct magnets spaced from each other, but having all of their poles disposed in approximately the same direction. One or more exciting coils are common to the magnets and interposed at least in part between them.

812,491. Telephone Switch-plug Mechanism. Adolph C. Gilgen, Passaic, N. J., assignor to the New York Automatic Telephone Company, Paterson, N. J. Application filed November 25, 1904.

In a switch-plug mechanism are a plug having a conical end and a contact spring having a portion disposed in the path of and constructed to engage the plug frictionally and hold the plug when the latter is moved in one direction and to act upon the conical end to complete the return movement of the plug.

812,500. Door-releasing Mechanism. Edward Kauntze, Hanford, Cal. Application filed November 25, 1904.

An electromagnet, operable from a distance, releases a cord and weight mechanism which closes the door.

812,504. Primary Battery. Charles E. Lockwood and George A. Lutz, New York, N. Y. Application filed July 18, 1904.

A battery element comprises perforated shells disposed one within another providing a space closed at opposite ends, a depolarizer within the space and a binder soluble in a battery liquid or solution serving to prevent the depolarizer from passing through the perforations of the shells. (See cut.)

812,505. Primary Battery. Charles E. Lockwood and George A. Lutz, New York, N. Y. Original application filed July 18, 1904. Divided and this application filed March 29, 1905.

A battery element comprises a perforated retainer containing a depolarizer and having a binder soluble in a battery liquid or solution applied to the wall of the retainer, closing the perforations therein to prevent the depolarizer from passing through the perforation in the retainer. The binder is of a character to not materially effect the electrical efficiency of the battery.

812,511. Electromagnet. Ernest H. Miller, Lancaster, Pa., assignor of two-thirds to John W. Holman and Charles V. Rote, Lancaster, Pa. Application filed April 25, 1904.

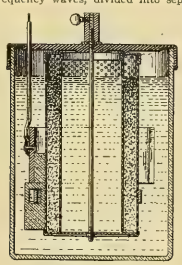
A solenoid having two or more coils at each side of its center is provided with similar terminals of the center coils electrically connected. The opposite terminal of one of the center coils is electrically connected with a dissimilar terminal of an outer coil, the latter having its other terminal connected with the feed wire.

812,542. Attachment for Keyboard Machines. Erl V. Beals, Boston, Mass. Application filed September 25, 1901.

In a keyboard-actuated composing machine are the keyboard, a number of electrically selected actuators successively selected by the keys on the board, means for arranging the actuators side by side and mechanism coacting with the actuators after the selection of a line is completed for operating the keys of the machine.

812,557. Method of Receiving Telegraphic Signals. Stephen D. Field, Stockbridge, Mass. Application filed June 10, 1905.

The method of signaling consists in initially transmitting high-frequency waves, divided into separate impulses,



NO. 812,504.—PRIMARY BATTERY.

to a coherer, establishing a circuit including a local battery through the coherer by means of the periodic currents, whereby the currents are transformed into single impulses in the local circuit, subjecting a mechanical vibrator having a gradually changing periodicity to the impulses and finally fixing the periodicity of the vibrator. (See cut.)

812,573. Automobile. Herman Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 9, 1904.

In combination with a prime mover are a differential gear, a dynamo-electric machine connected through the gear and a magnetic clutch in circuit with the machine and adapted to clutch the prime mover to the gear.

812,597. Railway Traffic-control System. William Rowe, Marrickville, near Sydney, New South Wales, Australia, assignor to Rowe's Patent Lock and Block, Limited, Sydney, New South Wales, Australia. Application filed February 23, 1905.

In positive lock-and-block railway-control system are operating devices of a key lock; the key is non-withdrawable except when the block instrument is cut out or excluded from the system, and adapted to operate the key lock of manually operative devices or an outdoor semaphore signal. The mechanism is non-withdrawable from the latter key lock unless the devices are locked in normal danger position.

812,607. Induction Coil. John Splitdorf, New York, N. Y. Application filed November 15, 1904.

A casing or retainer for an induction coil has apertures through its walls extending from an air space about the iron core to the outer atmosphere.

812,609. Electric Heater for Liquids. George E. Stevens, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 19, 1904.

An electric heater comprises a receptacle, a hollow heating member extending upward from the bottom of the receptacle and open to the exterior of the receptacle at its lower end, an electric-heating unit adapted to be inserted in and withdrawn from the member and having its resistance element in intimate thermal relation to the walls of the member, a lead extending from the upper end of the unit down through its center and a second lead secured to the lower end of the unit.

812,622. Electric Igniter for Internal-combustion Engines. William H. Walter, New York, N. Y. Application filed March 24, 1902. Renewed April 16, 1903.

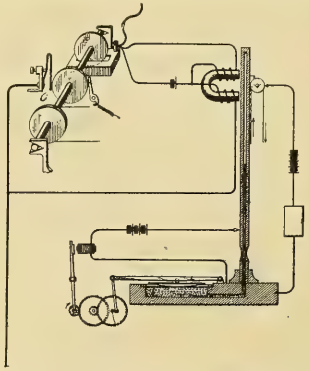
Details are described.

812,669. Furnace-draft Controller. William McClave, Scranton, Pa., assignor to the McClave-Brooks Company. Application filed November 3, 1904.

An electromagnetic device controls the pressure gauge of the draft controller.

812,700. Rheostat. George E. Stevens, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 12, 1904.

A rheostat comprises a fixed resistance element, a co-operating movable contact, a spring for returning the parts to off position, a fixed locking magnet, a yieldingly mounted armature therefor carried by the movable contact and movable transversely to the contact and means for moving the armature transversely into operative relation to the magnet.



NO. 212,557.—METHOD OF RECEIVING TELEGRAPH SIGNALS.

812,710. Portable Electric-lamp Outfit. Arthur Wilson, Berlin, Wis. Application filed March 28, 1905.

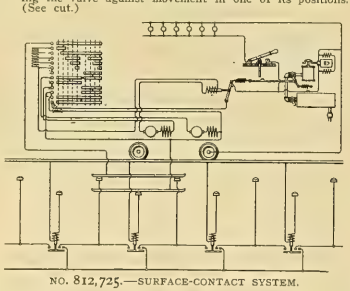
In a portable receptacle are the batteries therein, a second receptacle of less width than the first receptacle, being superposed upon the first. An electric lamp, flexible electric connections between the batteries and lamp extending through the upper receptacle and adapted to be stowed, together with the lamp, in the upper receptacle and means of electric connection with the batteries arranged without the upper receptacle are the other features.

812,718. Telephonic Repeating System. Adolph J. P. Bertschy, Woodstock, Ill., assignor of one-fourth to Charles H. Donnelly, Woodstock, Ill. Application filed June 4, 1904.

In a telephone repeating system are an electromagnet connected in a receiving circuit, a transmitter for controlling currents in the sending circuit, a vibratory diaphragm common to the electromagnet and the transmitter and an auxiliary switching device controlled by the diaphragm to cause the closure of a break in the sending circuit.

812,725. Surface-contact System. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 22, 1904.

In combination with an electric generator and its engine are a valve for controlling the admission of compressed fluid to the engine, a generator circuit and a switch therein, an operative connection between the valve and the switch, an auxiliary generating circuit provided with a circuit-closing device and interlocking means between the valve and the circuit-closing device for holding the valve against movement in one of its positions. (See cut.)



NO. 812,725.—SURFACE-CONTACT SYSTEM.

812,726. Locking Device for Automobiles. Alexander Churchward, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 30, 1904.

In an automobile, speed-changing power-transmitting mechanism comprises two dynamo-electric machines electrically and mechanically connected and means for locking the field and armature of one of the machines together.

812,733. Police Signaling Apparatus. Charles L. Foster and Peter K. Higgins, Los Angeles, Cal. Application filed July 14, 1904.

In combination with a normally open signal circuit having signals therein are controlling-circuit patrol boxes through which the controlling circuit passes, a central station and a relay in the controlling circuit having one side connected in series through each patrol box to ground and the other side connected to line leading into the central station. An armature for the relay is connected in the signal circuit and adapted to close the circuit when the relay is energized.

812,758. Brake. Sam H. Libby, East Orange, N. J., assignor to the Sprague Electric Company. Application filed September 16, 1904.

In a motor-operated hoist are a manually operated motor controller, a magnet winding in the motor circuit, a member controlled by the magnet winding, a brake and operative connections from the brake both to the controller and to the member. The means are adapted to release the brake only upon the simultaneous movement of the controller to a running position and the energizing of the winding.

812,760. Electrical Rosette. James A. Mebane, South Boston, Va. Application filed April 30, 1904.

The rosette cap is provided with a recess and a wire connection whose body portion is secured in the recess and whose end portions are folded or bent upon each other in S shape and constructed with notches.

812,773. Telegraph Instrument. Carl J. Schwarze, Adrian, Mich., assignor to the Schwarze Electric Company, Adrian, Mich. Application filed May 31, 1904.

The instrument comprises an electromagnet, a vibratory armature therefor, spring means controlling the armature and holding it normally retracted, a stop against which the armature is normally held and a closed induction coil on the electromagnet. (See cut.)

812,776. Automatic Fire Alarm. Alfred Taylor, Victoria, Canada, assignor of one-half to Thomas Henderson Horne, Victoria, Canada. Application filed May 13, 1905.

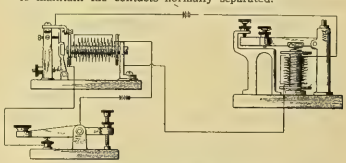
In an automatic fire alarm are the terminals of an electric-bell circuit and means for establishing a connection between the terminals and closing a circuit.

812,781. Electrically Conductive Rail Joint and Bond Therefor. Bancroft G. Braine, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Application filed April 11, 1904.

Combined with the rails and splice-bar, the latter having grooves with opposite undercut walls, are conductive plates inserted in the grooves and projecting at their opposite edges against the undercut side walls.

812,790. Electric-railway System. William N. Haring, Nyack, N. Y. Continuation of abandoned application, filed May 17, 1902. This application filed October 31, 1903.

In an electric-railway system are a conduit constructed with walls provided with projections, a hollow body in the conduit and provided with flanges adapted to engage the projections to support the body, means to engage the flanges and projections to secure the body in applied position, a terminal contact mounted in the body, a feed wire having connection with the contact, a contact movable in the body to engage the first-named contact, conductors carried by the last-named contact and means to maintain the contacts normally separated.



NO. 812,773.—TELEGRAPH INSTRUMENT.

812,791. Motor Controller. Wiley E. Houston, Santa Ana, Cal. Application filed June 14, 1905.

In combination with an electric motor are a pump having a delivery pipe, a valve in the delivery pipe adapted to check the downward flow of water, means for controlling the flow of the current to the motor and means connecting the valve with the controlling means, whereby when the upward flow of the water in the delivery pipe is stopped the valve closes and the current-controlling means cuts off the current to the motor.

812,797. Insulating Attachment for Electric Fixtures. Adolphus A. Knudson, New York, N. Y., assignor of one-half to Frank H. Clark, Brooklyn, N. Y. Application filed March 8, 1905.

An insulating material to be wound around the upper part of the fixture and fastened is described.

812,801. Electric Furnace. Julius E. Ober, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 15, 1904.

In an electric furnace are a carbon tube and a coating therefor formed of titanium carbide.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on February 19, 1906:

397,910. Electric Converter. L. Gutmann, New York, N. Y.
397,945. Electric Battery. E. A. Sperry, Chicago, Ill.
397,953. Electric-lamp Hanger. M. M. Wood, Erie, Pa.
397,965. Electrical Battery. W. Burnley, North East, Pa.
397,966. Electric-current Indicator. W. A. Carey, Malden, Mass.
397,969. Galvanic Battery. E. D. Cross, Chicago, Ill.
397,977. Telegraphy. C. E. Dressler, New York, N. Y.
397,992. Apparatus for Manufacturing Ozone. G. H. Merkel, Boston, Mass.
398,035. Floating Telegraph Station. U. Dieuleveult, Treguier, Cotes-du-Nord, France.
398,045. Apparatus for Bleaching by Electrolysis. E. Hermite, E. J. Paterson and C. F. Cooper, London, England.
398,075. Secondary Battery. J. T. Pedersen, New York, N. Y.
398,101. Process of Purifying Sewage by Electricity. William Webster, Jr., Lee Park, Lee, County of Kent, England.
398,172. Equalizer for Electric Currents. S. Bergmann, New York, N. Y.
398,132. Galvanic Battery. E. D. Cross, Chicago, Ill.
398,144. Door-spring Connection for Electric Burglar Alarms. J. Geary, Philadelphia, Pa.
398,194. Secondary Battery. I. A. Timmis, No. 2 Great George Street, Westminster, County of Middlesex, England.
398,272. Element for Thermo-electric Batteries. M. Mestern, Turin, Italy.
398,288. Switch for Electric Circuits. C. C. Stirling, Hartford, Conn.
398,327. Electric Spray-producing Apparatus. H. A. B. Huguet De Vars, Paris, France.

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Modern Central-station Design as Exemplified in La Crosse, Wis.

By C. H. Williams.

In the building of every central station the designers should be able to show wherein they have taken advantage of the experience of others, by bringing together into harmony the best features of other designs, and on the completion of the work engineers should have one more example of "good practice" to which reference could be made and from which suggestions could be taken.

There can be no "model plant" either for the large or the small electric company, for each case has its own characteristics and each plant must meet conditions peculiar to itself.

The technical press has done much to establish that which constitutes "good practice" by placing before its friends the outlines of types of construction which have been adopted by engineers in their work during the last few years and by stating the reasons why certain forms of construction were made use of under the existing conditions.

In this way the writer has borrowed many ideas from others, as found in the description of their properties, and to the end that some may find points of interest in the general scheme which has proved eminently satisfactory to our engineers, a general description of the new plant of the Wisconsin Light and Power Company follows, with illustrations.

Location of Plant.

The plant, which is steam driven, has been designed and constructed to supply the demands for light and power in the rapidly growing city of La Crosse, Wis., which [illegible] and is one of the [illegible] Northwest.

The generating [illegible] River at North La Crosse and [illegible] two blocks in length along the [illegible] depth of [illegible] feet, [illegible] two different systems are carried [illegible] age sheds.

The position of the plant in its present [illegible] was fixed largely on account of the nature of the water found in the Black River [illegible] the water found in the Mississippi, the two rivers uniting half a mile below the present site. The Black River is an old logging stream and has its bed lined with logs and bark, making a veritable boiler-compound of the water, relieving the boilers of all troublesome deposits of scale and solid matter which cause much trouble to users of water from the Mississippi.

The arrangement for the handling of fuel and ash is excellent, on account of the railway facilities, and although the district is not congested at the present time, a larger number of power consumers are locating in the immediate vicinity, attracted by the many advantages which the location offers for manufacturing purposes.

Station Building.

The station building (Fig. 1) is of absolutely modern fireproof construction of brick, concrete and expanded metal. It is built high, light and airy and presents the appearance of being neat, clean-cut and substantial, but without "fads and fancies."

Fig. 1. Exterior View of Power House.
Fig. 2. Steam Turbines, Generators and Condensers.
Fig. 3. Boiler Fronts.
Fig. 4. View in Basement, Showing Piping and Auxiliaries.

THE NEW CENTRAL STATION OF THE WISCONSIN LIGHT AND POWER COMPANY, LA CROSSE, WIS.

Equipment.

[illegible]

apparatus. Fig. 2 is a view of the turbine and condensing apparatus.

Safety Devices.

The rigs are equipped with all of the late developments in the way of safety devices, having the automatic engine stops which become operative above certain speeds, the electric annunciator showing a failure of the condensing apparatus which might allow the water of condensation to rise to a point which would endanger the turbine blading; and an electric alarm which operates when from any cause the level in the oil well is changed from normal, either from the failure of the pump, the clogging of the apparatus or lack of the lubricant itself, through leakage or loss.

Other than these are the automatic by-pass valves caring for excessive overloads and automatic back-pressure valves for opening the exhausts to atmosphere in case of failure of the condensing apparatus.

In the engine room and above the machines a

universal traveling crane, fitted with two carriages and hoists, serves the entire floor space and facilitates the handling of apparatus, as by means of one of the carriages, machine frames, covers or parts may be lifted out of the way and left suspended, while the remaining carriage is used to move or remove any parts without lowering the first to the floor. This effects a saving of time and still leaves the crane equipment with the same ultimate capacity, for the two hoists can be worked together as one with the additional advantage of making use of double the number of men on the chains where the hoists are operated by hand.

Condensing Apparatus.

The condensing water is taken from the Black River from a driven-pile crib properly protected against foreign matter by suitable screens, guards, rocks, etc., and the water is conducted into the plant through a short run of 20-inch suction pipe, cast iron being used in all cases above the surface of the water, with extra heavy spiral riveted pipe between the crib and the shore.

After the cooling water has passed through the condenser the discharge pipe is extended out into the river, and the water is discharged below the surface of the river, taking advantage of the siphon effect, with the result that the circulating pumps do but a small amount of work—that of moving the body of water against friction—and a test showing a vacuum of 5½ inches in the pipe on the discharge side of the pumps is evidence of the small amount of work required of them.

The condenser apparatus is in duplicate and so arranged that either shell, either air pump or either centrifugal circulating pump can be used with either turbine rig separately, or the two may be worked together. One turbine unit and condenser shell is illustrated in Fig. 6.

The conditions for high economy on this condensing apparatus are ideal, and under ordinary full-load conditions the mercury column connected to the exhaust opening at the low-pressure blades shows a vacuum which differs by not more than half an inch of mercury from the barometer at the United States Weather Bureau one mile away and on the same level.

Between the turbine shell and the condenser shell is placed a corrugated copper connecting piece to allow for the taking up of any unequal expansion or contraction due to changing temperatures, and it seems to be a never-ending source of amusement to the engineers on watch to prevail on their unsuspecting friends to feel of this connection carrying the exhaust, after giving them the impression that they are going to burn their fingers. The sensation is somewhat startling unless one stops to think, for the connection feels actually cold to the hand, the temperature being but from 45° to 55° F.

After passing through the condensing apparatus the condensed steam passes to a hot well, where it is taken up by pumps and forced through a surface heater and then back to the boilers; while in the heater the water of condensation is brought up to 212° F., taking up the heat of the exhaust from the auxiliaries and putting it back where it will do useful work.

Boilers.

The boiler equipment consists of 12,000 feet of Babcock & Wilcox high-pressure boilers arranged for automatic stokers. The boilers discharge their flue products into breechings connected to a steel stack 180 feet in height and eight feet six inches in diameter. A glimpse of the boiler fronts is given in Fig. 3.

Six-inch city water mains are run into the plant and connected by quick-opening valves to the circulating pumps where the city water could be used in case of trouble on the plant intake or pumps. There is a separate 2½-inch pipe laid to the river, connected to a pump for supplying a 35,000-gallon tank suspended from heavy I-beams above the boiler room. This supply is governed by a float valve in the tank, and the pump is under steam at all times, connected close to the boilers. Water in this tank supplies the deficiency in the heater if there is any and also supplies the lavatories, general plant service, and is available for priming, etc., in case of the failure of any of the other apparatus.

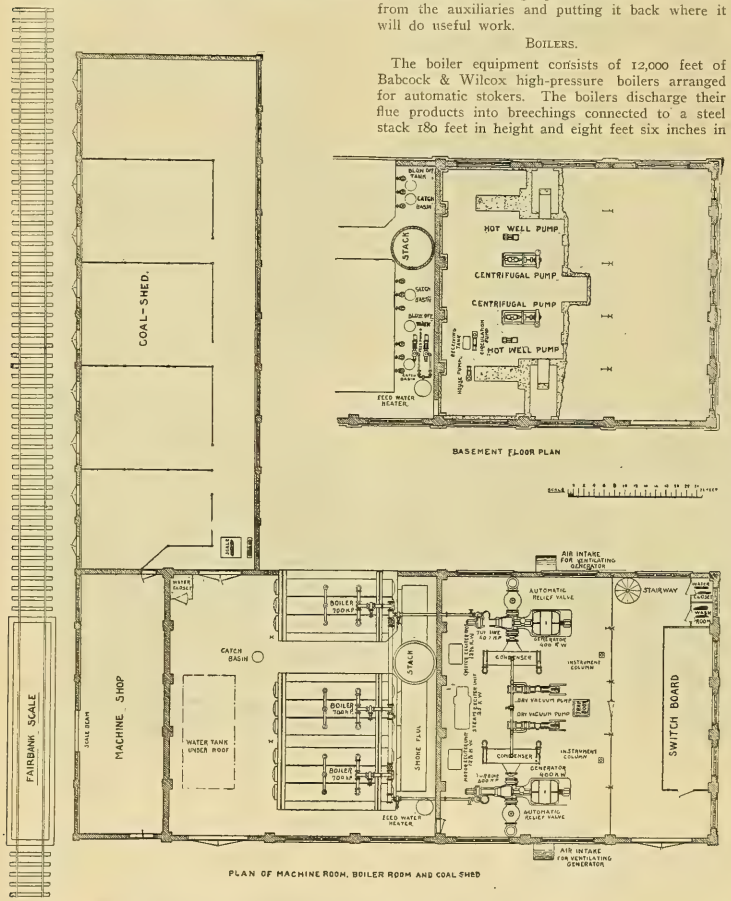


FIG. 5. ARRANGEMENT OF POWER HOUSE OF WISCONSIN LIGHT AND POWER COMPANY.

Fig. 4 is a view in the basement, showing piping and auxiliaries.

By the system of water piping and pumping the boilers have four separate and distinct means of receiving their feed water, and this is accomplished without any complication, and is a condition of circumstances rather than a prearranged plan.

The feed pumps themselves are outside-packed plunger pumps in duplicate, each one being capable of caring for 50 per cent. overload of the boilers.

A motor-driven triplex pump is being installed,

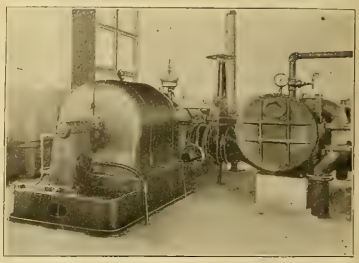


FIG. 6. ONE TURBINE UNIT AND CONDENSER SHELL.

as during certain portions of the 24 hours the motor-driven pump will show a greater net economy. All water which is used for oil cooling and jacket cooling is returned through the heaters to the boilers.

Coal Handling.

The coal coming into the plant is weighed on railroad scales, and each bin has a storage capacity of 200 tons; there being a total capacity under roof for 1,800 tons.

As the coal is taken from the furnace room it is weighed on truck scales and the weight of each bin is checked back with the railroad weights to detect and guard against any discrepancy which may arise.

A record is kept of the coal used on each shaft, together with the number of pounds of water evaporated, and the kilowatt output of the plant, and a detailed report is made of the number of pounds of water evaporated per pound of coal and per pound of combustible (the ash being weighed back), and the number of watts produced on the switchboard per pound of coal is determined. Later, when the station is working under established normal conditions, all of the station attendants will be placed on a basis where they will be directly interested in a financial way, in the economical results obtained in the plant.

Recording Instruments.

Recording instruments register the steam pressure, the absolute pressure of exhaust on the turbines and the electric pressure at the station and on the lines. Automatic regulators control the operation of the stack dampers, maintaining a very good steam chart and saving fuel by keeping normal furnace conditions.

All boiler and steam piping is installed according to the specification for extra heavy work, and every inch of surface is very effectively insulated to protect against losses of heat from radiation.

The boilers are so cross-connected that any one of them can be used on either turbo-rig or all may be operated together as a unit, making the system of the greatest flexibility, first cost being duly considered.

Extensions.

The boiler and engine room are constructed with the idea of adding additional units as the load requires, the walls of the boilers being built in at the time of the construction of the building so that additions may be made without other than pro-rata costs.

In laying out the switchboard all apparatus was installed with an ultimate capacity of four times the present station-generator capacity, additional generator and circuit panels being installed with the original installation to care for future developments.

Exciters.

The exciter units, arranged in duplicate, consist of two motor-driven units and one steam-driven unit, cross-connected, so that any exciter can be used with any turbine generator, or all can be paralleled on one set of exciter buses.

Switchboard.

The switchboard extends directly across the plant building and stands 15 feet from the wall,

allowing ample room for the switchboard wiring to be carried out straight and regular, and no complications or crossings are occasioned on account of crowding. The board consists of 11 standard size blue Vermont panels with cubbyes, finished with ornamental scroll work on top. It is enclosed at the ends with open grillwork, fitted with a locked

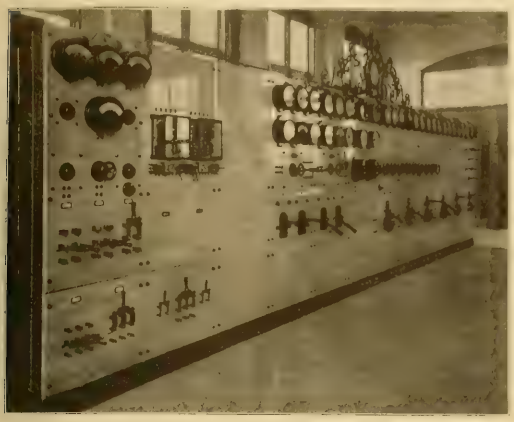


Fig. 7. Front View.

Fig. 8. Rear View.

SWITCHBOARD OF THE WISCONSIN LIGHT AND POWER COMPANY IN LA CROSSE.

door, so that no one, not authorized, can come in contact with any high-voltage current.

Figs. 7 and 8 show a general view in front, and the arrangement of regulators on the rear of the board.

Sanitary Equipment.

Not forgetting the welfare of the men, on whom depends the successful operation of the plant, the designer has found suitable places for lockers, bath-room, toilet rooms, engineer's office and testing rooms, all finished and furnished in a modern and comfortable way, and adding much to the convenience of the engineers in attendance.

Circuits.

The current is conducted from the station by three-wire three-phase distribution circuits, both for light and power, these being kept entirely separate from one another from the machines. Six such circuits leave the station, and provision is made for four more, including street-lighting circuits, for which a circuit panel has been installed.

Regulators.

Both light and power buses are equipped with the latest type of automatic regulators, and every wire leaving the plant has hand regulators to allow for mechanical adjustments in case of necessity.

Station Cables.

The wires leaving the oil switches on the board are carried into a discharge head leading to three-

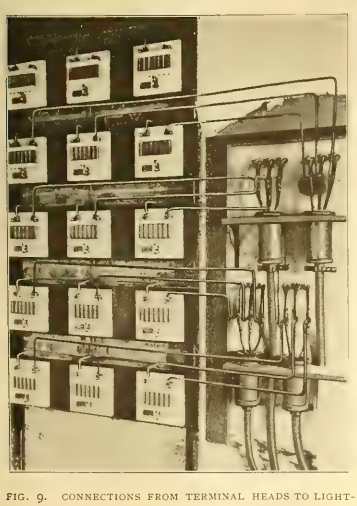


FIG. 9. CONNECTIONS FROM TERMINAL HEADS TO LIGHTNING ARRESTERS IN LIGHTNING-ARRESTER ROOM.

each connected to multi-gap lightning arresters in the lightning-arrester room (Fig. 9), which is directly over the switchboard, and is closed from dust and protected from trespass by proper locked doors and windows. Very direct ground wires of large capacity are carried down from the arresters to a large copper plate buried in charcoal below the river level.

Overhead Work.

The station is approximately 10,000 feet from the commercial lighting center, and 65-foot Idaho poles carry the three-phase delta circuits of 100,000 cir-

FIG. 10. OVERHEAD CONSTRUCTION IN LA CROSSE, WIS. (THE TALLER POLES ARE 65 FEET HIGH AND CARRY THREE-PHASE CIRCUITS.)

cular mils on special four and two-pin arms so arranged that each set of arms carries but one circuit on each side of the pole. The circuits are conducted in this way to a point where the brick-paved district begins, and here the circuits are carried underground. This overhead work is well illustrated in Fig. 10.

This brick-paved territory covers some 40 blocks of business district, through which the primaries for light and power are conducted in three-phase paper cable through eight and six-duct vitrified-clay conduits to distribution poles, up which the three primaries for both light and power are carried in every instance. These supply the three-phase power in the one case and allow of easy balancing where it is necessary to change lighting transformers from one phase to another in the other case. [See Mr. Burford's paper on page 180 for description of the underground construction.]

The primaries terminate in a discharge bell (Fig. 11), from which special rubber-covered cable is

on the power circuits, no exception being made to allow any inductive load on the lighting system.

Distribution System.

The main primary system of distribution is in reality that of a star, the main primary feeders coming to a center without being tapped, and district primaries are led away from this center in every direction, care being taken to balance residence and commercial lighting between the three phases to prevent the possibility of unequal voltage drops on the line, on different nights in the week, where business places are in the one case kept open, and in the other case closed.

As the natural center of distribution coincided with the geographical center of the business district, it was found that the center would fall within the underground territory, so it was also deemed expedient to arrange a system of tieing-in at the extremities of the points of the distributing star.

This was done because of the fact that, beyond the brick district, it was necessary to construct secondary trunk lines, and on the same poles carrying these lines the three-phase lighting primaries were conducted, tieing them in at the junction of each radiating line and the circumscribed circuit.

Outdoor Oil Switches.

Three-phase outdoor-type oil switches are used in each case where overhead conducting systems are connected to underground work, with the result that any section of either the overhead or the

FIG. 11. HIGH-VOLTAGE TERMINAL HEAD WITH COPPER HOOD.

underground system can be cut out without interfering, in any way, with the remaining system of distribution, and at several natural division points in the underground work the three-conductor cables are spliced out into single conductors, which are each led through water-tight high-tension junction boxes, to facilitate repairs or extensions.

Precautions Against Leakage from Other Company's Lines.

Extra precautions were taken along these lines, due to an existing condition, found when the company entered the field, where several telephone cables in underground districts were rapidly de-

stroyed on account of electrolytic action, apparently due to excessive leakage from direct-current light and power conductors, consisting of bare copper wire drawn into ordinary cotton-covered hose, and carried through underground conduits. The hose, rapidly becoming a fair conductor, allowed a dangerous amount of current to dissipate itself over water pipes, cables and conductors, and created a large amount of damage to all such work below the surface.

In the installation of the underground work for the new plant every precaution was taken to protect against this evil, but as leakage of stray direct current, to and from the sheaths of the lead-covered cables being installed, was still evident, the above-mentioned system of tieing-in was resorted to, to facilitate the serving of all consumers in the event of possible breakdown.

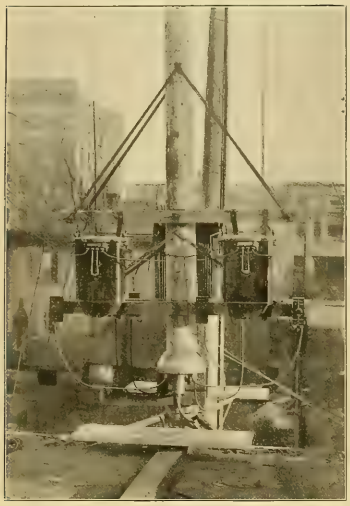


FIG. 12. ARRANGEMENT OF TRANSFORMERS ON DISTRIBUTING POLE IN LA CROSSE, WIS.

Tests.

Before the system was made alive for commercial use a strain of 10,000 volts was placed on it for a period of five minutes, following which a 30-minute test at 6,000 volts was made, these tests being conducted from each conductor to ground and from conductor to conductor within the cable—no defects being brought out on the trial, showed that the splicing and installing had been well and carefully done.

Insulators.

On the overhead work Idaho cedar poles are used throughout, the primary conductors occupying the same relative position spoken of before, and carried on high-tension insulators. The usefulness of these insulators may be seen from the fact that although the main lead parallels a heavy telephone lead of open work for a mile, on the same side of the street and but a few feet distant, no trouble is experienced by the telephone company at all, due care being exercised to prevent induction troubles. The high-tension insulators prevent leakage, which so frequently is looked upon as induction trouble on noisy telephone lines. The secondary wires occupy three pins of a lower arm and the Edison three-wire system of secondary distribution is used. The pole line presents an unusually good appearance, and possibly nowhere in the Northwest is there to be found a pole line made up of such uniformly straight, well-proportioned, clean-cut poles as these.

Junction Boxes.

Wherever possible the 110 and 220-volt secondaries are tied together on the Edison three-wire network of banked transformers, and junction fuses are inserted in the secondary leads between transformers to facilitate repairs and changes when necessary.

Transformers.

Three sizes of transformers are used—five, 10 and 20 kilowatts, additional transformers being inserted where districts become overloaded. By this means the number of sizes of fuses and supply parts necessary to be carried in stock and by patrol men is reduced to a minimum, and excellent regulation is secured.

Lightning Arresters.

Lightning protection is placed on both the primary and secondary lines at intervals of 1,000 feet, special care being taken to insure positive and permanent ground connections. The neutral wire of the three-wire lighting system and one leg of the three-phase power secondaries are permanently grounded to protect against a possible abnormal rise in secondary pressure.

Regulation and Load Factor.

The automatic regulators on the circuits maintain equal and normal pressure at all time, making possible the use of high-efficiency incandescent lamps and Nernst lamps, of which free renewals are furnished by the company.

Worthy of special note is the load factor under which the station is operating. The station was put into commission on the 27th day of November last, at which time no consumer was connected to its mains. Sixty days later finds the plant with 400 consumers receiving current, the peak load being but 20 per cent. of the station generating capacity, while the 24-hour output shows a load factor of 14.2 per cent. (load factor here being station output for 24 hours divided by rated station capacity times 24 hours).

An analysis of this simple statement shows that the nature of the business which has been taken on is almost exclusively that known as long-hour consumption, and much to be desired by any plant.

With the high class of apparatus installed the best of service is rendered; the operating costs are kept at a minimum; the maintenance costs will be extremely low; the ultimate capacity of the plant can be multiplied by three with an addition of but a small proportional expense, and, finally, the entire system is adaptable to any form of modern power development which the advancing times may bring.

Interurban Railway Development in Central Illinois.

One of the principal builders and operators of street and interurban electric railways in Illinois is the Illinois Traction System, otherwise known as the McKinley syndicate. Much has been written about the progress of this company, both as to building new lines and acquiring others by purchase. The operations principally have been in Central Illinois, and the company is now operating 110 miles of city track and about 235 miles of interurban track.

A glance at the accompanying map will show that the McKinley interests are operating an almost unbroken system from Danville, near the Indiana state line, to East St. Louis and Granite City, on the Mississippi River, at the other side of the state. The longest unbroken stretch is from Bloomington, through Decatur and Springfield, to East St. Louis. The uncompleted roadbed of the Springfield and Northwestern railway between Springfield and Bloomington has been purchased and will soon be added to the lines in operation.

The route between Bloomington and Peoria is not yet definitely settled. Two surveys have been made, one running along the Big Four steam railroad to Mackinaw, and from that point to Morton, paralleling the Vandalia, and from Morton across country to East Peoria. The other route runs from Bloomington to Congerville along the Lake Erie, from Congerville to Morton into East Peoria. The route from Morton to East Peoria is definitely settled and the contract has been let for the grading work. The question as to whether the route from Morton to Bloomington will be along the Big Four or Lake Erie will probably be decided soon. The company will build its own bridge, of the bascule type, over the Illinois River at Peoria. This division will be equipped for single-phase operation and will connect with the recently purchased city system in Peoria formerly owned by the Central Railway Company.

Engineers are now locating a route for a line covering the 42 miles between Champaign and Decatur. When this is completed it will be possible to ride over the company's lines from Danville to East St. Louis, a distance of 220 miles. Several branches are also in operation, as the one from Danville to Ridge Farm, and, at the southern end, from Staunton to Mt. Olive, Litchfield and Hillsboro. Another branch is proposed from Springfield to Jacksonville, and a line may also be built from Bloomington to Champaign.

The Illinois Traction System now controls the following companies: Danville Street Railway and Light Company; Danville, Urbana and Champaign Railway Company; Urbana and Champaign Railway, Gas and Electric Company; Decatur Railway and Light Company; Illinois Central Traction Company; St. Louis and Springfield Railway Company; Urbana Light, Heat and Power Company; Jacksonville Railway Company; Consumers' Light and Heat Company; Jacksonville Gas Light and Coke Company; St. Louis and Northeastern Railway Company; Chicago, Bloomington and Decatur Railway Company; Peoria, Bloomington and Champaign Traction Company; Springfield and Northeastern Railway; Central Railway Company, Peoria, and the Peoria, Bloomington and Normal Railway and Electric Company.

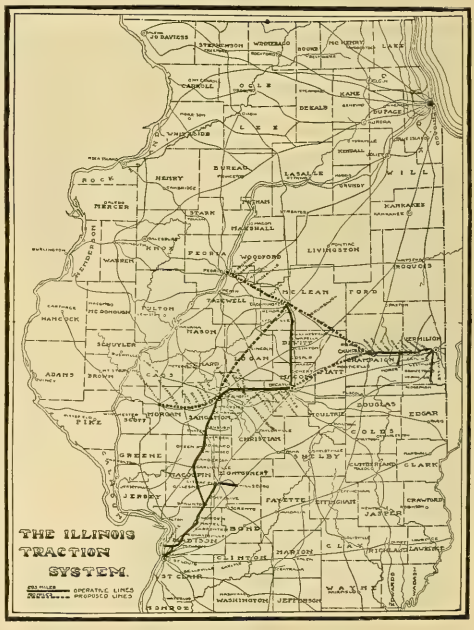
Officers of the company are: President, William B. McKinley; vice-president and general manager, L. E. Fischer; assistant manager, W. J. Ferris; general traffic manager, B. R. Stephens; engineer, H. C. Hoagland. Besides the secretary, treasurer, auditors, etc., there are general superintendents in each of the larger cities included in the company's system.

In connection with the McKinley developments, it is interesting to note the work of other interest which may become connected with the Illinois Traction System. The Joliet and Southern Traction Company, which is expected to connect with the McKinley system and become a vital portion of the north and south through service from Chicago to St. Louis, has made application to the City Council of Joliet for franchises to bring into Joliet interurban lines from Aurora, Morris, Dwight, Kankakee and Peotone, New Lennox, Blue Island, and incidentally facilities for other interurban lines that may hereafter be attracted to Joliet. A union station at Joliet for interurban cars is part of the project, and in connection with it will be a seven-story office building, located in the heart of the city and close to the proposed new union station.

The Joliet and Southern Traction Company contemplates paralleling the Rock Island to Blue Island. This line will be built for high-speed service. At Blue Island connection will be made with the tracks of the Chicago and Southern Traction Company, and cars will run over these tracks in connection with the South Side Elevated and deliver the passengers on the elevated loop in the heart of Chicago.

A line is also contemplated from Joliet through Manhattan, Wilton Center to Peotone, where connection will be made again with the Chicago and Southern Traction Company for Manteno, Bradley, Kankakee, Lafayette and Indianapolis. The line from Kankakee to Lafayette will then connect Kankakee and lines east through Joliet, Aurora and Elgin to Rockford and Janesville, Wis., and very soon to Madison.

The lines to the south and southwest will be



MAP OF LINES AND PROPOSED LINES OF ILLINOIS ELECTRIC TRACTION SYSTEM.

brought into Joliet through Elwood, Wilmington, Braidwood, Godley, Braceville, Gardner and Dwight, with a branch line from Gardner to South Wilmington and also from a point between Braidwood and Wilmington to Diamond, Coal City, Carbon Hill and Morris. At Dwight connection is made with the line now operating from Dwight to Pontiac, and it will be a very short time only until that line is extended to Bloomington.

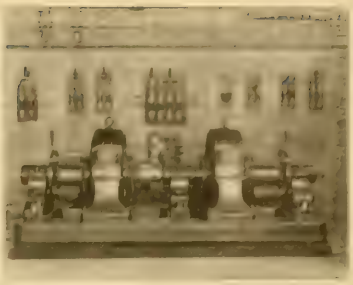
Electrical Equipment of Louisville and Nashville Railroad Shops.

By A. G. Wessling.

In the new shops of the Louisville and Nashville Railroad Company at South Louisville, Ky., electricity has been applied in a manner to interest engineers by the eminently practical results produced. So carefully has every detail been planned with reference both to its particular design and to its proper place in the general scheme, that the result is evident even to the untrained layman.

A railroad shop of this kind includes at least a dozen distinct lines of manufacturing, everyone of which is important. All these units must be efficiently operated, and their various products finally brought together and assembled into railway rolling stock in the shape of freight cars, passenger [illegible] into the latter type. A [illegible] inches [illegible] the [illegible] all, are motor-driven, [illegible] company [illegible]

In [illegible] ing application [illegible] the middle of the [illegible] ling the [illegible] them to the [illegible] Near the switchboard is located a [illegible] wire multiph [illegible] which divide the direct [illegible] by the main into [illegible] third wire, in addition to the [illegible] serves to supply three different [illegible] 140 and 240 volts, to the motor-driven tools [illegible] it is desired to operate at variable speed, [illegible] different voltage are applied to [illegible] motor armature by means of Bullock type [illegible] controllers, and intermediate speed and speeds above the normal at 240 volt are obtained by the use of shunt field resistance. Fig. 2 shows a 90-inch driving wheel lathe driven by a Bullock type N motor, operating on the three-wire system. Other special tools peculiar to locomotive shops are a three-head frame slotter and a three-column



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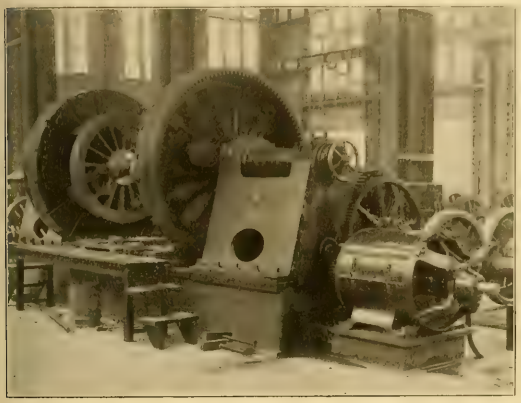

Fig. 2. Ninety-inch Lathe Driven by Motor.

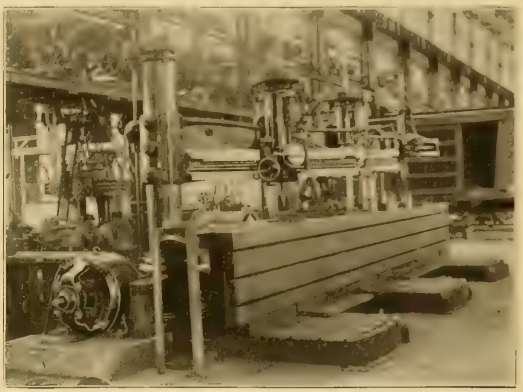

Fig. 3. Motor-driven Three-column Radial Drill.

ELECTRICAL EQUIPMENT OF LOUISVILLE AND NASHVILLE RAILROAD SHOPS.

coaches and locomotives. At the South Louisville shops a transfer table having a bridge 100 feet long and a transverse travel of 1,050 feet is the center about which the buildings are grouped, and serves as the connecting link to bind the various departments together. The bridge is operated by an electric railway motor capable of driving it at a speed of 12 miles an hour. By means of sliding clutches the motor may be disconnected from the bridge drive and connected to a drum to pull coaches and locomotives onto and off the bridge.

Along the north side of the transfer table lies the largest building of the group, having a length of 1,000 feet, and including under one roof the boiler shop, the general machine shop and the erecting shop. The south bay of this building is divided into 40 sections, and every section has a track connecting with the transfer table. Eleven of these sections are in the boiler shop, which is separated from the erecting shop by a brick wall 12 feet high. The erecting floor is served by a 100-ton crane, provided with two trolleys, and capable of carrying the largest-sized locomotives from any part of the erecting shop over the wall radial drill (the latter shown in Fig. 3). These tools are driven by Bullock variable-speed motors, as are also a number of heavy lathes and other tools of the kind common to all machine shops. The motors driving these large tools are rigidly connected to the machine, and the power is transmitted through gears. Such tools as are operated at constant speed are belted to a line shaft, which is driven by a belted motor.

In the boiler shop the large punches and shears are driven by individual motors, which are belted to the tools. Compound-wound motors are used. The slipping of the belt in starting, due to the unusually large inertia of this class of tools, allows the motor to start with much less current than would be required if the motors were geared, and the compounding of the fields has the same effect, as it increases the torque of the motor.

To the north of the machine shop lie the forge shop and the wheel shop. In the forge shop motors are used where possible, but, as nothing has been found thus far to displace steam hammers, the number of motors is not very large. In the wheel shop the machine tools are all of a constant-speed type

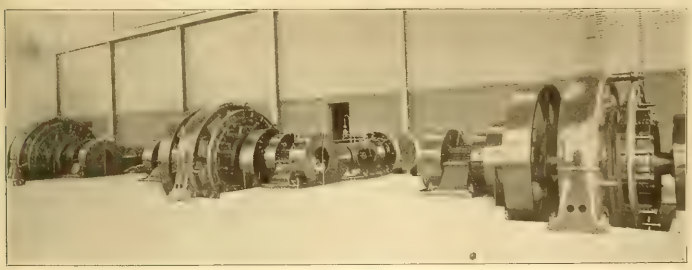

FIG. 4. THREE 350-KILOWATT GENERATORS IN SOUTH LOUISVILLE RAILROAD SHOPS.

tance from the power house to the foundry is so great that no other method of transmission could be considered.

Placed along the east side of the foundry is a runway supporting a traveling crane, and this runway passes along the side of the wheel shop, the end of the machine shop, and extends as far as the transfer table. The crane bridge is 40 feet long, thus giving excellent yard service to the various shops, and affording a very satisfactory method of transporting material from one department to another.

In the wood shop the tools are operated at constant speed, and most of them are driven by belts from line shafts, which are motor-driven.

The power house is located at the south of the group of buildings, where the handling of fuel and ashes can be done most conveniently. The equipment, as shown in Fig. 4, includes three 350-kilowatt 250-volt type-I Bullock generators, direct-connected to cross-compound Buckeye engines, running at 175 revolutions a minute. Steam at 125 pounds pressure is supplied by a battery of Stirling boilers, provided with mechanical stokers. The coal elevator is motor-driven. In addition to the generators, the engine room contains a cross-compound two-stage air compressor and a 12 and 18 by 24-inch fire pump. The switchboard, built by the Western Electric Company, is equipped with Weston flush-type instruments, which add greatly to its neat appearance.

The excellence of the plant as a whole is due to the clear foresight and careful personal supervision of Mr. Theodore H. Curtis, superintendent of machinery. Mr. Curtis came to the Louisville and Nashville from the Erie Railroad and was assistant superintendent at the time the work of building the new shop was inaugurated. Observing that the original plans were not in keeping with modern methods of manufacture, he made a thorough investigation of the problem, and having prepared his data, he soon convinced his superiors that the plans should be changed. Death having caused a vacancy, Mr. Curtis was appointed to his present position, and the work has been completed under his charge.

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CONTENTS OF THIS NUMBER.

Modern Central-station Design as Exemplified in La Crosse, Wis. By C. H. Williams. Illustrated....171, 172, 173, 174
Interurban Railway Development in Central Illinois. With Map....174, 175
Electrical Equipment of Louisville and Nashville Railroad Shops. By A. G. Wessling. Illustrated....175
Editorial....176
Old Edison Plant in San Francisco Destroyed by Fire....177
Institute Meetings in New York and Chicago....177
The Single-phase Motor for General Power Purposes....177
Lower Electric-light Rates Offered in Chicago....177
St. Croix River Power Development....177
80-Cent Gas for Manhattan....177
Electric Fans Discourage Flies....177
Electrical Exports of Germany and the United States Compared....178
Appleyard Properties Sold....178
Comparison of Large Steam and Electric Locomotives....178
Books Received....178
Copper Market....179
Chicago Street-railway Situation....179
Test of Underground Mail-conveying System in Chicago. Illustrated....179
New German Metallic-filament Lamp....179
Earnings of Stone & Webster Properties....179
Underground Construction in La Crosse, Wis. By W. D. Burford....180, 181
Electroliers Suggested for St. Louis Streets....181
Death of William A. Hovey....181
Power Transmission in Wales. Illustrated....181
Electric Automobile Truck. Illustrated....181
Large Waterpower Developments near Utica, N. Y....182
Electrically Operated Tunnel Excavator....182
Telephone Engineering. By J. J. Carty. Part I....182, 183, 184
Speech Reporting by Televant....184
New Companies....184
Indiana Telephone Items....184
Telephone News from the Northwest....184
Ohio Telephone Notes....184
Telephone Rate Agitation in Chicago....184
Cumberland Company Gets Telephone Franchise in Evansville....184
Bell Telephone Output for January....184
General Telephone News....185
Manufacturers and Dealers....185

DEPARTMENTS.

Correspondence....185, 186, 187
Great Britain....185
New York....185
Dominion of Canada....185, 186
New England....186
Mexico....186
Southeastern States....186
Ohio....186
Indiana....186, 187
Michigan....187
Northwestern States....187
Pacific Slope....187
Personal....187
Electric Lighting....187, 188
Electric Railways....188
Power Transmission....188
Publications....188
Societies and Schools....188
Automobiles....188, 189
Miscellaneous....189
Trade News....189
Business....189
Illustrated Electrical Patent Record....189, 190

DATES AHEAD.

Illuminating Engineering Society (next meeting), 44 West Twenty-seventh street, New York city, March 9th, at 8 p. m.

Iowa Telephone Association (annual convention), Chamberlain Hotel, Des Moines, March 13th, 14th and 15th.

Central Electric Railway Association (next meeting), Indianapolis, Ind., March 22d.

Ohio Independent Telephone Association (annual meeting), Columbus, Ohio, March 30th.

Iowa Electrical Association (annual convention), Kirkwood Hotel, Des Moines, April 18th and 19th.

Iowa Street and Interurban Railway Association (annual convention), Kirkwood Hotel, Des Moines, April 19th and 20th.

Indiana Independent Telephone Association (annual meeting), Indianapolis, Ind., May 17th.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st to 23d.

WATER PURIFICATION by direct application of electricity has attracted the attention of investigators, but it remains to determine whether the germicidal action of the current is available by some method of practical operation within such reasonable limits that the installation of working apparatus will be shown to be worth while. It is therefore worthy of note that the City Council of Minneapolis has made a small appropriation for the expenses of a test to be made at the city waterworks in relation to the electrical treatment of water used for domestic purposes. Preliminary tests seem to indicate that a comparatively small amount of electrical energy, properly applied, will kill most of the bacteria in water. Four of the senior students in electrical engineering at the University of Minnesota, under the direction of Prof. George D. Shepardson, expect to make some qualitative and quantitative tests to locate the bactericidal agency and the best means of applying the current. The matter is in the experimental stage, but the results will be awaited with interest, for it is probable that the electrical method, if practicable, would be found useful in many places.

WHY would it not be a good plan for central stations to make more of the "electric lawn-party" idea? In favorable seasons of the year such outdoor evening parties ought to be very popular. One hundred and fifty or two hundred incandescent lamps would make a brave showing in an ordinary lawn. They might be strung in festoons or placed on temporary standards or half concealed in the trees. One "bower" might be arranged for a mercury-vapor light, by which group photographs could be taken by amateurs or professionals. A searchlight would add to the entertainment. The supper might be served al fresco and cooked with electric utensils. Electric fans could be provided if needed. In fact, the electrical installation could be elaborated to any extent to meet the ideas of the host. The central station would provide the whole outfit and make the connections, also supplying one or more suitably dressed attendants to look after the installation and explain the use of the cooking and other apparatus to the guests. The cost would of course vary with the amount of time and apparatus used, but would no doubt be cheerfully met by the giver of the party, for the "function" ought to be a great success. Electrical appliances would be advertised and a new source of income gained for the electric-light company.

ELECTRICAL trade between the United States and Germany, as we have previously pointed out, is not very large. Nevertheless it is pleasing to observe that there will be no "tariff war" between the two countries for 15 months at least. Germany has voluntarily, as we understand it, granted to this country for that period of time, extending from March 1st, the "conventional" rates provided in the new, or comparatively new, German tariff. These are the rates enjoyed by countries having commercial treaties with the Fatherland, and it is certainly a high tribute to the strong position of this country in international trafficking that these rates were granted to the United States without a treaty and with only slight concessions on our part, and these relating to the penalty for undervaluation, which German exporters have considered too rigorous. It is evident that Germany realized that it could not afford a tariff war with the United States, for it is much more dependent on us than we are upon it. The new duties are higher than the old ones, but not nearly so high as the "autonomous" duties with which we were threatened.

In the electrical export trade Germany and the United States are chiefly interested in each other as competitors in neutral markets; they do comparatively little dealing with each other direct. For several years the electrical exports of the two countries were about equal in value, but last year the United States made a conspicuous increase over the year before, and is perhaps now ahead. An interesting article on this subject appeared in a recent issue of one of the German electrical journals, and a summary of this comparison is given elsewhere in this issue.

STATISTICS of electrical industries are now required by law to be collected and published once in every 10 years, whereas those on general manufacturing are required every five years. In view of the phenomenal development of the electrical art in the last two decades, this appears to be an underestimate of its importance. In relation to this matter Thomas A. Edison says: "Ten years in an electrical industry is equal to a lifetime in most others, and unless the figures are compared oftener than once in 10 years they do not bear so close a relationship to each other as the specialist and the business man could desire." During the recent discussion in the House of Representatives of the Permanent Census Office Bill, Representative Crumpacker of Indiana made a notable speech in which he referred to a clause in the bill requiring electrical statistics to be collected once in five years, and advocated strongly its adoption. He very rightly maintained that statistics collected at intervals of so long duration as 10 years lose their value for purposes of comparison, and he quoted the above remarks of Mr. Edison. In an industry in which many branches double or perhaps increase manyfold in importance in a period of a single decade, statistics 10 years back can have little real practical value when they finally do appear. Statistics five years back are unsatisfactory enough, though they would be some improvement.

In collecting estimates of electrical manufactures for its New Years numbers the Western Electrician presents this statistical material while it is fresh and valuable. The proposed Census reform is analogous.

AN IMPORTANT practical problem in central-station work is found in the selection of meter capacities for different classes of service. With the passing of the flat rate, almost the entire income of many central stations is determined by meter readings. Hence the imperative necessity of a wise selection of sizes in meeting the variable conditions of the consumers' loads. The life of the meter and the maintenance of its accuracy are chiefly determined by the judgment used in its application.

In selecting a meter it is almost always necessary to strike a balance between the injury caused by overloads and the inaccuracy of the instrument at light loads, which results from installing too large a meter for the average consumption encountered. It is exceedingly desirable for every central station to acquire accurate information in regard to the load factor of different classes of consumers. In residence work more than 50 per cent. of the lamps installed are rarely used at any one time, a fair average being 30 per cent. in city service. Hence a meter rated at from 30 to 50 per cent. of the connected load is generally desirable for residence service, the increased light-load accuracy compensating for the overload losses which occur in the rare occasions when social festivities require the use of every lamp in the installation.

It is customary in good practice to install meters for power service which have a rating from 25 to 50 per cent. in excess of the rated output of the motors. This enables the starting current to be integrated with fair accuracy and gives a reasonable idea of the average output without sacrificing too much in the way of light-load accuracy. When a large number of motors are to be metered it is an excellent plan to make tests of the maximum, minimum and average power consumption before selecting the permanent meter. In small mercantile houses, saloons, billiard halls and bowling alleys the average load usually is not far from the connected load, and in such cases the meter should have the capacity of the installation. Illuminated-sign work falls under the same category, the load being essentially constant during the hours of service.

In public halls, churches, department stores and factories it is desirable usually to install several meters and separate circuits rather than to force all the input through a single instrument, if there is any prospect that a very small percentage of the load will be used during the daytime. The first cost of smaller meters is greater, proportionally, and the efficiency is lower, than with large meters, but the light-load losses are reduced, and a better watch can be kept upon the bills and registrations with the departmental subdivision.

Old Edison Plant in San Francisco Destroyed by Fire.

The destruction of the old Edison three-wire station of the Pacific Gas and Electric Company in San Francisco, with its immense switchboard for distributing 110-volt direct current throughout the down-town district, entailed a very heavy loss on February 22d. The new distributing station fronting on Jessie Street, near Third, was damaged by water and the falling roof. There was considerable insurance on the old part of the station, which was to have been abandoned before long, but there was comparatively little on the new motor-generator sets recently installed. The total loss is estimated at over $100,000 at present, although the exact amount of salvage has not been determined. There were boilers and six engine-driven generating sets in the destroyed part of Station C.

The fire, which was discovered about 12:30 a. m., is supposed to have originated from short circuits of unknown origin in the large cables in the distributing tunnel underneath the building. These short circuits burned their way back to the switchboard, which burst into flames before the attendants could take measures to subdue them. Oil and waste contributed to make one of the hottest fires ever known in the city, and the iron roofs soon fell in. A number of station employes risked their lives plugging out the principal circuits so as to cause as little injury as possible to the main system. Nearly the entire fire department was called into requisition to extinguish the flames.

The damage to the new motor-generators is slight, but it will take some time to replace the distributing switchboard for the down-town supply of light and power. By working a large force of men on Washington's Birthday most of the large lighting customers were supplied the following night. An official says that 20 per cent. of the patronage of the company was affected by the fire. Both the Western Union and Postal Telegraph companies were crippled for a number of hours by lack of current to drive the dynamos supplying their telegraph circuits.

Station A, in the southern part of the city, has a much larger capacity than the 5,000-horsepower station that was destroyed, but it does not furnish direct current. So it was a question of using all the motor-generators and direct-current generators available to supply lights and motors on the direct-current mains. The Mutual Electric-light Company offered its assistance, and several isolated plants, including those of the Examiner, Call and the Mills Building, were connected up with the Pacific Gas and Electric Company's mains. In spite of these temporary makeshifts there was a serious shortage in the supply of current in the manufacturing district and several hundred shops were unable to operate on the 23d for lack of power.

Institute Meetings in New York and Chicago.

President S. S. Wheeler presided, as usual, at the meeting of the American Institute of Electrical Engineers held in the auditorium of the New York Edison Company, West Twenty-seventh Street, New York city, on the evening of February 23d. Secretary Pope announced that at the meeting of the board of directors held in the afternoon 62 associate members were elected, while William Henry Blood, Jr., of Boston, Louis Anthyme Herdt of Montreal, William Pestell of Worcester, and Hirschel A. Benedict of Albany were elected to full membership.

Mr. John J. Carty, chief engineer of the New York Telephone Company, then presented a paper on "Telephone Engineering." Mr. Carty's paper is one of considerable length and undoubted importance. The discussion was opened by Thomas D. Lockwood of Boston, advisory electrician of the American Telephone and Telegraph Company, who was followed by Prof. M. I. Pupin of Columbia University, B. Gherardi, chief engineer of the New York and New Jersey Telephone Company, and C. P. Steinmetz, electrician of the General Electric Company. Mr. Carty's paper received high praise as a compendium of elemental telephone engineering. It will be printed in full in the Western Electrician, beginning in this issue. Following the paper, an abstract of the discussion will be given also.

Chairman Kempster B. Miller called to order the regular meeting of the Chicago branch of the Institute on the evening of February 27th. He introduced Mr. W. A. Layman of St. Louis, manager of the Wagner Electric Manufacturing Company, who read a paper on the "Present Status of the Single-phase Motor in Central-station Work." Mr. Layman briefly reviewed the history of the development of the single-phase motor and discussed present types of motors available for miscellaneous power service. He was well prepared on the subject, and many questions were asked him as to the application of the motor for general power purposes. Some of the most important points brought out in the paper and ensuing discussion are given in the next column.

The Single-phase Motor for General Power Purposes.

Single-phase motors as applied to [illegible] work was the topic for discussion at the meeting of the Chicago branch of the American Institute of Electrical Engineers held February 27th. The subject was introduced by a paper by W. A. Layman of St. Louis upon the "Present Status of the Single-phase Motor in Central-station Work." Mr. Layman opened his paper, which was illustrated by numerous lantern slides, by giving a brief historical sketch outlining the development of the single-phase motor from its beginning as revealed by the Patent Office records. As shown by these patents, this motor has been developed along three lines, embodying the commutator type of motor, the synchronous type and the modified polyphase or split-phase type. The latter type is illustrated particularly in certain forms of wattmeter.

For central-station application in general power work the commutator type of motor is the most applicable, and the bulk of Mr. Layman's paper was given up to description of the Arnold and Schuler types of motors, which are built by the Wagner Electric Manufacturing Company, with which the lecturer is connected.

Slides showing various types of the Arnold motor as built by the Wagner company were shown and also some interesting curves representing the results of tests made by Professor Owens, now of McGill University, Montreal, but of the University of Nebraska at the time the experiments were carried on. The tests were made by the aid of an exploring coil, with the full voltage impressed on the field coils and the armature circuit open. The flux curves drawn from this data were interesting, showing that when the armature was idle the field was merely a pulsating one without any apparent shifting. Other curves taken with the armature running indicated that under those conditions a perfect rotating field was obtained.

This type of the Arnold motor is now built by the Wagner company as high as 40-horsepower capacity, operating on 60-cycle current. It is not limited to this size, however, and when the demand for larger types is sufficient there is no apparent reason why they should not be built.

The Schuler type of motor, built by this company, is the one which has attained a considerable degree of success in elevator work. Slides were used in the description of this motor, showing the machines with commutator on one end and slip rings on the other; also slides showing diagrammatically installations of elevator apparatus. With the usual installation about 150 per cent. of full load torque is required at starting. Mr. Layman, in answer to a query by one of the members, said that for starting conditions requiring, say four times normal full-load torque, about three times full-load current would be required. The efficiency of these elevator motors is maximum at about 80 per cent. of full load with a starting factor of about 68 per cent., the latter climbing up on the repulsion end to about 81 or 82.

In discussing the paper Mr. Miller asked what the present feeling is regarding the use of condensers in circuit with single-phase motors. In the earlier forms of split-phase motors these were used, but he had not heard much concerning their use of late years. Mr. Layman replied that their use was made impossible on account of their high cost and their perishability. Their use with the split-phase motors in earlier trials was to bring the line power factor up to unity. His company had made some installations in which condensers were used, but he found that in a few months the fuses had been blown and the condensers put out of service, but the motors still continued to operate satisfactorily, and the operator often did not know that anything had happened to them.

Mr. Rau asked if the combination repulsion and induction type of motor might not have some application, the running qualities and starting torque being good. Mr. Layman said that the Winter-Eichberg motor, which belongs to this type, is used principally in railway work, and he did not know of its application to general power purposes.

H. R. King asked if a polyphase motor can be run single-phase with the use of a condenser, to which Mr. Layman answered that he understood the manufacture of this type of motor had been discontinued on account of its impracticability.

J. R. Cravath said that perhaps in the smaller companies more than in the larger ones the application of the single-phase motor assumes importance. Many of the companies in the smaller cities and towns produce only single-phase current. When they wish to add a power load they are confronted with the problem of putting in direct current or else finding a motor applicable to their conditions. The single-phase motor seems to be the thing that is looked for. Again, where three-phase lines are run out to outlying districts it is often more desirable to connect single-phase motors at some little distance from the line than to tap off all three phases for use in a three-phase motor.

H. B. Gear of the Chicago Edison Company said that they had found the single-phase motor very satisfactory in many classes of work, especially in shops where a large number of sewing machines are used. They have several hundred motors connected for this work alone. As to the elevator problem, he was unprepared to express an opinion.

[illegible]

Lower Electric-light Rates Offered in Chicago.

[illegible] that Mr. Carroll [illegible] make a more comprehensive statement showing what it would cost for the city [illegible] wherever it is now furnished by the [illegible] companies.

A detailed report of the situation will be given in the Western Electrician next week.

St. Croix River Power Development.

Mr. Lee H. Parker, electrical engineer with Stone & Webster, lectured before the engineering students at the University of Minnesota on February 23d upon the development of waterpower at Taylor's Falls, St. Croix River, and its transmission to Minneapolis by the Columbia Improvement Company. The lecture was profusely illustrated with lantern slides showing views of the work at the waterpower for various stages of progress, plan and sections of power house, electric circuits, sub-stations, etc. The first installation of electric equipment will include four 3,000-kilowatt revolving-field three-phase generators, with transformers stepping from 2,300 to 50,000 volts, at which pressure power will be carried 41 miles over a three-phase line, consisting of No. 0000 copper 19-strand cable on a six-foot center. At the outskirts of Minneapolis step-down transformers will reduce the pressure from 45,000 to 13,200 volts, at which pressure the energy will be carried to the main station of the Minneapolis General Electric Company, where it is again reduced to 2,300 volts. The present pole line is near one side of a 60-foot private right-of-way, leaving room for a second pole line to be erected when the installation is complete. (See also Western Electrician of October 28, 1905, page 333.)

80-cent Gas for Manhattan.

The New York state commission on gas and electricity has ordered the fixing of the price of gas in Manhattan, New York city, at 80 cents a thousand feet, a reduction of 20 cents. The Consolidated Gas Company and its subsidiary concerns, which are affected, will, it is said, avail itself of the right to appeal to the Appellate Division of the Supreme Court within 30 days. The order of the state commission is to go into effect on May 1st, to remain in force three years from that date. It provides that the gas to be furnished at the reduced price shall be "of 22 candlepower and of a purity and pressure now established by law."

It was announced that a similar order will be issued forthwith against the Bronx companies, the Central Union and the Northern Union. The commission quoted figures showing that the cost to the Consolidated Gas Company, the largest of the companies operating in Manhattan Borough, of manufacturing and distributing gas for the year ended on March 31, 1905, was 60¾ cents per thousand cubic feet.

Electric Fans Discourage Flies.

Fan motors have long been found useful in keeping off flies, which will seldom settle where a strong breeze is felt, but a way is now suggested to use the fan as a "fly chaser" without employing the direct breeze, which is sometimes objectionable. Tie two or three ribbon streamers to the center of the guard in front, and let them blow out over the objects to be protected. Flies are disturbed far more by shadows of moving objects than by a breeze, and the results of this method should be more satisfactory.—Emerson Monthly.

Electrical Exports of Germany and the United States Compared.

An interesting analysis of the electrical exports of Germany and the United States has been made by Dr. Glier and published in the Elektrotechnische Zeitschrift of Berlin, under date of January 4, 1906. The following is taken from a summary of Dr. Glier's article printed in the London Electrical Review.

It is pointed out that, according to the United States census returns, the works engaged in the production of "electrical apparatus and supplies" numbered 76 in 1880, and employed 1,271 workers; in 1890 there were 189 works, and 8,802 employes, and in 1900 the figures were 580 and 40,890, respectively. In addition to these the concerns occupied with "electrical construction and repairs" comprised 1,162 in 1900, and employed 5,949 workers, thus making a grand total of 46,839 employes in that year. It is calculated that the total value of the products of the electrical industry amounted to £21,500,000 in 1900, but as the inland demand is unable to absorb the large output, the American firms have been compelled to enter the markets of the world, and this has been done with considerable success down to the present time. The author gives figures showing that the exports of electrical machinery and appliances from the United States, which reached a value of £964,000 in 1897-8 (the fiscal year ends on June 30th), advanced to £2,155,000 in 1899-1900, and to £2,450,000 in 1904-5. On the other hand, there were probably slight imports of electrical machinery, but these, with the exception of arc-light carbons, are not specially separated in the official statistics. In the case of Germany, the value of the exports of electrical machinery, accumulators, telegraph and telephone apparatus and cables and conductors averaged £2,200,000 in the three years, 1901, 1902 and 1903, the complete figures for 1904 not being cited.

The principal district which the Americans formerly contested the most in rivalry with the Germans was Europe. Of the total exports from the United States, the electrical machinery shipped to Europe represented 52 per cent. of the value in 1897-8, 49 per cent. in 1899-1900, 44 per cent. in 1902-3, 27 per cent. in 1903-4, and 23 per cent. in 1904-5. The value of electrical apparatus exported to Europe was 43 per cent. of the total exports in 1897-8, 50 per cent. in 1899-1900, 34 per cent. in 1902-3, and 45 per cent. in 1903-4. The decline in the American exports of machinery to Europe has therefore been considerable, although it is estimated that fully 20 per cent. of the exports still reach the Old World. As the main market of rivalry between the United States and Germany has hitherto been England, the following table of the values of the electrical machinery—not including apparatus—sent to the United Kingdom by both countries should be instructive for the period of years quoted:

Year.	German Electrical Machinery Exported to the United Kingdom.	Percentage Value of Total German Exports.
1900	£ 86,250	8
1901	120,950	12
1902	373,350	30
1903	289,550	27
1904	210,700	20

Year.	United States Electrical Machinery Exported to the United Kingdom.	Percentage Value of Total United States Exports.
1899-1900	£313,800	36
1900-1901	552,000	48
1901-1902	514,600	48
1902-1903	451,200	30
1903-1904	264,600	23
1904-1905	217,800	15

The considerable advance in the value of the exports from the United States in the earlier years mentioned is said to be connected with the association of the late Mr. Yerkes with the construction of underground railways in London; and the author admits that the Americans have badly beaten the Germans in the English market. Next in importance to the latter from the German standpoint are the markets of Belgium, Russia and Italy. These three countries combined absorbed 43 per cent. (£496,250) of the total German exports in 1900, 40 per cent. in 1901, 26 per cent. each in 1902 and 1903, and 29 per cent. (£313,400) in 1904. On the other hand, the American exports of electrical machinery to the three countries in question, which reached £47,600 in 1897-8, gradually declined to £20,800 in 1902-3, but recovered to £30,800 in 1903-4. The author, in commenting upon his detailed figures, states that while the Germans continue to make progress in Belgium, the Americans scarcely come into competition with them in that country, and that although the Teutonic exports to Italy and Russia are declining, this is not due to American rivalry, but rather to a lessened demand in conjunction with a growth of the native industries. Except in the case of France, American competition is insignificant or non-existent in other European countries, as, for instance, Spain, Holland, Sweden, Norway, Austria-Hungary and Switzerland. The value of the exports of United States machinery to Germany was £25,750 in 1900, as compared with only £5,900 in 1904.

The question of competition outside of Europe is then dealt with by Dr. Glier. Taking first of all the cases of British North America, Mexico and Japan, it is shown that these countries purchased electrical machinery to the extent of £80,000 from the United States in 1897-8, £555,200 in 1903-4, and £805,600 in 1904-5, or 20 per cent., 49 per cent. and 55 per cent., respectively, of the total exports of electrical machinery. The exports of electrical appliances from America to the three countries have also largely increased in the same period of years. In contradistinction to this position of affairs, the German exports to the same countries have been inconsiderable, and the author submits, therefore, that the Americans dominate the trade of Canada, Mexico and Japan, and that the Germans are not making progress in those countries.

The markets of South America also bring the two manufacturing nations into strong trade rivalry. By means of statistics it is demonstrated that in general the exports of machinery from Germany to Argentina and Brazil in the last five years have increased, but no signs of development are noticeable in regard to Chile, Uraguay and Peru. As against the German trade, the exports of the United States are shown to be increasing. Among other countries, it is mentioned that the Germans have beaten the Americans in the Australian market and that neither Algeria nor British East Africa comes into consideration for either of the two rivals, but that the keen contest in British South Africa seems to be tending in favor of the United States.

The question of electrical apparatus is treated separately from that of machinery. It is shown that the American exports amounted to £841,400 in 1902-3, £992,000 in 1903-4, and £992,600 in 1904-5, and that the principal quantity is forwarded to Europe, England in particular buying very largely. Dr. Glier recalls the fact that the imports of electrical machinery into the United States are not specifically enumerated, and that presumably they are very small. The figures which he gives for Germany are trivial, except in the case of arc-lamp carbons, the value of which averaged £14,600 in the five years ended with 1904. In conclusion, he briefly summarizes the conclusions which have already been set forth in relation to the results of the industrial competition between the two exporting countries as represented by the United States and Germany.

Appleyard Properties Sold.

Cleveland, February 24.—A. E. Locke of Boston, who has represented the bondholders and creditors of the Appleyard electric railways in Ohio, has purchased all the properties with one exception. As Mr. Locke was a member of the reorganization committee, the statement has been made that he purchased the properties for the syndicate represented by Randall Morgan and W. Kelsey Schoepf, and this is doubtless true.

The Dayton, Springfield and Urbana was sold for $600,000, just double the upset price fixed by the court. The bonded indebtedness of the company is $750,000 and the floating debt amounts to about $65,000.

As Mr. Locke was the only bidder for the Columbus, London and Springfield, he secured the property at the upset price of $250,000. It has a bonded indebtedness of $1,500,000 and a floating debt of perhaps $100,000. A park and several small properties went with the roads. The Springfield and Western branch was sold to George H. Warrington, representing the same interests, for $500.

On the second day of the sale Mr. Locke purchased the Central Market line in Columbus for $150,000. Bonds outstanding on this property amount to $500,000. On the Columbus, Grove City and Southwestern, which Mr. Locke purchased for $35,000, there are bonds amounting to $150,000. He was the only bidder on these lines. The Central Market has valuable franchises in Columbus. On the third day Mr. Locke purchased the Urbana, Bellefontaine and Northern, extending between Urbana and Bellefontaine, the Bellefontaine city lines and a spur extending to Silver Lake, at the upset price of $175,000.

This completes the purchase of the Appleyard roads. The sales will probably be confirmed by the United States court within a few days, although Dayton stockholders are threatening to oppose the confirmation of the sale of the Dayton, Springfield and Urbana, on the ground that it did not sell for enough money. So far as known, no contests have been thought of regarding the other lines. George H. Warrington has purchased the lease of the Dayton, Springfield and Urbana on the Urbana, Bellefontaine and Northern, which goes to show something of the plans that are in contemplation.

Attorneys have been at work on papers of incorporation for a holding company for the properties just purchased and which are to be turned over to the syndicate. It is stated that the capital stock will not be over $1,000,000. A large amount of money is to be spent upon improvements, and they will all be put in good condition. The new lines will give the syndicate through service from Cincinnati to Zanesville. The Cincinnati Northern, the Columbus, Buckeye Lake and Newark, the Columbus, Newark and Zanesville, the Lima city lines and connection with Indiana properties are owned by them. The syndicate is said to have made an attempt to purchase the Columbus, Delaware and Marion line, but did not succeed. This is one of the best lines in the state, and will ultimately connect with Cleveland. For this reason it is desirable as an almost direct line between Columbus and Cleveland. It is owned by John G. Webb and others.

Following these changes, a surveying party started out from Lima to run a line between that city and Bellefontaine for the Morgan-Schoepf people. With this gap filled, the syndicate will have a line from Cincinnati to Lima, connecting with the Ft. Wayne, Van Wert and Lima and the Lima and Toledo line, the latter under construction. Connections with Indiana lines will thus be secured for both northern and southern Ohio. The distance between Lima and Bellefontaine is 23 miles, and it is said the link will be built this summer.

C.

Comparison of Large Steam and Electric Locomotives.

J. E. Muhlfeld, general superintendent of the Baltimore and Ohio Railroad, read an interesting paper before the New York Railroad Club recently upon the subject of large steam and electric locomotives for heavy service. The Baltimore and Ohio Railroad has operated six electric locomotives of large size, four of them for a period of about 10 years, and the other two for about two years. The last two are designed especially as helping locomotives for heavy freight service. They handle through freight trains (and the steam locomotives attached to them) at Baltimore, from Camden Yard to Waverly, a distance of about 3.4 miles, returning light. During the last year's service the combined mileage of these two locomotives was 121,015, or an average of 5,042 miles a month for each locomotive.

During the operation of the two heavy electric locomotives careful observation of their performance was made. From the data obtained it was possible to make a comparison between the electric locomotive and a large steam locomotive of the Mallet articulated duplex-compound type.

Taking the results of his observations into consideration, Mr. Muhlfeld admitted that electricity as a motive power is superseding steam in many places, and that it may displace the latter for through passenger service in many cases. He thought, however, that it would be some time before electrical energy will supplant steam for handling heavy tonnage for considerable distances, believing that the cost of electrical equipment at the present time makes it prohibitive for such traffic. The reasons for this he summarized as follows:

An electric locomotive complete and crewed, ready for operation, would require, for terminal handling, a running repair shed, with drop pit and auxiliary facilities, tracks and switches, inspection pit and sand, repair material and general stores supply. For maintenance there would be necessary a general repair shop and equipment, and many expensive extra parts for quick repairs and renewals for locomotive and plant. For line operation there would be needed standard-gauge tracks, sand-supply stations, power-plant building and equipment.

On the other hand, a steam locomotive complete and crewed, ready for operation, would require for terminal handling, a running repair shed with drop pit and auxiliary facilities, tracks and switches, turntables, ash pit and coal, water, sand, repair material and general stores supply. For maintenance it would need a general repair shop and equipment, with a few inexpensive parts for locomotive repairs. And for line operation there would be necessary standard-gauge tracks and coal, water and sand supply stations.

Books Received.

"Wiring Handbook." By Cecil P. Poole. Published by McGraw Publishing Company, New York. Price, $1.

"Standard Telephone Wiring." By James F. Fairman. Published by McGraw Publishing Company, New York. Price, $1.

"Electric Railway Accounting." By W. B. Brockway. Published by McGraw Publishing Company, New York. Price, $1.25.

"Practical Electric-railway Handbook." By Albert B. Herrick. Published by McGraw Publishing Company, New York. Price, $3.

"Electric Power Transmission." (Fourth edition.) By Louis Bell, Ph. D. Published by McGraw Publishing Company. Price, $4.

"Alternating Currents: Their Theory, Generation and Transformation." By Alfred Hay. Published by the D. Van Nostrand Company, New York. Price, $2.50.

"Motive Power and Gearing for Electrical Machinery." By E. Tremlett Carter. Published by the D. Van Nostrand Company, New York (The Electrician Printing and Publishing Company, London). Price, $5.00.

"A Practical Treatise on the Steam-engine Indicator and Indicator Diagrams." By W. Worby Beaumont. Published by the D. Van Nostrand Company, New York (The Electrician Printing and Publishing Company, London). Price, $2.50.

Copper Market.

"The market for copper has had to contend against a dull and uneventful period during the last few weeks," says Copper Gossip of the National Conduit and Cable Company under date of February 20th, "but notwithstanding the feature of the situation leading sellers have not given any open evidence of succumbing to depressing influences. There is, however, neither necessity for nor use in denying that considerable sales have been made lately at 18 cents for electrolytic. Over against this fact may be placed another equally important one in some respects, namely, that some of the largest holders of the metal refused to change their quotation from 18½. Buyers are willing to pay 18 cents, but it is not every seller who will accept orders on that basis. Prices, therefore, have been more or less irregular, a condition growing out of the recent prevailing dullness in the market, and one generally utilized by certain operators to further their efforts to create a reactionary tendency. The absence of a vigorous buying movement has encouraged those with bearish proclivities to work for a reduction in prices in London and New York, and while these tactics have been partially successful in bringing out several million pounds of cheap copper, there are apparently no indications of any serious market slump in prospect to bring demoralization and permanent unsettlement. * * * In contrast to the quiet trading in copper referred to, consumption keeps up at an extraordinary rate, and there is neither let nor hindrance in the melting down of supplies at the big mills of the country. The leading plants appear to have about all they can do turning out stacks of orders, and the enormous quantities of copper being consumed in this country should not be underestimated.

"Producers report their output well sold up for this month and next, if not beyond these months. Deliveries on old contracts are being well absorbed, and these keep up a satisfactory movement from producer to consumer. The situation is probably well arranged for until April and May, but what the position of the market will be after outstanding contracts are fulfilled is the problem the consumer is now interested in. The wire drawer and brass manufacturer know what they can do with every pound of ready copper on hand, but what the situation will be in May and June, should they stock up at current rates, is the knotty part of the proposition. Four months ago we were buying copper on a rising scale of prices, but at present the question of moment confronting consumers is, has the market at 18 to 18½ cents reached its zenith? Events of 1905 showed clearly the wisdom as well as the necessity of buying from two to three months in advance of needs, and the operation worked all right. Can the same plan be followed in 1906 with as much safety as last year? Perhaps this query would call for too great prophetic discernment to answer it satisfactorily. But this feature is just the Chinese puzzle of the present situation, and we simply suggest the question without attempting to frame an answer."

Chicago Street-railway Situation.

Aside from the rumors that the North and West Side street-railway companies are dissatisfied with the conduct of the Chicago Union Traction Company, which operates the two systems under lease, and that these underlying companies will try to annul the lease, the principal topic of discussion in street-railway circles just at present is the matter of lowering the Chicago River tunnels used by the Union Traction Company. The date set by a federal order for the lowering of the tunnels is April 15th. The Union Traction Company has signified to the council its willingness to lower the tunnels at its own expense. But to lower them will require the abandoning of the cable system, and in view of this the company wants a permit to substitute the trolley on all its cable lines. Mayor Dunne is afraid the cause of municipal ownership will be injured if permits to "trolleyize" the lines were granted and therefore refuses to issue permits for any streets involved in the 99-year controversy.

On the other hand, the Union Traction Company says it cannot handle its traffic if compelled to switch at various points from cable to trolley and vice versa, and threatens to appeal to the courts for an order to compel the city to grant the trolley permits.

W. W. Gurley of the Union Traction Company, in a proposition to the mayor, proposes to build bulkheads at the ends of the tunnels and then knock the tops off in order to comply with the order of the government to remove the obstructions to navigation by April 15th. At the close of navigation in the fall, the tunnels would be reconstructed for [illegible] 26 feet of water over the [illegible] Union Traction Company agrees to [illegible] given the use of the tunnels [illegible]. In order to bring about [illegible] reconstruction period the company [illegible] the right to substitute trolley for [illegible] cable now used, not only in the [illegible] but on the North and West Sides.

Test of Underground Mail-conveying System in Chicago.

An official test of the electrically operated mail-conveying system to be used by the Chicago Post Office in connection with the Illinois Tunnel Company's system, to convey mail to and from the various railroad stations, was made on Saturday, February 24th, under the direction of Mr. George W. Jackson, chief engineer and general manager of the tunnel company. The government contract calls for the complete installation of the underground mail service within 60 days after the plans are approved. The plans for some of the railroad stations have not yet been sanctioned, but on others the work is well along, and in one instance, the La Salle Street station, it is expected that the service will be begun by March 10th, service to the other stations following gradually.

The test made last Saturday was on the conveying apparatus in the Federal Building, where the post office is located. Mr. Frank H. Galbraith, superintendent of mails, and Assistant Postmaster John M. Hubbard, who witnessed the experiments, both agreed that the service was satisfactory, and that when it is inaugurated the mail between the postoffice and the railway and sub-stations will be handled much more rapidly than is now possible with 85 mail wagons. This is the first underground electrical arrangement for handling of mail in the United States, and the officials of the Postoffice Department are watching the development with keen interest.

The postoffice by-pass in the tunnel is of extra large cross-section (12 by 13 feet), with double track, and extends from Jackson Street to Adams Street under the Federal Building. Fig. 1 is an elevation through the center of the tunnel, looking east, and shows also the location of the chutes for dropping the mail down to the tunnel cars, and the conveyor system for raising it from the cars into the building. The mail pouches are thrown down the chutes from the mailing platform in the postoffice and are delivered upon the mailing platform in the tunnel, where they are placed on the mail cars and sent to their destination. Incoming mail from the depots and sub-stations is unloaded from the tunnel cars onto the tunnel platform and from there placed on the conveyor and taken up and delivered on the mailing platform in the postoffice.

The conveyor is a large belt 30 inches in width, motor driven. As shown in Fig. 1, it travels horizontally in the tunnel, for a distance of 90 feet, then it ascends on an incline to a point just below the driveway under the building. At this point the pouches are deposited on a cross belt, which delivers them to the mailing platform. Fig. 2 is a section of the tunnel, showing the conveyors. Fig. 3 is a cross-section showing a mail chute which delivers the bags to the mailing platform in the tunnel.

For carrying the mail back and forth between the postoffice and the railway stations, a type of mail car is used which was illustrated in the Western Electrician of November 18, 1905. During the test a train of mail cars traveled from the postoffice to the La Salle Street station, deposited its burden, and was ready to leave on its return trip in three minutes. This distance is short, but for a team on the crowded streets above to make any such time would be out of the question.

Connections are being made at the Union Depot for delivering mail from the tunnel cars to the tracks above, by means of a conveyor. Another method may also be employed at this station, and [illegible]

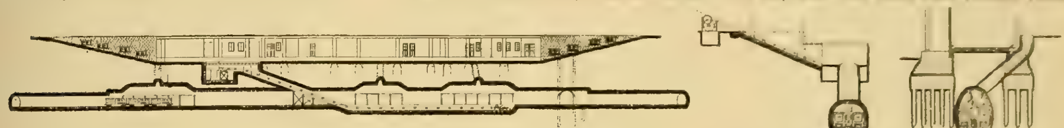


Fig. 1. Elevation through Center of Tunnel Showing Mail-conveying System.
Fig. 2. Cross-section Showing Mail Conveyor.
Fig. 3. Cross-section Showing Mail Chute.
TEST OF UNDERGROUND MAIL-CONVEYING SYSTEM IN CHICAGO.

New German Metallic-filament Lamp.

Dr. Hans [illegible] of a number of tests on a new German [illegible] report [illegible] watt per candle [illegible] hour. The results of these tests [illegible] London Electrician [illegible] ing figures from the report [illegible] will be of interest.

The first lamp was rated at 12 volts, 19.17 candlepower, 0.961 ampere and 1.12 watts per candlepower. The test was started [illegible] current just before the lamp [illegible] hours later being 0.472 ampere. [illegible] the loop after 1,010 hours [illegible] itself and went on burning. The watts per candlepower diminished gradually from 1.12 to 1.02 at the end of the life of the lamp, two or three readings showing some variation, however, from this downward trend.

The second lamp was rated at 30.25 volts, 12.39 candlepower, 0.461 ampere and 1.08 watts per candlepower. The lamp was still burning after 3,537 hours, it having burned through and rejoined at 1,490 hours. In this instance the watts per candlepower showed in general a slight increase as the test proceeded.

A test was next made upon a lamp of 19 volts, 29 candlepower, 1.48 amperes and 0.97 watts per candlepower. After it had burned for 1,686 hours the current was increased by raising the pressure to about 60 volts. In consequence the filament burned through, but rejoined, and the lamp went on burning. The amperes in this case remained very nearly constant, as did the watts per candlepower, except of course when the overload was put on.

Another lamp of 30 volts, 13.5 candlepower, 0.470 ampere, 1.05 watts per candlepower, was still burning after 3,103 hours, the amperes and watts per candlepower remaining practically constant.

Two other lamps tested showed practically the same characteristics. Two more were overrun as to current, one 233 per cent. and the other 201 per cent., and this without damage. In the second case the only result was that the normal candlepower of 19½ was increased to 20½.

Earnings of Stone & Webster Properties.

Stone & Webster of Boston have issued a statement of the earnings of companies controlled by them. The following condensed figures give the operating expenses and net earnings of some of the properties for the year 1905:

Edison Illuminating Company of Brockton, Mass.—Operating expenses, $111,821; net earnings, $34,158 (in 1904 the figures were, respectively, $81,230 and $40,505).

Lowell Electric Light Company, Lowell, Mass.—Operating expenses, $164,726; net earnings, $90,200 (in 1904, $154,230 and $85,139).

Jacksonville Electric Company, Jacksonville, Fla.—Operating expenses, $218,722; net earnings, $80,919 (in 1904, $213,264 and $77,233).

Savannah Electric Company, Savannah, Ga.—Operating expenses, $475,721; net earnings, $110,514 (in 1904, $442,006 and $101,238).

Houghton County Electric Light Company, Houghton, Mich.—Operating expenses, $127,440; net earnings, $84,283 (in 1904, $124,164 and $60,318).

Tampa Electric Company, Tampa, Fla.—Operating expenses, $258,919; net earnings, $152,844 (in 1904, $241,171 and $123,474).

Terre Haute Traction and Light Company, Terre Haute, Ind.—Operating expenses, $536,936; net earnings, $92,824 (in 1904, $482,879 and $86,550).

Underground Construction in La Crosse, Wis.[1]

By W. D. Burford.

There has recently been constructed at La Crosse, Wis., an electric-light plant which presents a very good example of underground distribution of light and power conductors.

[See Mr. Williams' article on page 171 of this issue for description of power house and overhead construction.]

The conduit used is the McRoy salt-glazed vitrified clay conduit containing four or six ducts. This conduit is laid in a trench on a two by two-inch hemlock plank, dressed on both sides and treated with a preparation of carbolineum, which is an excellent wood preservative. On this plank and at right angles to it are two by two-inch hemlock cleats 12 inches long laid at intervals so as to bring them four inches each way from the joints in the conduit. The conduit is then laid on the cleats and the joints between two sections of conduit are wrapped with a muslin strip four inches wide, saturated in water and overlapped in such a manner as to prevent the entrance of cement into the conduit. An iron mold eight inches wide and two inches thick is slipped down beside the conduit and tamped into position. The space thus formed between the mould and the joint is poured full of neat cement composed of equal parts of clean, sharp sand and Portland cement, when two more cleats are placed on top of the conduit four inches each way from the joint and filled with cement; this now forms a complete bond of cement two inches thick and eight inches wide, hermetically sealing the joints in the conduit. A two by 12-inch hemlock plank is placed on top of the completed work resting on the top cleat and serving as a protection to the conduit in case of future excavation. As the work progresses a mandrel slightly smaller than the duct and fitted with an iron ring in one end is pulled through each joint with an iron rod to insure perfect alignment. In the use of this style of conduit this is hardly necessary, as each section of conduit has a small hole in either end which contains a cast-iron aligning pin, but is done to be doubly sure of alignment. All spaces and interstices are carefully filled and tamped with dirt to prevent settling; the ditch is filled and the street repaved in the usual way.

The manholes having dimensions five feet in diameter by five feet deep from the street grade to the bottom of manhole are built of sewer brick laid in cement mortar. The circular brickwork is eight inches thick, resting on a concrete foundation seven feet in diameter and six inches thick. The bottom of the manhole is drained by means of three-inch vitrified bell-end pipe 12 inches long imbedded in the center of the concrete foundation. Manhole covers are of cast iron of the standard size and ventilated type.

The lateral pipes which are used for conducting the cables from the manholes up the distributing poles are three-inch wrought iron, bent in a 90-degree curve, painted with asphaltum varnish, and brought to a point three feet above the ground and securely stapled to the sides of the poles. They are fitted with a three by 2½-inch reducer at this point, and the pipes from here up to the discharge bells or potheads are 2½ inches in diameter, painted and stapled in the same manner. The top of the pipes are fitted with a wooden bushing which is driven in around the cable in halves in such a manner as to prevent the entrance of water into the top of the pipe. These pipes are carefully cemented where entering the manhole in such a manner as to make it watertight.

The cables were furnished by the John A. Roebling's Sons Company of Trenton, N. J., and are of the three-conductor paper-insulated type, especially designed for three-phase systems of an electromotive force of not less than 5,000 volts between conductors. Each wire is separately insulated with paper three-thirty-seconds of an inch thick, which is saturated with a heavy insulating oil. The interstices are filled with jute and the whole core is protected from the lead by a paper belt two-thirty-seconds of an inch thick. The lead sheath is one-eighth of an inch thick and contains three per cent. of tin. The copper conductors consist of stranded wire to insure flexibility and are guaranteed to have a conductivity of not less than 98 per cent. of that of pure copper. The insulation resistance of these cables on the reels was guaranteed to be not less than 60 megohms per mile at 60 degrees. The cables were subjected to a pressure of 10,000 volts for five minutes on the reels in the factory, and after being installed and spliced were subjected to a pressure of 6,000 volts for 30 minutes, tests being made from each conductor to ground and also from conductor to conductor within the cable. They stood this test very satisfactorily, showing no defects whatever.

Cables are shipped on heavy reels averaging 4,500 pounds each and were pulled into the conduit with a rope and winch. To get this rope through the duct a number of three-foot rods are jointed together with a patent coupling and pushed through from one manhole to the next. A wire is then attached to the rods and they are pulled out and disjointed until the wire is reached at the other end of the section. The rope is then pulled in with this wire. A heavy steel bar is passed through the core of the reel, which is lifted from the ground with a pair of jackscrews supporting the steel bar; this allows the reel being revolved readily.

To attach the cable a foot of lead sheath is removed from the end, the wires exposed and stripped of their insulation; they are served up through a chain link three inches long, which is made of one-half-inch wrought iron; this link is attached to an eye in the end of the rope by means of a repair link. A cast-iron mold fitted with a hole at one end of the diameter of the cable, and at the other end with holes to accommodate the chain link is placed around the end of the cable and closed firmly. This mold is poured full of hot lead through suitable vents on the top and then removed; the cast is allowed to cool, and the cable is ready to be pulled. This lead cast serves a double purpose, as it prevents any moisture which may be in the duct from entering the cable and also distributes the strain of pulling equally all the strands of the conductors. When assured that the ducts are dry the cast is unnecessary on the smaller sizes of cable, as with reasonable care the ends can be made up so as to bring the strain equally on all three conductors.

The rope at the pulling manhole is passed over a grooved pulley mounted between two heavy skids and is adjusted to be in line with the duct. The rope passes over a second grooved pulley, which is just above the street level, and from there it is passed around the drum of the winch, which is geared down to a crank shaft fitted with two cranks and operated by men. When enough cable has been pulled into the distant manhole to allow for racking and splicing, the ends are cut off in both manholes and the cable is carefully sealed to prevent the entrance of moisture. This is of great importance, as entire sections of cable are sometimes ruined, due to manholes being flooded by heavy storms and water entering the cable.

The splicing of light and power cables is a matter of the greatest importance, as herein lies the greatest danger of future trouble. The cables must be handled and bent with the greatest of care, particularly in cold weather, for if the cable is bent at too sharp an angle the paper insulation is apt to crack and break down. Probably 75 per cent. of breakdowns in high-tension cables occur in the bends. The cable factories advise not bending the cables in a circle of less than 18 inches.

Preparatory to splicing the cable it is first carefully trained around the wall of the manhole in such a manner as to occupy as little space as possible. The ends of the cable are then sawed off in such a manner that the two ends meet. The sheath is removed for a distance of 15 inches, eight inches from one end and seven inches from the other end. A lead cylinder 18 inches long and three inches in diameter with three-sixteenths-inch wall is then slipped over one end of the cable and back out of the way. The diameter of this cylinder, of course, is governed by the size of the cable. The dimensions given above are for a 100,000-circular-mil splice. Paper tubes of sufficient diameter to fit closely over the conductors are now slipped over each conductor on the eight-inch end and a large paper cylinder of sufficient diameter to contain these three paper tubes is slipped over the whole cable and back out of the way. These paper tubes are an innovation in high-tension cable splicing and are manufactured by the Standard Underground Cable Company, and are made of any required thickness of wall, according to the insulation on the cables on which they are to be used. They are prepared by being boiled in a heavy insulating compound at the factory to prevent the absorption of moisture. They greatly facilitate the making of straight splices, as they guarantee a uniform thickness of insulation at the splice. The next operation after slipping these paper tubes over the conductors is the removal of 1½ inches of paper insulation from the end of each conductor. The conductors are then joined together by slotted copper cylinders 2½ inches in length and of a sufficient diameter to fit snugly over the conductors. These connectors are carefully sweated with melted tin poured from a ladle, all surplus tin is wiped off, particular care being used to prevent the formation of any teats or needles. The joint is then allowed to cool and is painted with a hot solution of No. 1 minerallac, which is an excellent insulating compound, and is served with sufficient Empire tape to fill up the joints to a level with the adjoining paper insulation. This tape is a linen tape cut on the bias to increase its strength and saturated with an insulating compound, and is considered to be the most efficient and convenient form of insulating tape on the market. After taping the joints the paper tubes are slipped over the joints and the large paper belt is slipped over the entire work, binding the three paper tubes firmly together and serving to doubly insulate the connections from the lead sheath and secure the work against accidental slipping of the inner tubes. The large lead cylinder, previously mentioned, is now slipped over the completed splice, the ends are dressed down to a close fit on the lead sheath of the cable and a regular plumbers joint is wiped on either end. Two cuts are now made at right angles to each other on the top side of the lead cylinder and about six inches from one end, which allows of turning up a lip of lead. This opens a hole in the sleeve through which the splice is completely filled with No. 2 Minerallac or high-grade paraffin. No. 2 Minerallac is a heavy black insulating compound, which is considered excellent for this purpose. The splice is allowed to cool, then refilled until all air is expelled. The lip is hammered down flush and securely sealed with a soldering iron. This completes the splice, which is suspended on the wall of the manhole from suitable cable supports which are driven into holes drilled in the brick wall of the manhole and plugged with wooden plugs.

If there are a large number of cables along the wall of the same manhole it is more economical to erect two flat iron strips, vertically mounted, punched with holes at intervals of four inches, into which fit a special cable support equipped with rivet heads which engage in the holes of the vertical strips and thus allow the hanging of a number of cables without drilling a large number of holes in the brick wall.

These cable racks also facilitate the moving and handling of cables in case of future additions. All cables should be protected from contact with iron or other sharp corners by the use of strips of sheet lead. When splicing and racking is all completed the cables are all securely bonded together with heavy copper conductors sweated to the sheath to reduce danger from electrolysis. These bonds should be applied in every manhole.

The making of branch or tap splices is a much more difficult matter, requiring greater skill on the part of the splicer. No paper tubes are used in these splices, the insulation being secured by the use of Empire tape. A special copper connector is used, formed in such a manner as to accommodate the three or four conductors, as the case may be. These joints are made up in such a manner as to be staggered at intervals of three inches apart along the splice. This prevents the splice becoming too bulky and also insures a higher insulation. Great care must be used in making both kinds of splices not to bend the individual conductors abruptly, as there is considerable danger of weakening the paper insulation at the point where the lead sheath is removed. In branch splices the joints are wiped in the same manner as previously described, excepting that the joint wiped at one end is termed a Y joint. This work should never be attempted by any but an expert cable splicer, as a defective joint will allow the entrance of moisture, causing a breakdown in the cable, which is generally very hard to locate.

The pulling of lateral cables up the distributing pole is done by means of a rope threaded through a snatch block hung on top of the pole. The rope is passed through the pipe and into the manholes by means of a wire which is generally threaded through the pipes at the time they are installed. These cables are then spliced in the manhole to the main cable in the manner just described.

The upper end of the lateral cable is equipped with a discharge bell, sometimes termed a pot head. The purpose of this discharge bell is to seal the end of the cable hermetically and bring the conductors out in a manner convenient for connections to the primary service boxes. This head is in three parts, the base being of cast brass 4½ inches in diameter, with a hole in the lower end threaded in such a manner as to make a tight fit on the cable. After the cable is properly bent into position five inches of the sheath is removed. This brass casting is slipped down over the cable, with the large end up. It is then screwed down on the lead sheath, the threads cutting their way into the lead for a distance of about one-half inch along the sheath. This makes an air-tight connection and does away with the necessity of a wiped joint at this point. The three conductors are now bared for a distance of 1½ inches and are spliced to heavy rubber-covered braided wire of sufficient length to reach the primary service boxes.

The joints between these rubber-covered wires and the cable conductors are spliced in exactly the same manner as the straight splices, paper sleeves being used of sufficient diameter to slide back over the rubber insulation. When the splice is completed, as described, a brass shell 4½ inches in diameter and nine inches long, threaded at one end to fit a female thread in the top end of the brass casting previously mentioned, is then slipped over the ends of the rubber-covered wire and screwed into the brass casting. The discharge bell is now bent into an upright position and fitted into the wooden frame which is to hold it permanently in position. This frame is 18 inches wide and 24 inches high, made of seven-eighths-inch pine and painted with Carbolineum, the upper nine inches of it being sawed in a half circle. At right angle to this board and mounted on it by means of a pair of iron brackets is a seven-eighths-inch pine shelf cut in a half circle, nine inches wide and extending across the full width of the backboard. In the center of this shelf is a hole 4½ inches in diameter, up through which projects the brass shell of the discharge bell. The backboard is then securely screwed in position on the pole and a pair of iron clamps are screwed on the backboard in such a position as to securely grip the pot head around the collar

1. Abstract of a paper read before the Northwestern Electrical Association at Chicago, January 17, 1906.

of the brass casting, holding it in a permanent position in the frame. A hard maple collar boiled in Carbolineum is then slipped over the rubber-covered ends and fitted over the top of the brass shell, it being provided with a groove on its under side for that purpose. This maple ring is designed to prevent the wires from coming in contact with the brass shell. The wires are then tested out by means of a bank of dry batteries and a telephone receiver to get the A B and C phases in their proper relative position; the wires being bent down through porcelain tubes in holes in the horizontal shelf and curved up in a water drip and connected to the service boxes. The discharge bell is now filled with hot No. 2 Minerallac and allowed to cool, being refilled several times until all signs of settling have disappeared. A copper hood made of 16-gauge sheet copper and formed in the shape of a quarter section of a ball is slipped over the top of the frame, the lower edge of it extending slightly below the horizontal shelf and being tacked in position with iron tacks. This copper hood makes the discharge bell absolutely water, snow and insect proof.

Twelve inches above the discharge bell frame is mounted a set of double cross arms of Washington fir, 3¼ inches by 4¾ inches by eight feet long, bolted through the pole and securely blocked; 30 inches above this set of arms is a similar set. These arms carry the transformers and service boxes and are supported by heavy iron braces suspended from above. All transformers used are Westinghouse O D type, being of five to 10 or 20-kilowatt capacities.

The primary service boxes were furnished by the H. W. Johns-Manville Company and consist of a cast-iron box with a hinged cover, fitted with lugs which engage a toggle bolt and thumbscrew, allowing the cover to be bolted firmly down on a rubber gasket. The box contains a porcelain lining, in which are mounted the spring clamps for holding the Sachs Noark fuses, the porcelain cover of the inner box being equipped with the lobster-claw clutch, which permits of the fuse being removed while under load without and danger to the lineman. The inner box is also fitted with rubber gaskets, and the rubber-covered wires are led in through the bottom through porcelain tubes, the whole making a perfectly watertight box.

All power transformers are hung on the west or south side of the distributing poles, while the light transformers occupy the east or north side. This same rule is strictly adhered to in location of the cables in the conduit, thus making it an easy matter to trace any cable. In addition to this all cables are tagged with a brass tag on which is stamped "light" or "power" and the size of the conductor in the cable.

The transformer arms are mounted 25 feet from the ground in all cases, excepting where impracticable, due to the proximity of buildings, the object of this being to keep the weight of the transformers as close to the ground as possible. All distributing poles are 50 feet, eight-inch top, Idaho cedar. The service wires are distributed from the tops of these poles, in the usual method, from two sets of double cross-arms placed at right angles to each other, and the feeders are carried down vertically to the transformer arms on heavy porcelain cleats. Just below the discharge bell is mounted a double platform made of heavy angle iron rigidly braced and equipped with a pine floor, making it safe for the lineman to work on the service boxes while the lines are alive. These service boxes are so arranged that the load can be shifted at any distributing pole from any one phase to another phase in from one to three minutes, thus making it possible to equalize the load readily on all phases.

At various points in the outer limits of the underground districts are lateral poles, where the cables connect with long aerial lines supplying the residence districts. At all such lateral poles the cables are terminated in discharge bells as above described, the rubber-covered leads being directly connected to three-phase Westinghouse outdoor-type oil switches, which are mounted in a similar manner to the transformers. This allows the linemen to kill any section in case of repairs or extensions.

At two points in the underground system the main feeder cables are spliced through subway junction boxes in such a manner as to make it possible to disconnect various sections of the underground systems for purposes of repair; this is accomplished by splicing out each conductor to a separate single-conductor paper-insulated lead-covered cable which is led through a single line subway box, and thence to the other end of the main feeder, thus allowing the disconnection of any one of the phases, while the current is on. These subway junction boxes are furnished by the H. W. Johns-Manville Company and consist of a cast-iron box fitted with a cover which bolts down on a rubber gasket. In the back of the box is a heavy slate base on which are mounted heavy brass clamps, made to engage Sachs Noark fuses. In each end of the box is fitted brass couplings and nipples, which are connected to the cable sheath by a wiped joint.

In addition to bonding the cables in every manhole, there is a No. 0000 wire strung aerial from the end of the underground district to the grounded side of the generators of the street-railway company, the conductor being [illegible] bonded to the sheath of the [illegible] precaution is taken to prevent [illegible] of the cable [illegible].

Electroliers Suggested for St. Louis Streets.

A plan for illuminating the [illegible] to make the downtown portion of the city especially attractive, is promoted by [illegible] of the Real Estate Exchange, of which [illegible] Bowman is chairman. The plan, [illegible] install 1,729 new posts in the downtown [illegible]. On these would be placed electroliers [illegible] a cluster of five 50-candlepower incandescent [illegible].

John I. Beggs of the Union Electric Light and Power Company has been giving the committee the benefit of his knowledge and experience as to the cost and feasibility of the plan. Mr. Beggs points out that, as the city blocks vary in length, a minimum and maximum distance of 70 and 125 feet, respectively, between lamps should be established. This spacing works out with about four lamp posts to the block. The corner light would burn all night and the intermediate ones until 1 a. m.

Mr. Beggs figures that to illuminate the 1,729 electroliers, each giving 250 candlepower, would cost the city $171,329.04 a year. This takes account of the original investment incidental to the installment of the service and its repairs, the outset cost being estimated at $1,500,000. The cost to the city for lighting the same streets at present amounts to $266,000 a year.

In arriving at the annual cost of the proposed new illumination Mr. Beggs submits the following interesting figures:

"With lamps arranged in accordance with the proposed specifications, we find there will be 906 posts carrying all-night lights, and 823 posts carrying lights running till 1 a. m. only.

"All-night posts (906) at 4,100 burning hours per annum equals a total for all of 3,714,600 post-hours per annum.

"Posts lighted till 1 a. m. (823) at 2,416 burning hours each per annum equals a total for all of 1,988,368 post-hours per annum.

"All-night posts (906) with 250 candlepower per post each equals in all 928,650,000 candlepower-hours per annum.

"Posts lighted till 1 a. m. only (823), of 250 candlepower per post, equals in all 497,090,000 candlepower-hours per annum.

"A grand total of 1,729 posts as per above burning hours equals 1,427,742,000 candlepower-hours per annum.

"At $0.012 per candlepower-hour, cost of the above is $171,329.04 per annum.

"For convenience of comparison, would say at $0.012 per candlepower-hour, the standard 16-candlepower lamp would cost $0.192 per hour.

"For further convenience, would say that posts of 250 candlepower each, spaced as above, would cost about $11,500 per mile per annum to illuminate.

"This estimate includes the entire investment, lamp renewals, maintenance and current."

Death of William A. Hovey.

William Alfred Hovey, special agent for the American Bell Telephone Company, died on February 18th at the home of his daughter, Mrs. Edwin S. Webster, in Boston. Mr. Hovey was born in Boston and graduated from the Boston High School in 1860. After a trip to Europe he became associated with the Sanitary Commission, continuing with that body until 1865, and becoming tenth assistant secretary. He then studied mining and became engineer and superintendent of coal mines in Pennsylvania. Three years later he started a weekly newspaper in Chelsea, Mass., but this was not a financial success.

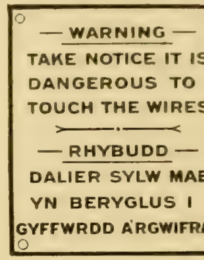
In 1872 Mr. Hovey became managing editor of the Boston Commercial Bulletin, going from there to the editorship of the Boston Transcript in 1875. He left the latter paper in 1881, when he established the Manufacturers' Gazette. Later he became president of the Merchants' Electric Light and Power Company of Boston. In April, 1884, he became an editor of the Electrical Review, and in June, 1885, he accepted a position with the American Bell Telephone Company. He superintended the preparation of that company's exhibit at the Chicago World's Fair and was in charge of the exhibit during the fair. His wife died 10 years ago. He left a son and two daughters.

Funeral services were held at his daughter's residence, with interment at Mount Auburn Cemetery. The pallbearers included Thomas B. Doolittle, as representative of the American Telephone and Telegraph Company. The company was further represented at the funeral by Thomas E. Sherwin, C. J. H. Woodbury, S. Howard Mildram, L. F. Rice, Jeffries Wyman and James C. T. Baldwin.

A stock company has been formed at New London, Ind., which proposes to construct a dam in Honey Creek and establish an electric plant to furnish light and power to towns and farms in the vicinity. The dam will form a large lake among the hills and the company proposes to develop a summer resort on the lake.

Power Transmission in Wales.

[illegible]



HOW IT LOOKS IN WELSH.

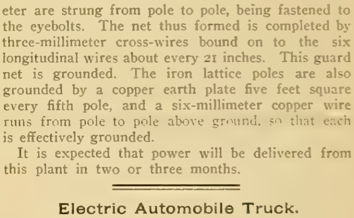
miles long and dropping 1,150 feet to a power house, where Pelton wheels (made by Ganz & Co. of Budapest) drive four 1,500-kilovolt-ampere three-phase 10,000-volt generators. The transmission lines are substantially built over a rugged country. Most of the poles are wooden, but in some places a light iron lattice-work construction has been preferred. Where six or nine transmission wires are carried double poles are used.

The safety precautions should be effectual. All the poles on a roadway or footway have a ring of galvanized iron with sharp points about 12 feet six inches from the ground, and a danger-sign board (see cut) bearing an inscription both in English and Welsh is fixed to them. In such positions also a guard net is provided. A simple piece of channel iron is fixed to each pole with a clip, and six galvanized mild-steel wires five millimeters in diameter are strung from pole to pole, being fastened to the eyebolts. The net thus formed is completed by three-millimeter cross-wires bound on to the six longitudinal wires about every 21 inches. This guard net is grounded. The iron lattice poles are also grounded by a copper earth plate five feet square every fifth pole, and a six-millimeter copper wire runs from pole to pole above ground, so that each is effectively grounded.

It is expected that power will be delivered from this plant in two or three months.

Electric Automobile Truck.

A serviceable and at the same time neat-appearing electric automobile truck is shown in the accompanying illustration. It is a product of the Studebaker Automobile Company of South Bend, Ind. The vehicle has a capacity of 3½ tons. The



STUDEBAKER 3½-TON ELECTRIC TRUCK.

gauge is five feet 11 inches, with a wheel base of 10 feet 10 inches; the wheels themselves have a diameter of three feet. Following are the general dimensions of the truck: Length of body, 16 feet; length over all, 17 feet six inches; width of body, five feet two inches; width over all, seven feet six inches; width of seat, four feet two inches; height of floor from ground, three feet six inches. The weight of the vehicle complete is 9,000 pounds.

Large Waterpower Developments Near Utica, N. Y.

Extensive power developments are contemplated by the Utica Gas and Electric Company of Utica, N. Y., and in consequence of the plans the capital stock of the company has been increased until it is now $3,500,000. It is the intention of the company immediately to develope to their fullest capacity the waterpowers owned by it at Trenton Falls and Prospect, giving the company at these two stations, on a very conservative estimate, a total of 22,000 horsepower, even in seasons of the greatest drouth.

West Canada Creek, in a distance of 3½ miles upstream from the present Trenton Falls power house, has a fall of 400 feet. The plant at Trenton Falls now in operation utilizes but 266 feet of this head. The immediate extensions planned will make use of the remainder of the power, and to do it a new dam and power house will be located about a mile above the Trenton Falls plant. Here the conditions are ideal, for the stream at the point selected for these structures is confined to a narrow gorge through the limestone rock, 90 feet in depth, the walls on either side being almost vertical, and considerably less than 100 feet distant from each other. All the material necessary for the erection of the dam and power house, with the exception of cement, are within almost arm's length of the location.

The company also owns another waterpower and a large tract of land at Enos on the Black River, eight miles across country from Prospect. This waterpower has a fall of 125 feet, and at minimum flow will give, it is estimated, at least 3,000 horsepower.

The capacity of the several stations as planned will be as follows: Trenton Falls, 16,000 horsepower; Prospect station, 7,000 horsepower; station at Enos on the Black River, 3,000 horsepower. The plans for the Prospect station and dam have been entirely completed. This station will be a model waterpower plant in every way, and in its equipment fully equal to the present plant at Trenton Falls, which has proved so satisfactory in its operation.

Among the strongest features of this 25,000-horsepower development will be its availability and reliability. The present transmission line from Trenton Falls to the company's distributing stations in Utica is but 12 miles in length. Another line will be built paralleling and duplicating the present line from Trenton Falls to Utica, on the present right-of-way owned by the company. The company has just completed a transmission line up the Mohawk Valley from Utica to Rome, and another transmission line will be built across country direct from Trenton Falls to Rome, passing through Holland Patent and Stittville. Eastward, the construction of a transmission line to Frankfort, Ilion, Mohawk, Herkimer and Little Falls will be begun at once.

Electrically Operated Tunnel Excavator.

Mr. George W. Jackson, chief engineer and general manager of the Illinois Tunnel Company, Chicago, has devised a new electrically operated machine which, it is expected, will fulfill the exacting conditions presented in the construction of the tunnels under Chicago, for which work the machine was primarily designed. The machine has not yet been built for practical use, but a model has been constructed which exhibits its essential features.

The excavator consists of a heavy movable base adapted to be pushed ahead through the narrow bore as the work progresses. Mounted on this base is a revoluble platform which allows the excavator to be swung in a horizontal plane and brought against the soil equally well at the center or sides of the tunnel. This platform is operated by gears controlled by the operator. The excavator proper consists of four arms carrying loop-shaped knives on their extremities which are attached to a revolving axle and project out in front of the machine. The axle is carried on a frame which is movable up and down in a vertical plane, and is also controlled by gears. The horizontal and vertical movements of the excavator allow the knives to cut into any part of the tunnel face.

Motion is given to the knives by a worm gear driven by the shaft of an electric motor carried on the machine and controlled by a clutch operated by a lever at the rear platform on which the operator stands. A motor of three or four horsepower will be all that is necessary to operate the machine. The dirt as it falls from the knives will be taken by a motor-driven conveyor and carried back to cars in the rear of the excavator.

A great amount of hand labor has been done so far in the excavation of the tunnels, as their small size do not permit of the use of any other power than electricity or compressed air, and the latter is not practicable for the operation of such a machine. By the use of this excavator, however, power can easily be brought to the apparatus, even through air-locks, where they are necessary, and the whole contrivance may be easily operated by one man who has control of all its movements from the plantform on which he stands.

Telephone Engineering.[1]

By J. J. Carty.

Part I.

Engineering may broadly be divided into two classes—civil and military. Military engineering is that which pertains to the conduct of war and is sufficiently understood to require no description. Civil engineering, as I am now using the term, comprehends all forms of engineering which are conducted without special reference to the operations of war. Falling within this definition of civil engineering we have electrical engineering, mechanical engineering, telegraph engineering, telephone engineering, and some others. As taught in colleges, however, and as generally understood, civil engineering is restricted and deals more especially with that branch of the art which pertains to the construction of bridges, waterworks, railroads, harbor improvements, and other public works of like character.

Inasmuch as the telephone is an electrical instrument, and inasmuch as electrical phenomena exert a dominating influence in the telephone art, telephone engineering is classed as a branch of electrical engineering, although it will be shown as I proceed that telephone engineering comprehends important elements not at all electrical in their character; indeed, it is a recognition of the existence of these elements and a knowledge of how to deal with them adequately which constitutes one of the important requirements of telephone engineering. A good knowledge of electrical laws and a fair acquaintance with electrical machinery may be gained in our electrical schools; and graduates from them are, as a rule, proficient in these matters.

Telephone engineering comprehends not only these, but other factors, the existence of which is not generally recognized. In this paper I shall, owing to the limitations of the time at my disposal tonight, attempt to explain the nature of only some of these factors, indicating their most important bearing upon the general subject. From your own knowledge you will be able to supply many more instances, illustrating perhaps better than those which I have chosen, the ideas which I wish to make plain.

To describe the proper scope of telephone engineering in its relation to the telephone industry is to consider the function of the telephone engineer. Not so many years ago it was thought that the functions of the telephone engineer consisted of doing little more than to provide and install switchboards. He was supposed to be consulted occasionally about the station apparatus, and later, when cables were introduced, his activities were extended so as to include the testing of cable after it had been bought and laid.

At the time of which I speak, telephone companies took almost an exclusively switchboard view of the telephone business. A building would be selected by someone connected with the company and the engineer would be consulted principally as to the selection of the switchboard and the placing of it in position. The size and location of the building, its relation to the existing and probable future subscribers, and all of the vast number of other factors now considered so vital in determining such matters, received but scant consideration. So it was with cables; whether the cable should contain wires of No. 22, No. 19, or No. 16 gauge; whether the insulation should be of cotton, rubber or gutta percha—these were questions which were as likely to be settled by the purchasing agent as by the engineer.

To one acquainted with the conditions of those times this is not at all surprising, because the telephone engineer of that period shared with all the rest of the world the prevailing ignorance concerning matters which have since been proved by laborious investigations to be governed by well-established laws, the nature of which was then unknown.

The proper status of telephone engineering and the true scope of the functions of the telephone engineer differ as greatly from this primitive view as does the modern telephone system differ from that which obtained in the period about which I have just spoken.

I shall endeavor to give a correct view of the true scope of telephone engineering, and to do so I shall broadly discuss a typical problem in telephone management, illustrating the various points I wish to make by reference to certain details which will be considered in connection with the problem chosen.

Let us take the case of New York city, with the suburban territory tributary to it, and assume that it is the intention of the telephone company to install within that territory a telephone system which will work at a proper degree of efficiency and at the same time yield to the investor a fair return upon his investment; and that it is necessary not only that this condition should exist during the first stages of the project, but that the undertaking should be so managed that this condition will be maintained indefinitely. With such a problem before the telephone management, what part of it should the management require the telephone engineer to work out? I shall answer this question by describing, in general terms, and sometimes, for the purposes of illustration, in considerable detail, what should be the work of the telephone engineer, in such a case.

The first question which the engineer must decide is, What is the period for which such construction as may be required should be planned? This is a question of far-reaching importance and requires for its answer that a vast amount of data should be collected, and that careful and long-continued study and investigation should be given to a large number of factors involving, among other things, first cost and character of construction of the diverse portions of a plant of such complicated nature, annual charges such as maintenance, depreciation and interest, and local conditions bearing upon the possibility of the renewal or extension at some future time of all of the elements of the plant.

In addition to this, due regard must be paid to possible changes in the art and also the fact that, owing to the exigencies of the business, many cases arise where it is necessary to carry out at the beginning, especially in underground work, all of the construction which may ever be needed.

At the outset the question of the period for which to plan depends upon the expectations of growth. With a given expectation of growth, the engineer, by taking into account all of the factors of the case, and balancing the annual charges resulting from the initial investment against the cost of reconstruction and rearrangement of the plant at some future time, arrives at the economical period for which to plan.

In this work the predictions as to growth are of the first importance, and, inasmuch as accurate predictions of this kind are attended with the greatest difficulty, it is essential that not only the judgment of the engineer, but that of the business management and all others who might be able to advise in connection with the matter, should be obtained.

At this stage of the work it is of the utmost importance that the bearing of these estimates of growth upon the future of the plant should be thoroughly understood by the business management, whose functions, in the nature of the case, exercise such a profound effect upon the extent and character of such growth. It is the duty of the engineer to make this point clear and to obtain from the business management serious and responsible estimates of future growth.

The number of lines which may be expected having been agreed upon, the question of for how long a period ahead we should plan is determined by a number of circumstances. For such conditions as obtain at New York, the period for much of the construction has been found to be from 17 to 20 years. This figure is arrived at by taking into account a large number of factors, such as life of the central-office switchboard, which is placed at about 15 years, the relative costs of placing in the subways a large number of ducts initially as compared with adding new ducts after a period of about 20 years, the uncertainty regarding the changes in the state of the art, and the difficulty of foretelling with sufficient detail conditions which are expected to obtain during a period so far ahead as 20 years.

In the case chosen for illustration, which was New York, the economical period was found to be about 20 years, and it was attempted to plan for conditions which would obtain in the year 1920 and for each year up to that date. The total number of lines to be provided for in the island of Manhattan is 300,000. The working out of the general plans for providing for this number of lines, which it was expected would be reached by the year 1920, constitutes what is known as the "300,000-line study." To give an idea of the nature of part of the work of the telephone engineer, I shall outline in general terms the character of this study.

Having determined upon 300,000 lines as the proper foundation of the study, and having received the proper authorization from the business management to proceed on that basis, the next step is to plot on a map the probable distribution of these lines. This is done, not by giving the location of each line, but by indicating by blocks the most probable distribution. Here again the judgment of the engineer must be assisted and directed by the business management, for next in importance to determining the total number of lines to be provided for comes the question of their distribution.

The number and distribution of lines having been agreed upon, the next step is to determine the number and arrangement of central-office districts, the size and boundaries of these districts and the size and location of the central-office switchboards.

It is conceivable, although obviously impracticable, that all of the 300,000 lines might be extended to one central office and operated in switchboards there; it is only necessary to state such a proposition to exclude it from further consideration. On the other hand, it is conceivable that a central office might be established in each block; this also is absurd and needs no further consideration. Somewhere between these two extremes must lie the most economical size and number of central offices. The next stage in the problem is to determine this number; to do this no formula, simple or otherwise, is available. The only practicable method is to lay out the territory to be served, in accordance with a number of different arrange-

1. A paper presented at the meeting of the American Institute of Electrical Engineers in New York, February 23, 1906. The author is chief engineer of the New York Telephone Company.

ments of districts and centers, starting, say with 10 centers and extending the study up to as many as 30 or 40, or even more. In the case of all these arrangements there would be certain elements of cost which would not be changed by the different arrangements of central offices assumed. Block wiring and station instruments are examples of these. These elements of cost are omitted from the comparison. All of the items of cost, however, which vary with the different number and arrangement of central offices are computed, all of these being reduced to annual charges.

From these figures, as applied to the various layouts, the number of central offices and the districts which are ideally most economical may be seen. I say ideally most economical for the reason that the practical application of such results requires that a difficult and very complicated adjustment of the existing plant, to conform as nearly as possible to the ideal condition, must be carried out.

While it must appear, even from the brief statement of the steps of the study thus far described, that a vast amount of labor and computation are involved, it by no means represents all that must be done. Before there can be made a comparison of the relative economies of the various groups of offices, a series of studies within studies must be carried out upon many other important elements of the problem.

The first of these is the switchboard study. Before the switchboard study can be made, general methods of operating must be agreed upon; such as the method of handling toll business; whether it shall be done wholly upon a toll board or partly upon a toll board and partly direct from "A" positions; whether it shall be done wholly upon a "two-number" basis or substantially upon a "particular-party" basis. The best method of handling local business must be determined. It must be decided whether the business shall be upon call wires or otherwise; what shall be the capacity of the call wire; what shall be the load which will be assigned to various operators in the system, this in turn being dependent, among other things, upon the character of the service which it is thought necessary to render.

Having agreed upon these and other fundamental data, the question of the best type of switchboard, whether it shall be full multiple or partial multiple, whether it shall be of the transfer type or otherwise, must be settled. The limit, so far as size is concerned, of the multiple board, or any other type which may be considered, must be determined. Also there must be settled a very large number of questions cropping out at every point involving maintenance and operating expenses and methods. All of these factors having been duly weighed, the maximum size and type of switchboard is agreed upon.

The switchboard determinations having been made, the type of cable to be employed must be settled upon. Here again a series of studies is necessary. Of first importance in the cable study is the determination of the standard of transmission which is to be employed, not only for talk between offices within a zone such as Manhattan Island, but also the standard of transmission which it is necessary to maintain between Manhattan Island and the suburbs and between various points in the suburbs passing through Manhattan, and to long-distant points. The importance of this determination will appear when we consider the standard already adopted as the Manhattan standard, which is, assuming the use of the present common-battery apparatus, that the cable employed in Manhattan shall at all times be such that it will give in the worst case a talk as good as could be obtained between two central offices joined by a trunk cable of 10 miles of the standard type having the No. 19 gauge conductors, with a mutual capacity of 0.07. If this standard were lowered so as to employ the use of No. 22 gauge cable instead of No. 19, it would permit the use of a trunk cable costing half as much as that required by the present standard, thus reducing the number of ducts required, and in that way profoundly affecting the results of the study.

In considering the type of cable employed, not only must the standard of transmission be borne in mind, but in determining upon the specifications for the various types of cable needed a long series of special studies is required. These are conducted with a view to determining upon that form of construction in each case which will give the highest standard of transmission and at the same time preserve the best mechanical conditions needed for hauling in and out of the duct, and also be so constructed electrically and mechanically as to require a minimum of attention from the maintenance point of view. Not only must the various types of cable be carefully fixed upon when considered strictly from the cable point of view, but where suburban and long-distance circuits are to be considered the problem of loading cables presents itself. This involves so much work and study that to give even a brief outline of what it involves would require a paper which itself would extend far beyond the limits of the time allotted for this very general statement of the case.

The general features of the study having been determined upon and the time having arrived to erect a given central office at a center previously located, the question of obtaining the necessary real estate and erecting the central office building [illegible] nomical land to purchase.

In other words, before even the land is bought a study must be made of a telephone building as might be erected upon it. [illegible] every case many different properties [illegible] sidered, studies for several different buildings must be carried out before the best combination can be determined. After these matters have been decided upon, the details of construction of the building must be further studied. This, as can readily be understood, naturally involves a vast amount of engineering work.

Thus far I have hastily sketched the outlines of a telephone development study as it is more particularly concerned with the local plant, but as the local plant must be, as time goes on, more and more intimately connected with neighboring plants in the suburbs, and with more distant plants reached by long-distance wires, most careful study must be given to the best methods of establishing proper relations with those plants.

Without attempting to outline in any detail the nature and extent of the work involved in the methods employed in making a suburban toll line study, and without going at all into the questions of methods of establishing the service to long-distance points, I will say that, considering the broad features of these various classes of conditions, it has been found best, in the particular case which I have taken for my example, to divide the telephone business into three classes—local, suburban and long-distance.

In determining what shall constitute the local class the engineer finds himself engaged in a problem of great magnitude which primarily concerns the business management and which is affected by important public and economic considerations as well as by engineering factors and methods. If the local zone is made too extensive it greatly increases the magnitude of the trunk-line plant from which no toll revenue can be derived. This fact reacts upon the rates in such a manner as to make it impossible to give as low a station rate as might otherwise be the case. This tends to restrict the growth of stations, and hence will act as a check upon the growth of the business at large.

The local zones having been determined upon, it must next be decided what shall be the limits of the suburban business and what shall be classed as long-distance business. Without attempting to explain the various points necessary to be taken into account in determining these questions, I will say that they involve not only those physical factors ordinarily considered to constitute engineering, but that they involve the methods of calling which may be permissible on the part of the subscriber, the entire system of toll rates which may be adopted by the telephone company, the question of whether the subscribers' names and numbers should be listed or not, and other questions of this nature.

When I review the outline of the methods and magnitude of a telephone-development study, such as I have here briefly sketched, I am not surprised that some who superficially consider the subject are inclined to doubt the value of results obtained in this way. This feeling is strengthened when they consider the nature of some of the fundamental data upon which all of the work rests. For instance, unless there is made a fairly correct forecast of the probable growth of subscribers' lines for a period of 15 or 20 years in advance, it is clear that substantial errors will be made; but, more than this, it is necessary not only to forecast the total number of lines expected, but their location must be determined within close limits. But this is by no means all. Not only must the location of the lines be decided upon, but the number of calls per day which may be expected over each line must be estimated; not only must the number of calls which are expected be correctly determined, but the time of the day during which these calls may be expected must be arrived at in some manner. Even more than this must be done, because it is necessary not only to know all of these facts, but also it must be known where the calls are to go. We must also know what proportion of these are likely to be toll calls, what proportion long-distance calls, and various other factors of like nature must be determined.

There can be no doubt that telephone development, as thus viewed, and as correctly viewed, presents abundant opportunities for errors, and that such errors must lead to expenditures of large sums of money, which, if infallible data were obtained, would not be required.

But conceding all this, what is the alternative method which we can follow? If we are to aban- [illegible] which [illegible] consequently dealt with. But in determining upon the size of the switchboard and its construction, whether we realize it or not, a definite, though unwitting, answer is made to the questions of what shall be the rate of calling, what shall be the destination of the calls, what shall be their character, and at what time they shall occur. The switchboard and building must be planned for some set of conditions, which can be established only by data of this character. Merely ignoring these questions and erecting the switchboard and arranging central offices without making a study does not avoid answering the questions, for by the construction carried out a direct and unequivocal answer to all of these questions is made, yet without giving consideration to any of them or even recognizing their existence.

So it is with subway construction. It is easy enough, after central offices have been located, to plan for a subway joining those offices, but somebody must answer the question of how many ducts shall be provided in this subway. This can be done by the method outlined in describing the study, or it can be determined at the time by somebody who is opening the streets. It may be done, on the one hand, by engineers after careful study, with all the facts before them, and after having analyzed the statistics of the past, and having exhausted all possible methods of throwing light upon the subject; or it may be done by a man in the street with a pickax. Those who would follow the pickax method would not avoid questions which the engineer has recognized and has undertaken to answer. They would, by the number of ducts they would put down and by the character and magnitude of the other construction, give their answer to all of these questions without having considered any of them. As to which of these two methods should be followed the telephone company must decide.

Thus far in my outline of that part of the telephone engineer's duties which pertain to development studies I have dealt more particularly with the physical features of the work. Ordinarily, engineering has to do principally, if not exclusively, with physical factors, but telephone engineering has not only to deal with physical factors of the utmost complexity, but it has also to deal with commercial questions which, of themselves, would seem to be only remotely connected with the work of the telephone engineer, but which really vitally affect it. Telephone engineering presents more factors of this nature than, I think, are to be found in many other branches. Take the case of a civil engineer who has before him the problem of constructing a masonry dam. This presents an instance involving solely physical factors. The stability of the dam or its capabilities of impounding the necessary amount of water are in no way affected by any action which the board of directors of the waterworks company may take with reference to its dealings with their customers.

It is not so with telephone engineering, for, as I will presently show, a telephone toll line and switchboard system might be designed in accordance with the highest state of the art and constructed so as to give the best efficiency, and yet by the action of the business management, causing the adoption of what might seem to be a reasonable commercial practice, the operativeness of the switchboard system might be totally destroyed. This idea will be readily comprehended when we consider what would happen to the present toll board at Cortlandt Street, operating on the recording basis, using the two-number method of calling, if, by some change in business plans, the particular-party method in use extensively in many

other localities were adopted. Only a brief consideration of this case is required to show that, in addition to the present recording operator, a second set of operators would have to be employed, who would be required to call up the subscriber desiring the toll connection and obtain from him the details of his call. The adoption of such a method, while in itself a wasteful and inefficient one, would in the case I have chosen require the radical reconstruction of our entire tollboard plant. More than this, the adoption of such a method would render it impracticable to follow the direct-line trunking method which is now possible by the use of the two-number plan of calling. The abandonment of this method would require such toll lines be handled from tollboards. The magnitude of the revolution which this would make in the engineer's plans will be seen when I say that whereas, by the two-number method, one tollboard occupying one floor of the Cortlandt Street exchange is sufficient, there would be required, if the particular-party method were employed exclusively, as many as five or six tollboards occupying five or six floors in the Cortlandt Street building, and requiring five or six times as many operators for their working. This is one of the best examples which could be given as showing the peculiar relation which obtains between telephone engineering and the business management of telephone companies.

[*To be concluded.*]

Speech Reporting by Televant.

At the office of the Grand Rapids (Mich.) Herald recently reporters were enabled to take down in full the speech of Secretary of War Taft, who spoke before the Chamber of Commerce at Detroit, 195 miles away. This was made possible by the use of the "televant," provided by the Michigan State Telephone Company. Two transmitters were placed within 15 feet of the speaker's table in Detroit, and the words of the speaker were far more clear in Grand Rapids, it is said, than to listeners at the farther tables in the hall where they were actually delivered. Before the speech of Secretary Taft the reporters listened to the entire programme of the Temple Theater in Detroit, hearing the music perfectly.

The "televant" is a supersensitive telephone transmitter. The idea of using it for the transmission of speeches, music and other sounds over a long distance is ascribed to James F. Land of Detroit, general manager of the Michigan State Telephone Company. The transmitter is smaller than the one in commercial use. It lies pointing toward the ceiling and responds to sound vibrations from any part of the room, although it is generally placed near the speaker. At the banquet of the Chamber of Commerce in Detroit, the transmitters, two in number, were hidden in a bower of foliage, about 15 feet in front of the speakers. The receivers in Grand Rapids did not differ from the ordinary type.

With an instrument capable of reproducing the vibrations of the human voice, difficulty is experienced, it is said, in reproducing music. The great difference in the volume of sound makes it necessary to have two transmitters, one for music and one for the voice. These are used as necessary and are switched on or off by an attendant at the central office. The telephonic impulses from Detroit were carried to Grand Rapids over a trunk line of No. 8 copper wire, weighing 340 pounds to the mile.

NEW COMPANIES.

The Cushing (Okla.) Telephone Company has been incorporated with a capital of $2,000 by W. W. Oder and others.

C. A. Townsend and associates of Page, Neb., have incorporated as the Page Telephone Company. The capital is $10,000.

The Bryson City (N. C.) Telephone Company has been incorporated with a capital stock of $5,000 by R. L. Sandridge and others.

Adam Brendle is interested in the Hickman Telephone Company of Hickman, Neb., which has been incorporated with a capital of $6,000.

The Farmers Telephone Company of Clatonia, Neb., has been incorporated with a capital stock of $2,400. W. B. Syker and associates are the incorporators.

The York-Troy Telephone Company has been incorporated at Lily, S. D., with a capital of $1,750. The incorporators are R. P. Korgard, M. A. Hanson, A. Knoble and others.

The following-named telephone companies have recently been incorporated in Kansas: Assaria Telephone Company of Assaria, Bunker Hill Telephone Company of Bunker Hill, and the Benton Telephone Company of Benton.

C. A. Fobes, manager of the Minnesota Central Telephone Company at Long Prairie, Minn., has been transferred to the management of the Springfield (Minn.) office of the company. Mr. McKenzie of Sleepy Eye will go to Long Prairie.

Indiana Telephone Items.

The City Council of Princeton has ordered the Princeton Independent Telephone Company to remove all poles and lines from the streets and alleys of the city within 60 days. The complaint against the company is that it has wilfully violated the provisions of its franchise by the failure to paint its poles and to furnish telephones for the city officials.

The Arlington Telephone Company, doing business in Arlington and Rush County, has ordered plans for the erection of a new exchange building.

The Central Union Telephone Company has entered upon the work of extensive improvements at Columbus. O. M. May, resident manager, says the work will commence in a few weeks. If a new exchange building is not erected, the present building will be thoroughly remodeled.

The Central Union Telephone Company announces that its plants at Greensburg, Connersville, Richmond and Muncie will be rebuilt this year.

The Central Union Telephone Company is erecting two branch exchanges in Indianapolis, one near Fountain Square on the South Side, and the other at Eighteenth and Rural streets, on the North Side. The company already has three branches of its main exchange on Ohio Street.

The Illinois Central Railway Company is stretching copper wire along the tracks of the Indianapolis and Southern, a new railroad about completed in Indiana. A complete duplicate telegraph and telephone service is being installed along the entire line.

A farmer near Bedford seeing his neighbor's house on fire, called his neighbor, and the ringing of the telephone bell is all that awakened the family and enabled it to escape.

A meeting of the directors of the Indianapolis Telephone Company will be held in Indianapolis next week. Several important questions will be brought up, among them the application for a new franchise with a provision permitting the company to increase its rates. This application is likely to precipitate a vigorous agitation by the citizens, since it has already been conducive to many wild rumors. A. L. Tetu of Nashville, Tenn., will remove to Indianapolis, to take up his duties as general manager.

The Scott Creek Telephone Company, capitalized at $3,000, has incorporated to build an exchange and telephone system in Scott Creek and Johnson County. The incorporators are George T. Shuck, R. W. Parkhurst and B. F. Cole.

The Peru Common-battery Lock-out Telephone Company has incorporated with the view of establishing a manufacturing plant in Peru to manufacture and sell a device for a common-battery lock-out telephone patented by Marke P. Boone. The capital stock is $7,000. The incorporators are Jerome Herff, L. B. Fulwiler, Marke P. Boone, E. H. Griswold and Joseph Andres. S.

Telephone News from the Northwest.

The Waseca Telephone Company of Waseca, Minn., expects to make extensive improvements and extensions to its system during the coming season.

The North Side exchange of the Northwestern Telephone Exchange Company in Minneapolis will have a new building erected during the summer, contracts for which have been placed.

The York-Troy Telephone Company has been incorporated at Lilly, S. D., with $1,750 capital.

The Northwestern Telephone Exchange Company has bought a site in Jamestown, N. D., and will erect thereon a fireproof telephone-exchange building.

The Fox River Valley Telephone and Telegraph Company of Green Bay, Wis., has arranged to build 75 miles of toll-line extensions the coming season.

The Grant County Telephone Company will install a central-energy system for the city exchange at Milbank, S. D.

A. T. Averil and G. M. Averil, both of Cedar Rapids, Iowa, have purchased one-half of the $46,000 worth of stock in the Johnson County Telephone Company. A. T. Averil becomes president and J. Chatham secretary-treasurer.

The annual meeting of the Northeastern Iowa Independent Telephone Association was held at Vinton on February 13th.

Ohio Telephone Notes.

Several Toledo telephone men held a conference with the officers of the Cuyahoga Telephone Company in Cleveland last week relative to the purchase of additional stock of that company. This syndicate some time ago purchased a block of the stock. Little has been made public regarding the conference, so it is not known whether the Toledo men desire to secure a controlling interest in the company or not.

The Cincinnati and Suburban Bell Telephone Company has received a large number of answers to its inquiry as to whether subscribers want two telephone systems in the city. It is said that most of them answered in the negative, but many of them stated that they desire a lower rate. The company has just announced quite a material reduction in rates on measured service and advertised the fact in half-page space in the Cincinnati daily papers.

The strike of the linemen and other electrical workers of the Cuyahoga Telephone Company has been settled by an increase in the wages from $2.50 to $2.85 a day, but without participation in the profit-sharing as has been the case formerly.

A hearing on the Independent telephone matter was had before the council committee on telephones and telegraphs at Cincinnati a few days ago, but nothing definite was done. Some of the companies presented letters from business men in different cities, where the Independents are operating, showing that rates had been reduced. The Queen City Home Telephone Company presented an outline showing the extent of its business. C.

Telephone Rate Agitation in Chicago.

Negotiations between the Chicago Council committee on gas, oil and electric light and the Chicago Telephone Company, following the Illinois Supreme Court decision referred to in the Western Electrician last week, have not yet developed anything definite, although the newspapers have printed columns to show that the present rates and service are unsatisfactory and that the company must be forced to make substantial concessions while it is on the defensive. President Arthur D. Wheeler of the Chicago Telephone Company has just returned from a trip to Mexico. His return may hasten some definite action as to the lower-rate agitation.

There are rumors that various other companies or projected companies are seeking to take advantage of the situation by offering to supply telephone service in Chicago at low rates. One of these, mentioned by Mayor Dunne, who is zealously advocating lower telephone rates, is the Wapaul Electric Company. The United States Telephone Company has been mentioned also. In relation to this report a Cleveland correspondent writes:

"So far as can be ascertained at Cleveland, no action has been taken by the United States Telephone Company to secure an entrance into Chicago, although it has for a long time been the intention of the management to build a trunk line into that city when the proper time comes. Likewise it has been planned by telephone men in St. Louis, Indianapolis, Minneapolis, the Iowa promoters and others to secure connections with that city. All the Independent companies would probably go into the city on one pole line or at least one right-of-way when the project is ripe. With the rapid development that is now taking place the time is not far distant when it will be necessary for the various lines to make connections in Chicago in order to secure a satisfactory interchange of business.

"James B. Hoge, president of the National-Interstate Telephone Association, says that it has always been the policy of the long-distance companies to wait for local men to install exchanges in the various cities and that they have expected a move of some kind in that direction at Chicago. It has been rather slow in coming, however. It has been the idea all along that the Automatic company would make arrangements whereby satisfactory connection with the city might be made, but it seems that nothing has yet been done. Independent men, or some of them at least, still feel that this will be the plan of entry, but others have different ideas."

The automatic telephone service referred to is that of the Illinois Tunnel Company. It serves only the central business district and has no out-of-town connections, it is believed.

Cumberland Company Gets Telephone Franchise in Evansville.

By a vote of 7 to 3, the grant of a franchise by the Board of Public Works to the Cumberland Telephone Company (Bell) was ratified last week by the City Council of Evansville, Ind. Nearly four hours were given to the discussion by citizens and members of the council who advocated and who opposed the franchise. This proceeding ends a dozen years of contention and litigation. The company will immediately pay into the treasury over $12,000 as back compensation, and three per cent. of the gross receipts will go to the city every year. Subscribers who are now paying $1 a month will continue to pay that rate. On four-party lines the charge will be $1.50. Exclusive business lines are reduced from $5.50 to $5 a month. The franchise is said to have advantages for the city, and it is approved, it is said, by a majority of the people. The Independents are still pressing their claims for a franchise, and it is thought that they will ultimately succeed.

Bell Output for January.

The American Telephone and Telegraph Company reports for the month of January, 1906, as follows: Gross output, 176,607, against 130,634 for the corresponding month in 1905; 90,644 in 1904, and 129,837 in 1903; returned, 63,224, against 37,700 last year, 36,854 in 1904, and 43,286 in 1903; net output, 113,383, against 92,934 last year, 53,790 in 1904, and 86,551 in 1903; outstanding January 31, 5,811,641, against 4,573,498 last year, 3,833,307 in 1904, and 3,236,871 in 1903.

GENERAL TELEPHONE NEWS

Stephens, Ark., has granted a telephone franchise to Lewis Brothers.

Frank M. Smith has been granted a franchise for an Independent telephone system in Wymore, Neb.

The capital stock of the Nebraska Telephone Company of Omaha, Neb., has been increased from $3,000,000 to $5,000,000.

The Southern Bell Telephone Company has opened a new exchange at Jonesville, S. C. A system is also being started up at Cowpens, S. C., which is ready for use about this date.

The Atlanta (Ga.) Telegraph and Telephone Company is undertaking the work of building a number of lines to nearby towns, in order to give a complete service to all of these points.

At a meeting in Green Bay, Wis., the directors of the Fox River Valley Telephone and Telegraph Company decided to build 75 miles of toll lines. W. E. Fairfield is president of the company.

The New England Telephone and Telegraph Company is about to erect a brick and stone building 30 by 100 feet on Mechanic Street in Worcester, Mass. The design of the building will be the same as that of the exchange on Commercial Street.

This newspaper "ad" makes a good point in a convincing way: "Telegraph by telephone! Call up the Western Union, or the Postal, and give them your message. They will charge it to your telephone number. Your credit's good if you have a telephone. Now, isn't that a convenience? Yet it's only one of the many a telephone makes possible."

The important decision to increase the capital of the Bell Telephone Company of Canada from $10,000,000 to $50,000,000 was reached at the annual meeting of the shareholders held in Montreal on February 22d. C. F. Sise, the president, stated that it was not the intention of the company to issue all of the increased capital at once. A decision was also reached to increase the number of the board of directors by three, securing representatives from different parts of the country, one being from Manitoba. The report shows that 12,035 subscribers have been added during the year, the total numbers of sets of instruments now earning rental being 78,195.

MANUFACTURERS AND DEALERS.

The Century Telephone Construction Company of Buffalo, N. Y., is sending out a sample of an attractive celluloid long-distance telephone marker which it has been using to good advantage in advertising Independent telephone service. The celluloid sheet is mounted on the transmitter of the telephone, being held in place by the mouthpiece. The company will be pleased to furnish a sample to anyone interested.

Telephones and accessories are presented in an attractive manner in bulletin 39 of the Sumter Telephone Manufacturing Company of Sumter, S. C. A type of instrument which is original in design is shown in the bulletin, which is called the New Beauty telephone. Besides the instruments themselves the standard parts, such as transmitters, receivers, generators, etc., are given attention in detail. Under "Information of Interest" there appear some very good practical hints as to the installation of telephones which may be carefully read with profit.

Under date of February 23d the following announcement comes from the Automatic Time Stamp Company of Boston: "In the case of the Calculagraph Company of New York against John C. Wilson, which was a suit brought under the patents of Hamilton and Abbott to enjoin the Automatic Time Stamp Company from making or selling an instrument known as the timeometer, used on telephone toll-line switchboards to record the time the toll line is in use by a customer, the United States Circuit Court of Appeals, in an elaborate opinion by Judge Colt, has reversed the decision of Judge Hale of the United States District Court and has remanded the case to the Circuit Court, with directions to dismiss the bill of the Calculagraph Company, with costs, in the Circuit Court and in the Court of Appeals. Judge Hale had also found the defendant in contempt for making another machine for the same purpose, known as the duragraph, and this decision of the Court of Appeals acts to void this finding also."

The report of the third annual convention of the American Railway Mechanical and Electrical Association has been published, and it is a creditable piece of work. As the frontispiece, there is a picture of Mr. C. F. Baker, who was president during 1904-5. Besides the report of the proceedings of the convention in Philadelphia, which is complete, with papers and discussions, there is given a complete list of the members of the society. Announcement is made on the second page that the name of the association has been changed to the Street and Interurban Railway Engineering Association.

CORRESPONDENCE.

Great Britain.

London, February 14.—A new system of [illegible] way permanent way construction [illegible] attention here just now. [illegible] in anticipation of renewal, [illegible] in view the [illegible] are constructed in [illegible]. One portion consists of a [illegible] which is laid permanently, and on the top of [illegible] is laid the ordinary grooved [illegible] tongue project downward and which [illegible] of special machinery are bent [illegible] the under side of the girder [illegible] portion of the rail [illegible] about nine inches of the roadway on either side of the tracks. The adhesion of the two portions of rail is such that a test has shown it to be as high as 23 tons. The machinery used in the operations of laying and removing the track is propelled by steam and resembles a sort of traction engine, and as much as 10 feet per minute can be laid. Already the system has been used in Leeds.

The question of higher technical education is still being much discussed here and the final report of a departmental committee which inquired into the working of the Royal College of Science and the Royal School of Mines, in order to see what was necessary more fitly to utilize their resources, has brought the matter into prominence again. The committee was an exceedingly strong one and on the general question it came to the conclusion that England compared not unfavorably with other countries in the provision made for what might be called the lower and intermediate grades of technical education as well as for the technical training for the learned professions obtainable at many of our universities. Our principal deficiency lay in the sphere of the highest technological education, although it cannot be stated that such backwardness was necessarily to be traced to the absence of a uniform policy running through the educational system here. The object of the report in question is to bring about some co-ordination and co-operation of the numerous higher technical training institutions, of which there are so many, even in London alone, and also to have one establishment in London of a group of associated colleges of science and technology, where the highest possible specialized instruction should be given.

Several years ago a parliamentary committee surprised many people by granting powers for the construction of a mono-rail railway between Liverpool and Manchester, upon which a speed of over 100 miles an hour was to be attained. The Behr mono-rail system was to be adopted and the Board of Trade insisted that a short length of line should be laid for experiments before it could pass the plans of the main railway. The chief argument in favor of the line was that a similar undertaking was working in Germany. However, after many postponements, an attempt was made in 1903 to secure the necessary capital by public subscription, but without success, and I understand that the project will in all likelihood now be abandoned.

In a paper read before the Society of Arts a few days ago on the question of effecting greater progress and economies in electric lighting, the author, Mr. Leon Gaster, urged the necessity of the establishment of a legal primary unit standard of light which would be recognized throughout the world, the establishment at the British National Physical Laboratory of a properly equipped photometric department, the framing of a standard specification for carbon filament lamps, and the conduct of an exhaustive study into the principles concerning the conversion of electrical energy into light. In connection with this paper it is interesting to note that efforts are being made here to evolve a universal standard of light and also a standard specification for incandescent lamps. Both the National Physical Laboratory and the engineering standards committee have the matter under advisement, and it is not unlikely that some publication bearing on the results will be made ere long.

A feature of note in the various annual reports this year of the railway companies in England which have electrified some or all of their lines is that as a consequence total working expenses have gone up. But the receipts have also increased considerably, while the working expenses per train-mile have in some cases been reduced by 50 per cent. Everyone, however, is looking to a period of normal working which the next 12 months should produce, to restore complete confidence in railway electric traction, for it is felt generally that the most efficient results could not be hoped for during the period of changing over from one system to another. It is evident, however, that economical management and strict efficiency are necessary to extract the fullest results from electric-railway working, as the reductions in fares and the abolition of second-class passengers are important factors.

An echo of the London power-bill fight last session is seen in the accounts of at least one existing electric-light company. In one instance alone the dividend has been reduced by two per cent., which is the estimated cost of opposing the power bills last year. And, further, the general effect of the power proposals has been considerable reductions in prices.

A tramway company in the south of England, viz., the Hastings company, which recently opened

New York.

[illegible] length of Manhattan Island.

The New York [illegible] editorial that the Interborough-Metropolitan capitalization of $225,000,000 represents [illegible] railroad, whereas the Missouri Pacific railroad, with the same capital, [illegible] miles long. Other comparisons are made with the [illegible] road with $224,000,000 stock and [illegible] with the Canadian Pacific railroad with $[illegible] and 7,863 miles.

State Attorney-general Mayer gave a hearing Tuesday in regard to an application to declare that the recent transit merger is illegal and a violation of the corporation law. On the other side it was pointed out that for years it has been the declared policy of the Legislature to encourage the merger of local transportation corporations in other parts of the state, namely, at Albany, Troy, Buffalo, Ogdensburg and Rochester.

Attorney Peter R. Gatens, addressing a legislative committee on Wednesday, pleaded for an official investigation into the franchises now in force in New York city. He alleged that an inquiry would show that many franchises were being operated illegally.

Brooklyn Borough President Bird S. Coler has prepared an amendment to the city charter enabling the city to build a municipal street railway in Brooklyn. The proposed route is from the end of Brooklyn Bridge to East New York.

Three thousand persons are to be moved from their present homes before March 1st in order to make room for the construction of the Pennsylvania Tunnel terminal on West Thirty-second Street.

George H. Daniels, the newly appointed general advertising manager of the Vanderbilt lines, was entertained at dinner at the Waldorf-Astoria Hotel on Tuesday evening as the guest of about 500 of those who had been associated with him when he was formerly general passenger agent of the New York Central railroad.

John H. Palmer, electrician of the Casino Theater, New York, died on Thursday, aged 54 years. At the time of his death Mr. Palmer was acting as mayor of Woodridge, N. J., but his technical associates were not generally aware that he filled this official position.

Extensive additions are announced to be made to the Bush Dock terminal. The present designs include a group of factory buildings, wherein tenants can obtain a supply of electrical energy for manufacturing purposes.

A few interesting electrical devices are on view at the annual sportsmen's show at Madison Square Garden. An Italian inventor named Pescatore shows an automobile wherein any surplus energy from the gasoline engine is used to charge a battery, the battery current being used to help the car ascend inclines. A similar auxiliary electric system is shown in connection with a small yacht.

The Turbo-electric Construction Company has been incorporated at Albany with a capital of $75,000. The directors are W. D. Vanderbilt, G. F. Archer and G. E. Hesse. D. W. W.

Dominion of Canada.

Ottawa, Ont., February 24.—The Ottawa Board of Trade has passed the resolution [see Western Electrician of last week, page 152] urging the Provincial and Dominion governments not to interfere with the free development of power at the Niagara Falls, and asking that a law be enacted prohibiting the export of power from Canada under any contract not terminable on one year's notice.

The municipal light and power plant of Westmount, an important suburb of the city of Montreal, will be in full operation on June 1st. It is announced that electric-lighting rates for houses will be 15 cents a kilowatt-hour, with one-third discount off of accounts if paid within 10 days after receipt.

Mr. H. S. Holt, president of the Montreal Light, Heat and Power Company, announces that the company's plant at Soulanges will be ready to

deliver 14,000 horsepower at the company's Wellington Street station by August 1, 1907. As soon as the Soulanges plant is ready, work will be started at the Buisson property, and the company's engineers say that they will be ready with an additional 18,000 horsepower either by the fall of 1908 or the following spring. According to the present rate of the business expansion of the company, it is said that the whole of the 32,000 horsepower will be required within three years' time.

The Montreal street railway has been allowed to increase its capital from $7,000,000 to $18,000,000. The company has purchased the Terminal Railway, which runs from the city to Bout de l'Isle, for $400,000. The company will build around the island of Montreal down to St. Vincent de Paul.

E. W. Backus of Minneapolis, Minn., has been interviewing the Ontario government in regard to the power-development project at Fort Francis, of the Minnesota and Ontario Power Company, of which he is the principal. It is said that the company is desirous of securing an extension of time, among other things, for the completion of the works on the Canadian side of Rainy River. The latter being an international stream, the company is working on the Canadian side under an act of incorporation obtained from the Dominion government, as well as the charter from the Ontario government. Under the Dominion act, the company must develop power on the Canadian side concurrently with development on the American side, the Railway Commission at Ottawa to fix conditions as to the transmission of surplus energy from side to side, as the demand warrants it.

Mr. Pain of the Ontario Power Company states that his company has suspended operations for power transmission through Canadian territory pending the publication of the report of the Municipal Power Commission for Ontario. The Ontario Power Company is installing the fourth section of its power-house equipment, which will be the largest unit for the generating of electricity in the world. Its capacity will be 12,500 horsepower. It will be ready for operation in March, and a fifth unit of equal size will be ready during April.

The business of the Canadian General Electric Company has increased very rapidly, and the general belief is that the progress of the Canadian industrial development during the next few years will be even more rapid than in the past, owing to the building of the Grand Trunk Pacific railway, the Canadian Northern railway, the extension of the Canadian Pacific railway and the construction of the great electrical power stations at Niagara Falls, and many other important enterprises now under way in the Dominion. As an indication of the business now being transacted by this company, it is pointed out that it has over $5,000,000 worth of work on hand. W.

New England.

Boston, Mass., February 23.—The Massachusetts railroad commissioners have issued an order regulating the use of searchlights as headlights on electric cars. The Natick and Cochituate Street Railway Company has been using these powerful lights for headlights, and the people of Wellesley, Mass., objected to them on the grounds that they frightened horses, blinded pedestrians, and annoyed residents of houses so situated that the lights of cars going around curves would flash into the rooms. On the other hand residents of other parts of the state have petitioned for the use of searchlights on electric cars, claiming that they were necessary for the greatest safety in running cars. In their order the commissioners show that it is necessary, in the interest of safety, to throw light a considerable distance ahead of the car, but they say that the companies must take prompt action to provide a suitable device for so governing the direction of the light as to confine the effect of its high power to the track. Meanwhile, they should turn off or obscure the light while cars are moving through streets otherwise well lighted or through thickly settled communities.

The Stanley Company of Pittsfield, Mass., has petitioned for the closing of Woodlawn Avenue, which bisects the company's land in that city. The company wishes to build a storage building 675 by 100 feet and three stories high, a department building, a molding insulation building 80 by 250 feet, and a foundry, 600 by 200 feet, as well as a good-sized addition to its lamp-department building. This involves an expenditure of from $750,000 to $1,000,000. The company proposes to connect the various parts of its plant by tracks, over which it will run electric cars. The development of the plant means the employment of 5,000 to 6,000 persons, against 1,200 now employed.

The Consolidated Electric Company of Burlington, Vt., has completed its new power house at Passumpsic, thereby increasing its power for motors and lights.

The board of directors of the Boston Chamber of Commerce has declared its opposition to "all bills or movements calculated to remove the safeguards now provided by law for the prevention of hasty and ill-considered actions by any Massachusetts city or town, upon the question of the acquisition of municipal lighting plants." The directors of the Boston Merchants' Association have also declared themselves opposed to the bill to enable cities and towns to take over their lighting plants, now pending before the Massachusetts Legislature.

The Boston Suburban Electric Companies and the Worcester, Consolidated Street Railway Company are arranging for a transfer of passengers so that they can establish passenger and express traffic between Boston and Worcester, Mass. The arrangement provides for changes of cars at Newton and South Framingham, and this will be likely to prevent this route becoming a serious competitor to the Boston and Worcester Street Railway Company's route, over which through cars are run.

The New York, New Haven and Hartford Railroad Company has raised the pay of its electric car conductors from $2.50 to $2.60 per day.

The Stafford Springs Street Railway Company will hold a meeting March 20th, at which the stockholders will vote on the proposition to sell the company's contracts, property and franchises to the Consolidated Railway Company and distribute the proceeds among the stockholders. The meeting will be a mere formality, as James F. Shaw & Co. of Boston control the company, and they concluded the deal with the Consolidated company.

Norman McD. Crawford, receiver of the Eddy Electric Company of Windsor, Conn., has filed his report with the Superior Court at Hartford, and Judge Wheeler has issued an order winding up the receivership. A final dividend of 3¾ per cent. was ordered, making total payments of 48¾ per cent. on allowed claims. When the company went into the hands of the receiver, some four years ago, its liabilities were $100,000 and its assets were valued at about $35,000, by the appraisers. The Eddy Manufacturing Corporation has taken the company's business. B.

Mexico.

City of Mexico, February 19.—Preliminary surveys for the electric development proposed by Alfred Lilliendahl and associates for the city of Saltillo have been completed. A waterfall near Arteaga is to be used for furnishing the initial power. In addition to building an electric transmission line to Saltillo and the installation of a complete system of electric lighting for that city, the power will be transmitted to mining camps and other industrial centers throughout that district. An electric street railway from Arteaga to Saltillo, touching at the large cotton factories of Aurora and La Libertad, is also proposed.

The Borde Electric Light Company of Tampico is extending its lighting system to Dona Cecilia and intermediate points. Additional machinery will be installed by the company. C. C. Freston is manager.

The National Railroad Company of Mexico is preparing to install electricity for the operation of its large shops at Santiago, City of Mexico.

An electric power plant to cost $500,000 is to be installed at the Guadalupe de los Reyes mines in the state of Sinaloa. The order for the machinery for the proposed plant will be placed in the United States.

The American employes of the Mexico Electric Tramways, Limited, of the City of Mexico, are required to attend classes in Spanish, in order to become proficient in speaking the language.

Southeastern States.

Charlotte, N. C., February 24.—Federal Judge Waddill at Norfolk, Va., has entered a decree fixing the fees of the receivers, attorneys, special master and many others in the case of the receivership of the Hampton Roads railway litigation. The receivership has been in force for about 2½ years. The total amount allowed is close to $60,000.

The Savannah River Power Company has awarded the contract for the completion of the dam at Greggs Shoals by October 1st. The dam will be located on the Savannah River near Anderson, S. C.

It is stated that the waterpower at Bluitt's Falls near Lilesville, N. C., will be developed in the near future by Hugh MacRae & Co. of Wilmington, N. C., and that 26,000 horsepower will be secured, which will be sold to mills and towns in the surrounding country.

The new electric plant of the Union (S. C.) Manufacturing and Power Company has just been successfully tested and put into operation. About 7,000 horsepower is available. It was thought at one time that the connection of the power company with the Union and Buffalo Cotton Mills, which have been involved in some litigation, would affect the electrical development, but this has been obviated by the reorganization of the cotton mills. The dam across Broad River where the power is generated is over 900 feet in length.

The report that the property of the United Railways and Electric Company of Baltimore had been sold is strongly denied by the company. The report seems to have grown out of the marked strength developed by the stock of this concern recently.

The Winchester and Washington City Railway Company of Virginia has virtually closed a deal, it is said, for the purchase of the plant of the Winchester Gas and Electric Company. The purchasing company is developing a large waterpower on the Shenandoah River in the state of West Virginia, and, it is announced, will supply lights to Winchester and other towns, beginning June 1st.

A movement is on foot at Edgefield, S. C., to establish a water and electric-light plant. At a recent mass-meeting to consider the matter Col. N. K. Bailey presided, and the total estimated cost by an expert was given at $51,000 for the water and lights.

A new lighting system has been installed at Louisburg, N. C., and the lights have been turned on.

The Adel (Ga.) Electric Light and Power Company has been organized, with William Scandrett president. The preliminary work will be started at once.

The commercial bodies of Louisville, Ky., are planning a campaign to have erected permanent electric arches in the business section of that city.

The street-car factory at High Point, N. C., is meeting with continued success and is receiving orders for cars from all sections.

The sum of $1,000,000 will be expended by the Norfolk (Va.) Railway and Light Company for a new power house and new machinery, with other improvements, according to the statement of the general manager of the company.

D. C. Waddell, C. W. Petty and others are the incorporators of the Central Electric Company at Greensboro, N. C.

The North American Company's ordinance asking for the sale of a franchise for selling electricity in the city of Louisville, Ky., has been referred by the lower board of the City Council to the revision committee. L.

Ohio.

Cleveland, February 24.—A company has been formed to build an electric railway from Vanport, Pa., to Smith's Ferry, Pa., where it will connect with a road running to East Liverpool and Wellsville. It will be known as the Ohio Valley Traction Company. S. L. Tone, C. S. Mitchell and other men connected with the Pittsburg Railway Company are the incorporators. The road will probably be under the control of that company, which will build several links down the Ohio River to connect Pittsburg and Wheeling.

Representative Bassett has introduced a bill in the Legislature giving heating and lighting companies the right to appeal to the Probate Court for a franchise when city councils delay action unnecessarily. This bill is primarily designed to relieve the situation at Toledo, where rival companies are contending.

Two electric cars designed for use on the Canton-Akron line made a long trip last week. Starting from Marion, Ind., they went to Ft. Wayne, thence to Lima, from there to Findlay, and then to Toledo. Here they were transferred to the Lake Shore Electric for Cleveland. From the latter place they went to Akron, Canton and Canal Dover, in all a distance of something like 500 miles.

The Ottawa Beach and Southern has secured enough right-of-way to enable it to begin work in the early spring. The road is an extension of the Toledo Railways and Light Company's lines to some of the resorts.

Mayor Johnson of Cleveland has been in Columbus most of the time for several weeks, pushing legislation that he desires. One of these is the Metzger bill, which provides that all applications for franchises must be referred to the voters of a municipality.

G. W. Meeker of Columbus, W. E. Moser of Toledo, and others, are mapping out a line from Findlay to Marion to connect with the Columbus, Delaware and Marion. This connection would make a line from Columbus to Toledo.

J. W. Holcomb of Cleveland is said to be interested in a proposed electric railway from Ravenna to Canal Dover and New Philadelphia, with a branch to Kensington. This would be a good feeder to the proposed Cleveland, Alliance and Ravenna.

The People's Light, Heat and Power Company of Springfield is selling $375,000 treasury stock at par, with an equal amount of common stock as a bonus.

The Dillonvale and Ohio River Traction Company of Martins Ferry has been incorporated with a capital stock of $10,000 by James T. Hodgens and others.

Former Senator William Flynn of Pittsburg is said to be interested in connecting up lines between Pittsburg and Cleveland, in order to make a system that will compete with the steam roads on through business. Work is being rushed on the line between Pittsburg and Butler, and this will be extended on to Newcastle. Connections between Cleveland and Youngstown will then be made. O. M. C.

Indiana.

Indianapolis, February 24.—It is reported that the Muncie, Hartford City and Ft. Wayne Electric railway was sold to the Indiana Union Traction Company a few days ago. The line is 42 miles long, and connects Muncie and Bluffton,

connection being made at Bluffton with the Ft. Wayne, Bluffton and Marion line.

The City Council of Bedford has granted a franchise to the Indianapolis, Vincennes and Evansville Traction Company upon condition that the road shall be completed to Bedford by December 1st.

The Pennsylvania Railroad Company is distributing poles along the Madison branch, between Columbus and Madison, and this has given rise to the current belief that the company intends putting on electric cars on this division. The workmen engaged in planting the poles say that they have not been advised of the purpose of the poles.

The Indianapolis and Eastern Traction Company will remove its car shops from Greenfield to Richmond. A single emergency shop will be maintained at Greenfield, as will also the dispatcher's office. This removal is the result of the merger, and will occasion about 40 families to remove to Richmond.

The survey of the connecting trolley link between Celina, Ohio, and Portland, Ind., which will complete the direct route between Detroit and Indianapolis, is nearing completion. The promoters say the road will be an air line, and will therefore miss by several miles thriving villages which had hoped to secure the road. Ft. Recovery and Wabash are included in the points skipped.

The Indianapolis Traction and Terminal Company has adopted the pay car plan of paying 2,100 employes, of whom 750 are motormen and conductors. The pay car leaves the company's headquarters every Wednesday morning and travels about the city all day on a regular schedule. Thus the employes know when to expect it, and there is no delay handing out the money. The car is accompanied by a police officer and sufficiently equipped to make it interesting to those who should attempt a holdup.

The Central Manufacturing Company of Connersville announces that it will equip its new plant with motors and operate the new machinery by electricity.

Fifty prominent citizens of the west part of Howard County have organized a company at New London, for the purpose of constructing a dam in Honey Creek to generate electricity for light and power. The country in the locality is very beautiful and scenic, and a pleasure-park resort with an artificial lake will also be provided.

The City Council of Marion is considering a proposition made by the Diesel Engine Company of Indianapolis whereby the latter will place machinery in the Marion city light plant, furnish street lights for the city for 10 years on a basis of 300 lights at $55 a light a year, or 350 lights at $47.50 a year, the city to receive all income from commercial lighting, and at the expiration of 10 years the plant, valued at $100,000, will become the property of the city. S. S.

Michigan.

Grand Rapids, February 24.—Nearly 300 farmers of Ronald and adjoining townships in Ionia county and a delegation of Ionia business men met at Palo recently to discuss interurban-railroad matters, the object being to secure a line from Ionia to Alma by way of Palo, Hubbardston and Crystal. A committee was appointed to get a survey from Ionia to Hubbardston and Palo. It is proposed to utilize the Prairie Creek waterpower and make the road a branch of the Grand Rapids and Ionia interurban now building. A local board of trade has been organized in Ionia to furnish a working aggregation to go abroad and interest capital. Many of the farmers stand ready to donate right-of-way.

It is announced that a franchise has been secured to construct an electric railway from Mt. Clemens to the mouth of the Clinton River and Belvidere, with a view to developing the lake front. The line will enter Mt. Clemens over the Rapid Railway, it is said. Carl Schweikert of Detroit and Anthony Amels, who secured the franchise, have extensive holdings along the lake and river front.

Proper protection against high-tension electric wires where they cross the telegraph wires of railroad companies is a problem recently presented to the Michigan state railroad department. The Commonwealth Power Company, which gets its electricity from waterpower in the southern part of the state, is erecting a line of wires from Jackson to Lansing, and it plans to cross the Michigan Central tracks twice, at Rives Junction and a few miles south of Lansing. The railroad officials picture dire calamities should the wires carrying about 40,000 volts break at a point where they cross the telegraph wires. Cradles are being considered to support the wires at the points of crossing, but these will furnish opportunity for ice and snow to accumulate. The railroads object to the wires being placed underground, through fear of interference with their own electrical systems. The rapid development of great waterpowers in the state and the transmission of the current long distances is likely to result in legislation protecting both the high-tension wires and the lines which are crossed.

The Michigan Power Company has absorbed the Piatt Power and Heat Company at Lansing. The company is capitalized at $2,500,000, and a site has been selected and a power house will be erected and equipped at a cost of $250,000. It will be [illegible] 175 feet [illegible] power [illegible] Work [illegible] and be completed [illegible] will be completed [illegible].

Committees [illegible] the proposition [illegible] Jackson [illegible] ing [illegible] the [illegible] rate [illegible] special rate to students to [illegible] maintenance of 60 or 70 lights [illegible] yet reached.

The Michigan United Railways [illegible] poles of lighting [illegible] property [illegible] efficiency, has begun to purchase new cars. [illegible] R. Elliott, general manager, has gone to St. Louis to purchase cars for the line. The [illegible] business is to be pushed vigorously. L. W. B.

Northwestern States.

Minneapolis, February 24.—The council at Afton, Iowa, has let the contract to the Commercial Electrical Supply Company of St. Louis for installing an electric-light plant.

The council at Grand Forks, N. D., has returned all bids, unopened, for engines for the electric-light plant, the financial condition of the city being such that no expenditure was allowable.

Extensive improvements are being planned for the electric-lighting system at Luverne, Minn.

An electric-light system will be put in at Freeport, Minn., and operated in connection with the canning factory.

The Northern Heating and Electric Company has applied for an electric-light and power franchise at St. Paul. The company has increased its capital from $500,000 to $1,500,000.

The Duluth and Iron Range Railway Company is planning the erection of a large electric-light and power plant at its shops at Two Harbors, Minn. It will cost about $60,000. The contract has been let to the Erie Heating Company of Chicago.

The Virginia (Minn.) Light and Water Company will install a new 1,000-horsepower engine and new dynamo at its plant.

It is reported that it is the ultimate purpose of the La Crosse Hydro-electric Light and Power Company, which is building a power plant near Black River Falls, Wis., to build a trolley line from La Crosse to Superior.

The Grand Forks (N. D.) Transit Company is considering a proposition to build an elevated line to the State University, to replace the present surface line.

The council at Bridgewater, S. D., has offered a bonus of $5,000 to the Electrical Interurban Railway Company of Sioux Falls if it will build to Bridgewater.

Negotiations have been closed for the merging of the local traction and lighting interests at Green Bay, Wis., the Green Bay Traction Company taking over the Green Bay Gas and Electric Company.

The Great Northern Development Company of Duluth, Minn., is investigating the feasibility of developing 300,000 horsepower at Fond du Lac, Minn., and transmitting it to Minneapolis and St. Paul for industrial purposes. Eastern capitalists are figuring with the company on the proposition. R.

Pacific Slope.

San Francisco, February 23.—An application has been made to the Board of Trustees of Fullerton, Cal., for a franchise to operate an electric-light and power system in that city. Sealed bids for the franchise will be received on April 9th.

The city trustees of Anaheim, Cal., have called a bond election to vote on a proposition to issue bonds to the amount of $69,000 for an electric-light plant.

The City Council of Bandon, Ore., has granted a 20-year electric-light franchise to the Bandon Electric-light Company, work to be commenced by May 1st.

The plans for the Geary Street municipal electric road have been filed with the Board of Supervisors of San Francisco and a resolution has been passed calling for bids for the construction of the line. No date has yet been set for the opening of the bids.

The City Council of Los Angeles, Cal., is preparing to carry out the new public-service law in the matter of fixing rates for public-service corporations. Rates for electric light have been fixed at 11 cents per kilowatt and for power at 10 cents per kilowatt. These rates make no great change, and it is thought that the companies affected will make no contest. When telephone rates are taken up trouble is expected, as the two companies operating in Los Angeles maintain different rates.

Norman Gratz of Boise, Ida., is building a power plant at Payette, Ida., for the Centerville Dredging Company, which will use the power developed to operate its dredging plants and for other mining purposes.

The Tanana Electric Company of Tanana, Alaska, is installing a plant capable of supplying 3,000 lights. A.

PERSONAL

[illegible]

[illegible]

[illegible]

[illegible] February 27.

H. [illegible] of the Metropolitan [illegible] Company of Chicago, [illegible] New York. He is to have charge of the electrical and mechanical department [illegible].

[illegible] Randolph of Chicago, chief engineer of the Drainage Canal, has b[illegible] Internal Improvements [illegible] was appointed by Governor [illegible] to investigate the feasibility of [illegible] from Lake Michigan to the Gulf of Mexico.

L. H. Newbert, manager of the [illegible] Gas and Electric Company, has been transferred to Redwood City to take charge of the [illegible] division of the California Gas and Electric Corporation. He will live in San Mateo [illegible] office in Redwood City. J. L. [illegible], formerly of Grass Valley, but lately of San Francisco, will take charge of the Marysville office.

Henry Rustin, who was chief electrical and mechanical engineer at the Louisiana Purchase Exposition, but who was compelled to resign on account of ill health before putting into effect his conception of an illuminating effect for the St. Louis Fair, died at his home in Florence, near Omaha, Neb., on February 27th. Mr. Rustin was also prominent in the beautiful illumination of the Pan-American Exposition at Buffalo. A picture of him and a sketch of his career will be given in the Western Electrician next week.

Dennis J. Hern, formerly general manager of the Mutual District Messenger Company of Boston, has resigned his position on the Boston Board of Health and has been nominated superintendent of the Lamp Department of Boston by Mayor Fitzgerald. Mr. Hern is well known in electrical circles, having filled important positions with telegraph companies and having been interested in a company which assisted inventors in perfecting and selling electrical devices. He was the New England superintendent of the Mutual Union Telegraph Company during its entire existence.

Mr. Edward R. Mason of Porter & Berg, Chicago, has successfully passed through an operation for appendicitis, and his friends will be greatly pleased to learn that he is now doing nicely and is well on the road to recovery. For several years Mr. Mason has been outside representative for Porter & Berg and he has contributed not a little to the success of the firm. He has been in the Lakeside Hospital, Chicago, for three weeks, but owing to the serious nature of his illness it will be several weeks more before his physician will allow him again to think of business.

Mr. F. E. Donohoe, western agent for the American Electrical Works of Providence, R. I., has just accepted the management of his company's New York house. Mr. Donohoe and his family left for the East last Saturday to make permanent residence in New York or vicinity. Mr. Donohoe has been in charge of the western business of the American Electrical Works for about 12 years, and his prosecution of the business of his company has been a marked success. He leaves behind him a large number of western friends. Mr. Donohoe was at one time in the navy. He opened the Chicago office of his company in June, 1894, and just prior to this he was in the wire business in the East. Mr. and Mrs. Donohoe have been very popular in Chicago social circles. Mrs. Donohoe is a noted golf player, and it is understood that her husband played her a very fair second. Mr. E. H. Hammond, who became Mr. Donohoe's lieutenant when the latter took charge of the company's western business in 1894, succeeds Mr. Donohoe in the responsible position of western agent. Trained under Mr. Donohoe's capable management, there is no doubt that Mr. Hammond will manage the company's western department to his own and his company's credit.

ELECTRIC LIGHTING.

Texas papers say that Sam J. Brown and W. H. Rosecrans of Chicago have applied for a franchise to establish an electric-light and power plant in Fort Gibson, Texas. This, it is said, is the preliminary move toward securing the right to erect a large dam and electric plant on the Grand River near Fort

Gibson for the purpose of supplying other towns with electric power.

Table Rock, Neb., may have an electric-light plant. J. R. Sutton and others are interested.

The Anderson County Light and Heat Company of Colony, Kan., has been incorporated with a capital stock of $16,000.

An election will be held in Iron River, Mich., on March 12th to decide the question of issuing bonds for an electric-light plant.

It is stated that the Illinois Illuminating Company of East St. Louis will expend $1,000,000 in improvements on the plant.

The Winchester (Va.) Electric Light Company has sold its plant to the Winchester and Washington Railway Company for $12,000.

The Eaton Water, Light and Power Company of Eaton, Colo., has been incorporated with a capital stock of $35,000 by John McCarthy and others.

The city of Aberdeen, Miss., will install a 250-kilowatt Allis-Chalmers alternator, three-phase 60 cycles, and a 60-kilowatt machine of the same description, with belted exciters and switchboard complete.

It is reported that papers have been signed by which eastern capitalists buy all the traction, electric-light, power and gas properties in Davenport, Iowa, and Rock Island and Moline, Ill., and the interurban line from these cities to Watertown, Ill.

The Electric Light and Power Company of Essex, Iowa, has secured the services of J. A. McMasters to take charge of the plant, which will be rebuilt. The stock has been increased by $25,000 and the whole system will be enlarged and improved.

The capital stock of the Cincinnati Gas and Electric Company has been ordered increased from $31,000,000 to $36,000,000 by almost unanimous vote of the shareholders. The $5,000,000 increase thus provided will be used for extensions incidental to the introduction of natural gas and for the extension of the electrical wiring and equipment.

The Electric Company of America, with headquarters at Philadelphia, recently purchased for one of its constituent companies, the Atlantic Electric-light and Power Company of Atlantic City, N. J., two 22 and 36 by 42-inch Allis-Chalmers heavy-duty cross-compound engines for direct connection to generators supplying the motor and lighting load for the famous summer-resort city. The new units will be ready for operation some time early in June.

The St. John's Light and Power Company of St. Augustine, Fla., owing to the increasing demand upon its present power and traction facilities has recently negotiated the purchase of additional engine and generator units, with exciters, switchboard and accessories, consisting of a 325-kilowatt alternator, direct coupled to an 18 and 36 by 30-inch cross-compound engine, a 250-kilowatt alternator, direct connected to an 18 by 30-inch engine and a 100-kilowatt railway-type generator direct connected to a 12 by 24-inch engine; also a 90-kilowatt motor-generator set and complete switchboard, the apparatus being of the Allis-Chalmers make. In arranging the station for the installation of the new units, special care was taken to provide for a future unit, which may be added at any time without disturbing the station arrangement.

ELECTRIC RAILWAYS.

Both street-railway franchises at Mankato, Minn., have expired by limitation and were declared forfeited by the council.

A company is being organized in New Orleans to be known as the New Orleans-Crowley and Western railway, capital $1,000,000. The road will be equipped with electric motive power.

Two new transformer stations to be used in distributing the additional electric current supplied by the Chicago Edison Company for the Metropolitan elevated railway will be built at once at a cost of over $300,000.

Rumors are again in circulation that the near future will bring several consolidations among the elevated roads of Chicago. One rumor contemplates a consolidation of the Northwestern Elevated and the Chicago and Oak Park, while another would unite the South Side and Metropolitan lines.

The granting of a charter to the Allentown, Tamaqua and Ashland (Pa.) Railroad Company is said to be a step in establishing electric-railway connections throughout the state. The capital stock of the new company will be $20,000,000. The Pottsville Union Traction Company's lines may be a part of the system.

The Danville, Urbana and Champaign Railway Company of Champaign, Ill., having shared liberally in the general prosperity of the last year, has undertaken extensive additions and improvements in its present power-house equipment. A feature of the additions will be the complete new Allis-Chalmers power unit, engine and generator, which has recently been purchased, and which will be in readiness for operation on or about the middle of June. The engine is 28 by 48 inches and of the heavy-duty type, direct connected to a 500-kilowatt railway generator.

The stockholders of the East St. Louis and Suburban Electric Railroad Company and of the Akron, Granite City and St. Louis Electric Railway Company have signed a preliminary agreement for the consolidation of the properties of the two companies. The united companies will constitute a $14,000,000 corporation, controlling lines connecting 21 towns and embracing 175 miles of track.

There were rumors last week that some of the Vanderbilt railroads in Northern Indiana and Southern Michigan were to be equipped with electric traction on the third-rail system. Towns on the Lake Shore, the Michigan Central, the Big Four and the Lake Erie and Western where interurban competition exists, were to be the first to get the new service by the steam lines, according to newspaper reports.

The net earnings of the Aurora, Elgin and Chicago railroad and the Elgin, Aurora and Southern for the year 1905 were $485,000, according to the annual reports which have just been made public. The net earnings of the Aurora, Elgin and Chicago road, which now enjoys arrangements with the Metropolitan Elevated by which the interurban cars are brought into the heart of Chicago, increased from $187,056 in 1904 to $272,261 in 1905.

Upon application to the United States Court by Granger Farwell & Co., holders of the bonds, amounting to $250,000, and the Merchants' Loan and Trust Company, trustees, both of Chicago, the Marquette County Gas Light and Traction Company, operating gas and electric plants and a street-car system at Ishpeming and Negaunee, Mich., has gone into the hands of a receiver. E. B. Finch, secretary of the company, is made receiver.

The Common Council of Milwaukee has passed the ordinance giving a franchise to the Chicago and Milwaukee Electric Railroad Company to the heart of the city. Mayor Rose, who was in the council chamber, at once signed the ordinance. "We will begin the work of construction at the south end as soon as the frost is out of the ground," President Frost is quoted as saying. "We expect to reach Racine by the middle of the summer and may possibly reach Milwaukee late next fall."

In South Chicago a few days ago a street car was used as a hearse and 20 other cars followed in line in place of carriages. The occasion was the burial at Mount Olive Cemetery of Rev. Martin Van de Laar, pastor of St. Patrick's Roman Catholic Church of South Chicago. This was in accordance with a provision of the priest's will, inspired, as he stated, by the knowledge that many of his parishioners who could not afford to rent carriages to attend the funeral might be spared such expense.

POWER TRANSMISSION.

The Rio de Janeiro (Brazil) Tramway, Light and Power Company has placed orders in the United States for part of the equipment of a 100,000-horsepower electric plant to utilize water-power 85 miles from the city.

W. H. Standish of Grand Falls, Mo., is endeavoring to have Congress declare the James and White rivers unnavigable above Cotter, Ark. Mr. Standish owns large tracts along these two rivers, and he proposes to dam and tunnel the rivers so that the water may be used as the power to generate electricity, which will be furnished all over Southwest Missouri and Northern Arkansas.

PUBLICATIONS.

The Banner Electric Company of Youngstown, Ohio, has issued a new price list on the Banner special lamps.

Fusible hanger boards, tapiets, panel cut-outs, entrance switches, panel boxes, etc., are described and illustrated in the latest bulletin of the H. T. Paiste Company of Philadelphia.

An elaborate catalogue on cement-making machinery, rock breakers, crushers, dryers, etc., has just been issued by the Allis-Chalmers Company. Machinery for every stage of cement making by wet or dry process is descibed.

The 1906 wall calendar of the Hazard Manufacturing Company of Wilkesbarre, Pa., is large and the figures exceptionally distinct, making them visible from a considerable distance. The company manufactures many kinds of wire, metal rope and cables.

"Cedar Products" is the title of a pamphlet compiled by the C. H. Worcester Company of Chicago, producers and wholesalers of cedar poles, railroad ties and kindred products. The pamphlet contains the company's complete telegraphic code for ordering products, the Northwestern Cedarmen's Association standard specification of white-cedar products, inspection comments upon these specifications, shipping notes, and a table of weights of posts and poles in shipping dry condition. Throughout the pamphlet are some very interesting pictures showing how the poles are handled in the woods.

A pleasing bulletin from the Goulds Manufacturing Company of Seneca Falls, N. Y., describes a high-pressure fire-protection plant installed in New York at Coney Island. It contains complete descriptions of the Goulds apparatus and many interesting pictures of this important installation.

An address on "Underground Chicago" was delivered before the Chicago Architectural Business Men's Association on January 23d by George W. Jackson, chief engineer and general manager of the Illinois Tunnel Company. This address has been reprinted in a tasteful brochure and is being distributed with the compliments of the company.

SOCIETIES AND SCHOOLS.

The "Proceedings" of the Iowa Electrical Association, just issued, covering the report of the fifth annual convention held at Dubuque, April 19 and 20, 1905, contains 80 pages and is a well-bound and attractive book. A list of members is given, together with a complete report of the transactions of the convention. Austin Burt of Waterloo is president of the association.

The annual inspection trip of engineering students of Purdue University will be begun on March 27th. The students will be divided into three sections, relating, respectively, to mechanical, civil and electrical engineering. Prof. W. F. M. Goss, dean of the engineering schools, will have charge of the engineering party, and the large plants in Chicago will be visited first.

The Illuminating Engineering Society will hold its next regular meeting in the Edison Auditorium, 44 West Twenty-seventh Street, New York city, on Friday evening, March 9th, at 8 p. m. Papers will be presented on the following subjects: "The Luminous Arc," by E. L. Elliott; "The Inverted Incandescent Gas Burner," by Victor Rettich; "Illuminating Engineering from the Architect's Standpoint," by W. S. Kellogg. The papers will be open to general discussion, and all interested in the subjects treated are invited to attend.

The first list of questions for the "Question Box" of the National Electric Light Association for the Atlantic City convention next June has appeared, and even at this early date a creditable and diversified list is presented. Mr. Paul Lüpke of 222 East State Street, Trenton, N. J., is the editor of this department and he will be glad to receive as many answers to these questions as possible, also new questions of timely interest. "To Keep Your Knowledge Alive is to Give it Away" is the motto adopted by the department, and contributions to this important work will be appreciated by the association as a whole.

The Iowa Street and Interurban Railway Association will hold its next convention in the Kirkwood Hotel, Des Moines, on April 19th and 20th. Papers will be presented on "Standard Car and Truck Construction for Interurban Work," "Discipline of Car-service Employes," "Comparative Value of the Alternating-current and Direct-current Systems of Distribution for Railway Work," "Gasoline Engines for Interurban Service" (probably), and "Rail-bond, Field and Armature Testing." Manufacturers and dealers and their representatives are extended a hearty invitation to be present. L. D. Mathes, general manager of the Union Electric Company of Dubuque, is the secretary of the association.

Applications have already been made by manufacturing companies for two-thirds of this year's electrical engineering class in the University of Minnesota. Subjects of thesis investigation by members of the class are as follows: "Wave Forms of High-frequency Alternating Current," "An Electrolytic Survey," "Variable-speed Induction Motors," "Mercury-vapor Rectifiers," "Performance of a Three-phase 13,000-volt 10-mile Underground Cable," "Design and Test of an Interchangeable Arc Lamp," "Purification of City Water Supply by Electricity," "Spectrophotometer Study of Flaming Arc Lamps," "Tests of a Central Station," "Test of Electric Headlights," "Tests of a High-speed Electric Car," "Photographic Values of Various Electric Lights," "Design, Construction and Test of an Induction Motor."

AUTOMOBILES.

Possibly the finest private automobile in the world is that owned by George W. Perkins of New York, which is reputed to have cost $23,000. Electricity is used for auxiliary purposes. Various ordinary instructions to the driver are posted on the dash-board, each indicated by an electric lamp. Pressing a corresponding button inside the car lights the proper lamp. A telephone is also available if special orders are to be given the driver. The car is said to contain revolving chairs, a washstand, toilet cases, mirrors, electric lights, electric heaters, hat cords, parcel nets, leather pockets filled with various articles,

a writing desk and a cabinet containing mole[illegible] articles.

The Association of Electric Vehicle Manufacturers has been incorporated at Albany, N. Y., to bring together the leading manufacturers in electric machines and adopt measures in encouragement of the trade. The main offices will be in New York city. The directors are Robert M. Lloyd of New York, George Pope of Hartford, Conn., M. L. Goo[illegible], and J. W. McCrea of Cleveland, T. W. Goodridge of South Bend, Ind., and James McNaughton of Buffalo.

MISCELLANEOUS

The city of Ellensburg, Wash., propose to install an electric fire alarm system.

Recharging dry batteries may be accomplished, it is said, by pouring about a gill of dilute sulphuric acid (three parts water, one part acid) through two small holes bored in the top of the battery, the solution percolating down through the interior. The holes are then plugged up with common soap and the battery allowed to stand about 12 hours before using.

Prof. H. C. Ernst of Harvard Medical School is said to have devised a means whereby bacteria may be photographed, making it possible to watch the life of the germs. This is done by using ultraviolet rays, and a series of pictures may be taken every minute to show the growth of the germ. Under the action of these rays the bacteria show up on the negative without any artificial coloring.

Sir William Arrol & Co. have constructed for John Brown & Co., Glasgow, two very high electric derricks for use in the building of the express Cunarder. On account of the great height of the ship, exceptional derricks are necessary, and those now erected are designed to raise a load of five tons to a height of 120 feet from the ground level, with a working radius of 35 feet from the center of the mast and with a jib slewing through 180 degrees. The mast is an open lattice-work column of square sections six feet square at the center and tapering to 18 inches at the ends. The platform for the electrical apparatus is at a height of 95 feet from the ground level.

TRADE NEWS

At the annual meeting of the National Carbon Company it was reported that the company during the fiscal year ended January 31st earned $222,250, or 4.03 per cent. on the common stock. This amount compares with $147,970, or 2.85 per cent. earned on the common stock during the previous fiscal year. Profits for the year [illegible] compared with [illegible].

The Electric Construction Company [illegible], Mo., has been incorporated with [illegible] 000 by Arthur W. Lambert and others.

The constructing quartermaster [illegible], Mich., is inviting sealed proposals until March [illegible] for furnishing electrical fixtures [illegible] in certain buildings at Fort Brady. Detailed information will be furnished upon application.

The Navy Department, through the Bureau of Yards and Docks, is inviting sealed proposals until March 31 for furnishing boilers [illegible], etc., for the power plant at the New York navy yard. Plans and specifications will be furnished intending bidders upon application to the commandant of the yard.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until March 13th for furnishing incandescent lamps, conductors, magnet wire and miscellaneous electrical supplies, embraced in schedule 383, obtainable at the navy pay office in New York, or upon application to the bureau at Washington.

Steel towers built by the Aermotor Company of Chicago are used by the Niagara, Lockport and Ontario Power Company in the power transmission line extending eastward from Niagara Falls. Some of these towers are 50 feet high and designed to withstand a pull of 3,500 pounds at the top of any insulator pin, or a total pull at the top of the tower of 15,000 pounds.

Queen & Co. of Philadelphia announce their removal to the northwest corner of Eighth and Arch streets. The new quarters are for the mathematical, drafting and engineering instrument departments, physical and electrical department, meteorological department, optical-instrument department, chemical apparatus, and wholesale department. Here they will enjoy increased facilities for the display and shipment of goods and the filling of orders. Large additions have also been made to the company's manufacturing plants in Philadelphia and New Jersey.

The Allis-Chalmers Company calls attention to United States patent No. 811,520, issued on January 30, 1906. This patent relates to horizontal-vertical types of steam engines, and was granted, after long deliberation and controversy in the Patent Office, on an application filed in August, 1900, by Mr. Edwin Reynolds, and was assigned by him to the Allis-Chalmers Company. According to the company, the claims under this patent [illegible]

BUSINESS

[illegible]

The Westinghouse Machine Company [illegible] that during the [illegible] steam turbine has been introduced. Among [illegible] the Phosphate Manufacturing Company of [illegible], Fla., Columbia Electric Street Railway, Light and Power Company of Columbia, S. C., [illegible] Light and Power Company of Adrian, Mich., Pennsylvania Light and Power Company of Allegheny, Pa., E. I. Dupont Company of Wilmington, Del., and the Kennebec Light and Heat Company of Augusta, Maine.

Electricians of all kinds having fastenings to make to marble, brick, tile, slate and other substances of that nature should be interested in the Star screw anchor, which is especially adapted for their class of work. These anchors are made of a lead composition, which is non-rusting, and will not chip, mar or crack the material into which it is inserted. Any wood, machine or special screw can be used with these anchors, as they enable the screw to cut its own thread. The anchors are used in large quantities by telephone companies for fastening wire distributing rings and the like, and on switchboards and other classes of work for making fastenings of various kinds. Samples and full information will be sent upon request to the Star Expansion Bolt Company, 147-149 Cedar Street, New York city.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 20, 1906.

812,825. Railway Switch-operating Apparatus. Clyde J. Coleman, Rockaway, N. J., assignor of one-half to Sidney Aronstein, New York, N. Y. Application filed February 4, 1905.

Railway switch-operating apparatus comprises fluid-pressure motive apparatus in actuative co-operation with a track switch and including an expansible motive chamber and a tubular electric conductor in fluid communication with the motive chamber and arranged to receive motive fluid and to heat and expand it by caloric energy generated by passage of an electric current in the tubular conductor.

812,847. Trolley Wheel. John Hensley, Huntington, Ind. Application filed November 6, 1905.

Mechanical features of a trolley wheel are set forth.

812,851. Trolley for Electric Cars. John H. Kinter, Indiana, Pa. Application filed August 5, 1904.

A device for maintaining the wheel upon the trolley wire is the basis of the patent.

812,872. Incandescent Electric Lamp. Herschel C. Parker, New York, N. Y., assignor to the Parker-Clark Electric Company, Jersey City, N. J. Application filed April 8, 1905.

An incandescent electric lamp comprises a tube of highly refractory material which is permeable to light, a highly refractory conductive film on the inner surface of the tube and connections at the tube ends for the conductive film.

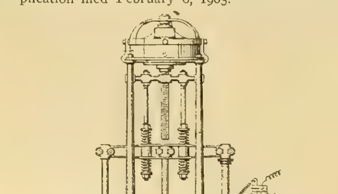
812,878. Turbine-driven Machinery. Auguste C. E. Rateau and Gaston Sautter, Paris, France, assignors to the Rateau Turbine Company, Chicago, Ill. Application filed August 17, 1903.

Associated with a number of turbines connected in series with respect to the passage of steam are a corresponding number of electric generators driven by the turbines, a connection between the driven machines to maintain approximately a fixed relative speed and a governor mechanism responsive to changes in speed of the system controlling the admission of steam to the first turbine of the series.

812,880. Switch or Circuit-breaker for High-potential Circuits. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 30, 1899.

Means for rupturing a high-potential current comprise contacts, an inclosure around the points of contact adapted to store high pressure upon the separation of the contacts, a body of insulating liquid submerging the contacts and quick-acting means for separating the contacts with a quick break and a long motion whereby the arc products are squeezed into small cross-section and the arc is stretched until ruptured. (See cut.)

812,881. Hanger or Ear for Overhead Electric Trolley Wires. Abraham Richardson, Blackpool, England, assignor of seven-eighths to Joseph Heap, Henry Heap, James Bailey, Thomas Brierley, Robert Billington, James Haydock and Thomas Smith Jones, Blackpool, England. Application filed February 6, 1905.



NO. 812,880.—OIL SWITCH OR CIRCUIT-BREAKER.

An ear or hanger for supporting or holding up electric conductor wires, constructed with two jaws to grip the wires, is made the basis of the patent.

812,891. Interconnected Suspension Means for Gearless Motors. Robert Siegfried, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 12, 1905.

In combination with a truck are a pair of electric motors and supporting connections between the motors and the trucks, and a pair of balancing links, each of which connects the upper side of the one motor with the lower side of the other.

812,900. Rail Bond. Edward G. Thomas, Cambridge, Mass. Application filed December 24, 1902.

A rail bond comprises a number of flexible strips provided with an attaching surface formed by the cohesive exposed surfaces of the strips on one side of the bond, in combination with a U-shaped binding plate having its middle portion placed against the strips [illegible] the attaching surface and having its ends arranged to confine the strips against lateral separation.

812,949. Electromagnetic Power Generator. Joseph L. Potter, Indianapolis, Ind. Application filed May 26, 1905.

The power generator includes several vibrating arms, means for actuating the arms and a rotative shaft carrying a device intermittently engaged by the arms and actuated directly by them.

812,965. Electrical Heater. Emma L. Vaughn, San Francisco, Cal., assignor to G. X. Wendling, San Francisco, Cal. Application filed October 14, 1905.

In a temperature-changing device, an open-ended perforated casing has a partition nearer one end than the other and an electrical translating device connected with the partition.

812,969. Electric Welding Machine. William C. Winfield, Warren, Ohio, assignor to the Winfield Manufacturing Company, Warren, Ohio. Application filed January 9, 1905.

An electric welding machine comprises a pair of conductors horizontally disposed with a space between them. Associated with the conductors are a [illegible] support for a vessel body adapted to engage the vessel inside, and means outside to hold the bottom section in welding relation to the body section.

812,980. Self-soldering Heat Cartridge and Protective Apparatus. Frank B. Cook, Chicago, Ill. Application filed November 26, 1904.

An inclosing shell has suitable conducting end caps secured to it and a heat-producing member extending completely through the shell and end caps and projecting from at least one end of the device.

813,048. Anode. Louis Levett, New York, N. Y. Application filed May 9, 1905.

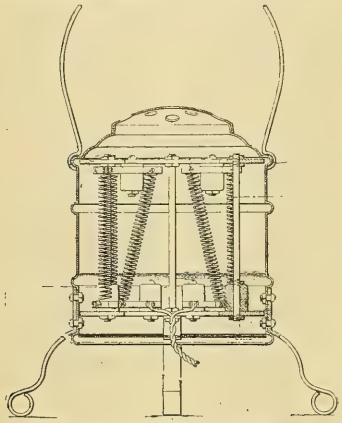
Combined with a core are metal portion constructed to fit onto and surround the core, means for retaining the metal portion and insulating material covering the exposed portions of the core.

813,052. Electric Brake for Vehicles. Joseph N. Mahoney, Astoria, N. Y., assignor to the American Electric Brake Company. Application filed November 8, 1901.

Fundamental features of an electric braking system consist of a brake magnet having two windings acting to produce pressure between braking surfaces, an automatic controller acting to control the braking current in one of the windings and means whereby the motorman may at will control within limits the action of the automatic controller.

813,063. Process of Separating Substances of Different Dielectric Capacities. Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Texas. Application filed April 18, 1903.

The process consists of separating particles of a mass or components of a mixture, developing in the particles or components dielectric hysteretic impedance and simultaneously exposing them to the inductive action of a polarized terminal and separately collecting the separated particles or components.



NO. 813,113.—ELECTRIC HEATER.

813,077. Automatic Flashlight Apparatus. Stanislaus Berens, La Grange, and Abraham N. Gatzert, Chicago, Ill. Application filed June 22, 1905.

In an automatic flashlight apparatus are a gas fixture, a gas-regulating valve mounted thereon, an expansible piece mounted above the fixture in the path of the heat of the flame therefrom, and an electromagnet in circuit with the expansible piece. Means connect the valve and the magnet whereby the valve will be turned when the circuit is completed, so as to decrease the flow of gas, and a spring connected to the valve turns it when the circuit is broken so as to increase the flow of gas.

813,081. Sparking Igniter for Explosive Engines. George Cormack, Jr., and Frederick C. Zumdahl, Rockford, Ill. Application filed February 5, 1904.

Details are described.

813,082. Mechanical and Magnetic Toy. Herbert Cottrell, Newark, N. J. Application filed February 27, 1900.

A toy operated by a magnet is described.

813,083. Electrically Controlled Regulating Valve for Humidifying and Heating Systems. Stuart W. Cramer, Charlotte, N. C. Application filed December 29, 1904.

Means for indicating both the humidity and temperature of the air are connected to electrical circuits, which control the valves supplying the heating medium.

813,093. Binding Post. Edwin C. Henn, Cleveland, Ohio. Application filed May 9, 1905.

A binding post for making connections to a battery is described.

813,101. Closed Conduit for Electric Railways. Augustus W. Lohmann, Sr., Chattanooga, Tenn., and Johan Pruis, Chicago, Ill. Application filed March 22, 1905.

Combined with the conduit opening are shutters, each having sides forming an angle. The sides extend from one side of the slot and meet at the opposite side.

813,104. Sparking Device. Harry A. Miller, Los Angeles, Cal. Application filed January 14, 1905.

An ignition device comprises a plug, a spring-held reciprocable contact member, an oscillating contact member, a chamber communicating with the inner end of the plug and a member contained in the chamber and exposed to the cylinder pressure and serving to actuate the second-named contact member.

813,105. Process for Decomposing Water by Electrolysis. William F. M. McCarty, Rocky Ridge, Md., assignor to Thomas A. Darby, trustee, New York, N. Y. Application filed November 8, 1904.

The process of decomposing water consists in adding to the water metallic sodium and then subjecting the water to the action of an electric current.

813,113. Electric Heater. Austin A. Pratt, Los Angeles, Cal. Application filed June 21, 1905.

In an electric heater are a casing, a pair of supporting members arranged therein, insulating blocks carried by the members, conducting clips supported by the blocks and series-connected resistance coils extending between the clips. (See cut.)

813,119. Electric Lock Strike. Harry F. Smith, Richmond, Va., assignor of one-third to J. S Hopkins and one-third to George J. Hooper, Richmond, Va. Application filed January 4, 1905.

A series of lock-releasing devices, each comprising an electromagnet and a movable part, are associated with a group of electric contacts and a switch attached to and operating with the movable part for successively throwing the circuits into action and cutting them out of action.

813,154. Automatic Switch for Electric Railways. Victor Joksch, Karlin-Prague, and Josef Pertik, Prague, Austria-Hungary, assignors of one-third to Richard Butta, Prague, Austria-Hungary. Application filed May 26, 1905.

Magneto-electric devices controllable from the vehicle throw the switch.

813,161. Self-winding Electric Clock. Max Menkin, New York, N. Y. Application filed March 30, 1904.

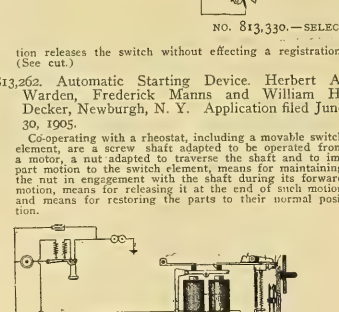
Details are described.

813,184. Relay. Angel Vera and Louis G. Vera, Queretaro, Mexico. Application filed November 26, 1904.

In combination with an armature are opposed electromagnets, one arranged to operate more rapidly than the other, the more rapid of the magnets actuating the armature upon closing of a circuit, and the other magnet actuating the armature upon opening of the circuit.

813,230. Service Meter for Telephone Exchanges. Frank R. McBerty, Evanston, and Edward B. Craft, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed June 10, 1905.

Combined with a tilting lever are electromagnetic mechanism for moving the lever in either direction, a switch controlling the circuit connections of the mechanism and a catch adapted to lock the switch in its actuated position. A registering train is operated by the movement of the lever in one direction, the lever being adapted in such movement to operate the catch to release the switch. The lever when moved in the opposite direction releases the switch without effecting a registration. (See cut.)



NO. 813,230.—SERVICE METER FOR TELEPHOEN EXCHANGES.

813,262. Automatic Starting Device. Herbert A. Warden, Frederick Manns and William H. Decker, Newburgh, N. Y. Application filed June 30, 1905.

Co-operating with a rheostat, including a movable switch element, are a screw shaft adapted to be operated from a motor, a nut adapted to traverse the shaft and to impart motion to the switch element, means for maintaining the nut in engagement with the shaft during its forward motion, means for releasing it at the end of such motion and means for restoring the parts to their normal position.

813,269. Galvanometer. Philip H. Wynne, Boston, Mass., assignor of one-half to Agnes Wynne and one-half to the L. E. Knott Apparatus Company, Boston, Mass. Application filed July 14, 1905.

In a galvanometer are an inverted horseshoe magnet, stilts or struts of non-magnetic material, on which the magnet is supported, and a coil suspended between the poles of the magnet to swing about a vertical axis.

813,287. Electric Traction System. James P. Gorman, Jr., New York, N. Y. Application filed March 31, 1905.

A contact device for electric traction systems comprises a pole, a conductor extending through the pole and having its upper end threaded, a contact block surrounding the conductor and a nut operating upon the conductor thread above the contact block.

813,297. Electrical Safety Device. Elwood B. Hosmer and William N. Dietrich, Montreal, Canada. Application filed June 30, 1902.

Protection for an electric circuit is assured by an electric safety device, comprising an additional circuit in shunt with the circuit, the additional circuit including two electromagnets, the relative positions of which are changeable. Means coacting with the electromagnets are actuated upon the change of position, for opening the circuit to be protected. A permanent ground connection is connected to the shunt circuit.

813,308. Warp Stop-motion for Looms. Frederic E. Kip, Montclair, N. J., and Ernest Greenwood, Bridgeport, Conn., assignors to the Kip-Armstrong Company, New York, N. Y. Application filed March 3, 1905.

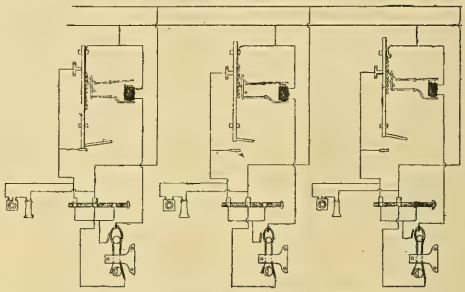
In a warp stop-motion for looms are a controlling circuit for setting in operation the stopping mechanism, a harness frame having a fixed contact bar secured thereto, a series of heddles suspended on the bar, a switch comprising plates to which the terminals of the circuit are connected and shoes carried by the harness frame and electrically connected to the bar. The shoes are adapted to break and close the circuit through the plates as the frame alternately rises and falls.

813,309. Warp Stop-motion for Looms. Frederic E. Kip, Montclair, N. J., and Edwin C. Smith, Central Falls, R. I., assignors to the Kip-Armstrong Company, New York, N. Y. Application filed October 27, 1905.

In a warp stop-motion for looms are a controlling circuit for setting in operation the stopping mechanism, a harness frame having a series of heddles suspended therein, a switch included in the circuit, pattern-forming mechanism and means actuated directly by the pattern-forming mechanism for controlling the opening and closing of the switch.

813,330. Telephone System. Ralph Sherer, Eaton, Ohio. Application filed October 17, 1904.

A selective telephone comprises talking and ringing circuits, movable bars having contact plates arranged in the talking circuit, electromagnets arranged in the ringing circuit, pawls actuated by the magnets adapted to lift the bars step by step and means for cutting out the electromagnet at the calling station. (See cut.)



NO. 813,330.—SELECTIVE TELEPHONE SYSTEM.

813,353. Insulator. Huntington B. Crouse, Syracuse, N. Y. Application filed April 18, 1904.

A cup-shaped insulator has an end wall or bottom provided with a central opening surrounded by an annular flange in combination with a metal socket having bottom flanges resting upon the bottom of the insulator at opposite sides of the flange.

REISSUE.

12,453. Electric Meter. Thomas Duncan, Lafayette, Ind., assignor to the Duncan Electric Manufacturing Company, Lafayete, Ind. Application filed August 9, 1905. Original application dated August 1, 1905.

Combined with a motor wattmeter whose shaft has a lower bearing and an upper inverted end thrust bearing are a magnetic suspension device for supporting the rotating element of the meter and mechanism for effecting adjustment of the end-thrust bearing axially of the shaft. The bearing at the upper end of the shaft serves to aline the shaft at the upper end and to prevent lateral deflection thereof mechanically.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on February 26, 1906:

398,402. Current-collecting Device for Electric Railways. R. M. Hunter, Philadelphia, Pa.

398,420. Electric Burglar Alarm. L. A. McCarthy, Brooklyn, N. Y.

398,457. Alternate-current Electric Motor. O. B. Shallenberger, Rochester, Pa.

398,458. Alternate-current Electric Motor. O. B. Shallenberger, Rochester, Pa.

398,489. Support for Electric-railway Wires. T. H. Brady, New Britain, Conn.

398,498. Conductor for Electric Railways. O. Dahl, Brooklyn, N. Y.

398,513 Electric Switch. W. S. Hill, Boston, Mass.

398,560. Electric Switch, F. A. Weller and A. F. Rietzel, Lynn, Mass.

398,561. Electric Switch. F. A. Weller and A. F. Rietzel, Lynn, Mass.

398,566. Electric Cut-out. W. H. S. Wright, Kansas City, Mo.

398,577. Electric Brake for Railway Trains. A. H. Bowman, Packerton, Pa., and W. P. Widdifield, Uxbridge, Ontario, Canada.

398,613. Electrical Railway Signal. H. Hayden, Jr., and W. F. Z. Desant, New York, N. Y.

398,614. Quadruplex Telegraphy. C. L. Healy, Brooklyn, N. Y.

398,661. Insulating Support for Electric Conductors. S. H. Short, Columbus, Ohio.

398,662. Electric Railway. S. H. Short, Columbus, Ohio.

398,663. Switch Mechanism for Electric Railways. S. H. Short, Columbus, Ohio.

398,668. Regulator for Dynamo-electric Machines. E. A. Sperry, Chicago, Ill.

398,731. Electrical Bathing Machine. J. W. James, Cuba, Tenn.

398,769. Electric Circuit Coupler. S. C. C. Currie, Philadelphia, Pa.

398,774. Incandescent Electric Lamp. T. A. Edison, Menlo Park, N. J.

398,794. System of Synchronizing Electric Motors. F. J. Patten, New York, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVIII. CHICAGO, MARCH 10, 1906.

Twenty-thousand Volt Single-phase Locomotive for the Swedish Railways.

By C. Smith.

The Swedish Railways have been conducting experiments for the last six months with two locomotives and two motor cars constructed by different concerns, with a view to electrifying their lines. These trials were conducted on the line from Tomtebode to Vartrau, near Stockholm. A single-phase current of 25 cycles frequency was used. The locomotive shown attached to a train in the accompanying illustration was built by the Siemens-Schuckert Company, while others were furnished by the Allgemeine Electric Company of Berlin and the Westinghouse Company of London.

The Siemens-Schuckert locomotive has three

20,000-VOLT SINGLE-PHASE LOCOMOTIVE ATTACHED TO TRAIN ON SWEDISH RAILWAY.

driving axles, each driven by a compensated series motor similar in design to those used on the Murnau-Oberammergau line in Bavaria, and described by the writer in the Western Electrician of September 9, 1905. The motors have a capacity of 110 horsepower and work under a pressure of 320 volts, the frequency being 25 cycles. Gearing reduces the speed 1 to 5.

A freight train can be drawn with a speed of 45 kilometers an hour on the level and 24 kilometers an hour on a 10 per cent. gradient. The locomotive itself weighs 36 tons. The maximum tractive effort of the motors at the wheels is 6,000 kilograms.

The chassis is short and compact, and carries the body of the locomotive. This is of steel construction, and is divided into two parts, the engineer's compartment and a place for the apparatus. The total height is 3.5 meters and the length of the body is 6.4 meters. The driving wheels have a diameter of 1,100 millimeters.

An oil-cooled transformer of 300 kilowatts capacity is located in the forward compartment of the locomotive and feeds the motors. The primary is divided into eight windings, which can be grouped in series or parallel, so that the voltage supplied to the primary through the overhead line may vary. The maximum and ordinary tension is 20,000 volts, but since one of the principal purposes of the tests was to find the highest satisfactory voltage for single-phase traction service, the hydro-electric plant supplying the power varies the tension as desired from 2,500 to 20,000 volts by steps of 2,500 volts.

In any case use is made of the grouping corresponding to the voltage furnished. By means of

engineer's compartment. A bare copper wire supported by insulators then receives the current, which also passes through lightning arresters.

The brakes are of the vacuum type. The 12 shoes exert a pressure of 80 per cent. of the total weight. An air reservoir is placed in the cab. An auxiliary hand brake is also utilized.

Electrical Exports for January.

Electrical exports from the United States for the month of January amounted to a total value of $1,329,192. This may be compared with $952,609 in January, 1905. The figures for January, 1906, are nearly as large as those for the best month in 1905, which was December, with total electrical exports amounting to $1,525,717. Both classes of goods—electrical machinery and electrical appliances, the latter including telegraph and telephone instruments—show a good increase for January, 1906, over the corresponding month in 1905. The figures are: Electrical appliances—January, 1906, $529,253; January, 1905, $387,610. Electrical machinery—January, 1906, $799,939; January, 1905, $564,999.

Considering electrical machinery only, the following named countries, with the amounts of their purchases, were the principal buyers of electrical machinery from the United States in January, 1906: British North America, $195,142; United Kingdom, $158,569; Mexico, $87,758; Cuba, $81,175; Japan, $39,046; France, $31,532; British Africa, $20,931; British Australasia, $29,572; British East Indies, $20,400; Brazil, $9,507; Germany, $7,233; Philippine Islands, $7,049; Hongkong, $3,838; Argentina, $4,516; Chinese Empire, $2,280; Central American states and British Honduras, $3,000.

Niagara Waterpower Situation.

[illegible]

which are on the Canadian side and six on the American side of the river. It is further pointed out that the International Paper Company and the Niagara Falls Water Works Company use not a little of the water from the upper river, and it is mentioned that the Ontario Power Company has a franchise for taking water from the Welland River, in addition to its Niagara River rights, which it is now developing. Should all of the 10 non-developing companies which have been granted authority to use Niagara water on both sides of the river, and which are not limited in respect to the quantity they may take, carry out their undertakings upon anything like the scale adopted by the companies whose works are now in course of construction, there can be no question, say the commissioners, that the Falls of Niagara as a scenic spectacle would be most seriously impaired, if not entirely destroyed.

For this reason the commissioners offer the following suggestions:

(1) That the whole subject involving the further diversion of water from the Niagara River for power development in excess of the charters now being exercised be referred to an international commission appointed by the governments directly interested, territorially or otherwise, in order that an agreement may be arrived at between such governments as to further withdrawals of water on both sides of the river.

(2) That a careful inquiry be made by the governments indicated respecting the charters already granted, but in regard to which no works whatever have been commenced, with a view to the cancellation of the same.

The report makes mention of the fact that the sources of the Niagara River reach into seven states of the Union, besides the province of Ontario, and that this fact, with other considerations, makes the question an international one. As the relative drainage area in each country into the

Great Lakes and through the Niagara River is approximately the same, the withdrawal of water on each side of the line should in theory be approximately the same. The flow over the Canadian Fall, however, is about 90 per cent. of the entire waters of the river. The average outflow has been determined by United States engineers to be 222,400 cubic feet per second, which will produce, with 210 feet estimated head, a theoretical energy equivalent to 5,300,000 horsepower. Under the most favorable circumstances, however, only about two-thirds of the nominal power could be available. The Chicago Drainage System, withdrawing 600,000 cubic feet a minute[1] from the lake supply, has also to be considered, while the actual heads under which the various companies operate have also to be taken into account. The available head at Niagara is 210 feet, and the Niagara Falls Hydraulic Power and Manufacturing Company is the only company using this head.

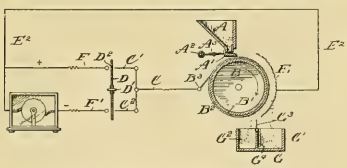
Electrical Separation of Substances of Different Dielectric Capacities.

Various methods of separating, by electrical or magnetic means, the particles of a mass or the components of a mixture have been operated with success. These processes, however, generally utilize the difference in conductivity of the particles to bring about the desired results, or else make use of the magnetic or diamagnetic effects produced upon a limited number of certain substances introduced into the field of an electromagnet excited by an alternating current. The diamagnetic particle in this case tend to move from the strong to the weak part of the field, the maximum effect manifesting itself in particles which are conductors of electricity.

One of the principal objects and advantages of an invention recently patented by Henry M. Sutton, Walter L. Steele and Edwin G. Steele of Dallas, Texas, is to provide an electrical process of separation which can be applied to substances regardless of their being or not being electrically conductive or magnetic. The invention, briefly stated, consists in developing in the particles or components to be separated dielectric hysteretic impedance. It also consists in various modifications in the degree, periodicity and maintenance of the impedance.

Dielectric hysteretic impedance may be produced from various sources of energy and by various means. In the present instance an alternating, varying, pulsating, static current is employed to produce dielectric hysteresis in the substances to be separated, and this dielectric hysteresis impedes the static charges on the surface of the particles of the mixture, and is called "dielectric hysteretic impedance." This, the governing factor in the process, may be produced by static currents that alternate in polarity, making an alternating static field; or by static charges which are pulsating, but of the same polarity, making a pulsating static field; or by static charges which vary in strength, making a static field of varying intensity; or by alternating static currents of unequal periods.

The development of a sufficient dielectric hysteretic impedance to cause particles to be swerved from a normal path or to adhere to a conveying surface is the proper measure of frequency of alternation or variation, and this differs with the different particles of substances. This result having been produced in some of the particles, other



ELECTRICAL SEPARATION OF SUBSTANCES HAVING DIFFERENT DIELECTRIC CAPACITIES.

particles in which impedance develops at a different speed of alternation or variation are in condition for actual separation by subsequent treatment or by mechanical or other means. Again, some particles are more susceptible to a negative charge than to a positive, or vice versa, as the molecules more easily turn on their axis in one direction than the other, so that changes in polarity of the static field and of periodicity have effective value in developing in the particles the desired hysteresis.

When subjected to periodic, pulsating, or varied electrostatic influence or stress, particles take on a molecular strain or polarization, which manifests itself after the removal of the influence or charge that causes the strain, and its effects are afterward shown by the appearance of a residual charge similar in its nature to that appearing in a Leyden jar after a few moments' rest subsequent to a recent discharge. This residual charge varies in amount according to the dielectric which separates the two coatings of the jar. Similar conditions can be brought about in the invention, the substances to be separated being the dielectric between the surfaces that serve as media for the subjection of the substances to the action of the separative force or forces.

The accompanying diagram is a representation of an apparatus adapted to subject material for separation to an alternating electrostatic field. (A) is a hopper provided at its outlet with a shaking pan (A'), operated by an eccentric (A^2) and connecting rod (A^3) to distribute the mass coming from the hopper upon the cylinder (B), which is provided with any suitable means for rotating in the direction indicated by the curved arrow. The cylinder (B) has an insulating covering (B') and an outer conducting surface (B^2), which is adapted to be charged by a brush (B^2), connected by electrical conductors with an alternating static generator or pole changer (D). At one side of the cylinder (B) a metallic plate or screen (E) is located, and this may be grounded, or connected to the opposite side of the electrostatic generator from that which is connected to the cylinder (B), as at (E^2).

One type of pole changer is shown in the diagram and consists of a disk (D) of hard rubber or other insulating material and mounted on a suitable shaft (D') for rotation by any suitable means and having one or more holes (D^2) located between its center and its periphery, whereby charges of successive signs, plus and minus, will pass through the holes to one of the terminals (C') or (C^2) during each revolution of the disk. A given speed of rotation will deliver a definite number of positive and a definite number of negative charges to the cylinder (B), by which any desired frequency can be attained. To vary the relative periodicity of alternation, a slot may be used instead of a hole in any series of openings which may be formed in the disk.

The operation in the form shown in the illustration is as follows: The mass is fed from the hopper to the conducting surface of the cylinder, which is charged from an alternating source of static electricity capable of giving definite periods of alternations. Some of the particles of the mass thus subjected to periodic changes are caused to differ in potential from that of the surface of the cylinder, while others that develop little hysteretic impedance at certain periodicities of the electrostatic charges are practically capable of allowing the charges induced on their surfaces to follow in phase that of the conveying surface of the cylinder, so that an alternation of one polarity practically neutralizes that of the other, and these particles consequently remain in an approximately neutral condition, and on rotation of the cylinder they drop through the screen into the compartment (G') of the receptacle (G). On the contrary, the particles, by impedance in phase caused by their molecular polarity or hysteresis, lag in phase of change behind that of the conducting surface, and this causes a difference of potential to be constantly maintained between the particles and the conducting surface of the cylinder, so that they adhere until further rotation of the cylinder carries them beyond the condensing action of the screen (E), and they fall into the compartment (G^2). The screen serves to bring about the opposite relation of the conducting surface, so as to intensify the electrostatic field.

There are various other forms of the apparatus described, but this forms a typical example of the method of operation.

Hydro-electric Station of Plan du Var.

By A. de Courcy.

The Mediterranean region of France is one in which hydraulic power is developing considerably. The different coast towns, such as Nice, Cannes and others, are using a large amount of current for lighting as well as for the extensive tramway systems which are now in operation. The mountain region which lies near the coast furnishes the necessary power, and it is stated that before long there will be as much as 35,000 horsepower utilized in hydraulic plants. At present the largest of these stations are those of Mescla, Levens and Loup, which have been running for some time. A new plant has, however, been lately erected in this region which is of importance, and which was briefly alluded to in the Western Electrician of January 6th. It is known as the Plan du Var station, and was erected by the French Thomson-Houston Company for the local syndicate known as Energie Electrique du Littoral Mediterranéen. When entirely completed it is to contain three main turbine and dynamo sets. The current is added to the circuits of the Mescla and Levens stations, which were installed by the same company. Fig. 1 is a view of the plant. Fig. 2 is a picture showing one of the most recent of the Plan du Var sub-stations, which is of somewhat unusual architecture. Fig. 3 is a view illustrating the high-tension line construction at a railroad-crossing point.

FIG. 1. HYDRO ELECTRIC STATION OF THE PLAN DU VAR POWER PLANT.

The hydraulic-turbine unit now installed is of the double horizontal-shaft type. These wheels were furnished by the well-known Swiss firm of Escher, Wyss & Co. and were built at their factory at Zurich, being constructed on the Francis system. The capacity of the turbines is rated at 900 to 1,000 horsepower. Direct coupled to the wheel is a three-phase alternator, which gives 600 kilowatts normally, and was built at the Paris shops of the Thomson-Houston Company. The turbines are designed to operate under a head of water from the Var River which varies from 25 to 27 meters, and arrangement have been made to add to this height by suction of the water some 6.75 meters, counted from the floor level of the dynamo room down to the water level in the offtake canal. When working under the conditions the turbine can develop its normal power at the speed of 375 revolutions a minute.

At present the form of turbine wheel consists

1. This is erroneous as referring to existing conditions. The present capacity of the Drainage Canal is 300,000 cubic feet a minute.—Ed. W. E.

essentially of a spiral water chamber with inlet tube and base, containing a double wheel, besides a double water distributor with movable vanes and two bracket bearings. A hand speed regulator is provided, besides an automatic speed governor which acts upon the water distributing vanes. The bearings of the wheel are provided with anti friction metal, and are of the self oiling type. They are provided with special arrangements for taking up the wear in a continuous manner without displacing the axis of the wheel. The vanes of the water distributors are of the best quality cast steel, and are provided with bronze sockets, so as to reduce to a minimum the wear from the water of the Var, which is often charged with impurities. The main shaft of the turbine drives by belt an automatic regulator of the oil pressure type, consisting of a differential piston, which is made to act upon the movable vanes of the water supply, and this device is designed so that it reduces the section of the flow without producing any disturbance inside the wheel.

Oil which is needed for operating the differential piston is furnished by a high-pressure pump. The latter is provided with an oil reservoir, an air chamber and a controlling pressure gauge of large dial. This pump, which is connected by special piping with the oil reservoir, on the one hand, and with the differential piston on the other, is operated by an electric motor on the station circuit, using a double-belt transmission. In this way the speed of the motor, which is 750 revolutions a minute, is reduced to 60 revolutions for the pump. The turbine outfit is completed by different accessories which are used to operate it, such as the pressure gauge, vacuometer, with valves and piping, and a tachometer driven by belting.

Regarding the three-phase alternators which are mounted in the Plan du Var station, these machines are of the type having a fixed exterior armature placed in the outer casting and a revolving field of eight poles mounted on the shaft.. This machine is able to deliver the 600 kilowatts without having any of the parts heat up to more than 40° C. above the surrounding atmosphere. The normal

FIG. 2. ONE OF THE PLAN DU VAR SUBSTATIONS.

speed of the alternator is 375 revolutions a minute, and it delivers the three-phase current at a maximum tension of 11,000 volts when running at full load, with a power factor of 0.9 and a frequency of 25 cycles. The armature coils are wound on special forms, so as to make them interchangeable and allow them to be easily replaced in case they become damaged.

Field coils are formed of a copper-band winding, and an independent exciter is used to furnish the current for the fields, which are run at 60 volts. As to the efficiency of the above group, it is stated to reach about 71 per cent. upon a full non-inductive load, allowing 75 per cent. for the turbine and 95 per cent. for the alternator.

For the exciter of the above machines a compound dynamo is used which has a capacity of 30 kilowatts, operating at 800 revolutions a minute. The exciter is driven by belt from a pulley mounted on the shaft of the alternator next the turbine, and it has sufficient capacity to take care of all three alternators of the station when they are installed. The exciter is mounted upon the same foundation with a small compound-wound machine, to which it is connected by a coupling, so as to drive it direct. The latter machine is used to deliver current at 110 volts for the lighting and motors of the station.

Fig. 4 shows a view of the switchboard, which is mounted in one side of the dynamo room. The main switchboard is contained in an upper gallery, while below it is placed the [illegible] apparatus. Since that the Plan du Var station, besides furnishing current [illegible] used as a reserve current for the [illegible] belonging to the [illegible] Mediterranean Company, the [illegible] carries a double set of bus-bars, [illegible] and one [illegible] panel [illegible] used for the alternator and [illegible] three main lines of the Mediterranean [illegible] pumping the current from the [illegible] Lecque, and Var Valley, can be connected [illegible] the alternator, with one of the [illegible]

FIG. 3. HIGH-TENSION LINE OF PLAN DU VAR CROSSING RAILROAD TRACK.

bus-bars by double-throw switches. This allows of realizing all the possible combinations of machines and circuits, and is especially useful in allowing the machines in the present station to be connected in so as to help out either the Pataras or the Mescla circuits. Below the ironwork gallery which contains the switchboard panels is placed a series of chambers built of brick. These chambers hold the oil switches, including the double-throw switches mentioned above. Each of the line panels carries a switch, three ammeters (one per phase), a three-pole oil switch for high tension with separate phases, provided with a circuit-changer operated from a distance, and an automatic-break magnet for overload. The station panel carries an oil switch of the preceding form, but it is not made automatic. It is designed to allow, when necessary, the coupling of the two series of bus-bars, and they are equipped with two voltmeters for this purpose. The alternator panel carries an ammeter, a voltmeter, a power-factor indicator, a field rheostat with hand-wheel, provided with field switch and discharge resistances, a polyphase meter of the induction type, a double-throw switch and an automatic oil switch.

All the oil switches of the automatic type are provided with a tripping coil, which is supplied at low voltage from a small battery of accumulators of 12 cells. The overload relays close the circuits of these coils when the main current through the corresponding switches becomes too high. In the rear of the switchboard, along the wall of the building, are placed the outgoing circuits of the lines of Var, Mescla and Levens.

Proposed Wire Ordinance in Minneapolis.

The recent agitation in Minneapolis over electrical conditions has resulted in the drafting of a new wire ordinance by George T. Raymond, outside wire inspector, which will soon be ready for presentation to the City Council. Following are the most important features of the ordinance:

Permits issued by the outside wire inspector must be obtained for all work contemplated by the wire companies. Owners of existing overhead wires or underground conduits must file plans of the same with the city engineer within six months after the passage of the ordinance. Service wires must be properly insulated and line wires must be covered with weatherproof paint, and such wires shall not pass over roofs or under sidewalks except within the block where distribution pole is situated. No wires shall cross alleys or streets diagonally from distribution pole to buildings, but must span the space horizontally to buildings and follow wall surface of building up or down. All poles must be tagged with name of owner, and on joint pole lines different companies must use separate cross-arms, each arm to be painted a different color for purposes of identification. High-potential wires on roof fixtures must be differentiated from other wires by special insulation to signify that they are dangerous to human life. Wire network in congested districts to be eliminated by substituting underground conduits or aerial cables for groups of wires entering buildings from terminal poles.

It is also the intent of the ordinance to compel

Organization of Pacific Gas and Electric Company Completed.

[illegible] board, [illegible]

[illegible] A. Britton; [illegible]

The company [illegible] the [illegible] Superintendent [illegible] tion of [illegible] current. The [illegible] destroyed [illegible] rent downtown, according to [illegible] number of private direct-current plants [illegible] were drawn upon during the [illegible] by the fire, and some of [illegible] current. The [illegible] estimated at $550,000 and the net [illegible] The insurance on the damaged [illegible]

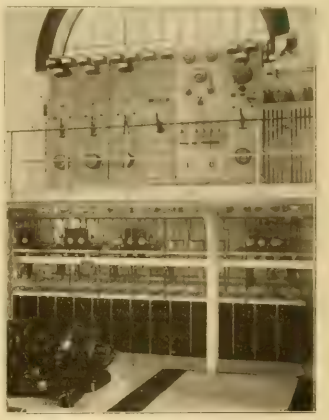


FIG. 4. SWITCHBOARD AND HIGH-TENSION APPARATUS IN PLAN DU VAR STATION.

tion is about $135,000. The insurance companies have not completed their appraisement, however. Out of the six engines and 11 generators in the burned dynamo room only one engine is in a condition that will permit of repairing. This part of the plant was to have been closed down permanently within a few weeks.

The Board of Supervisors of San Francisco has reduced the gas rate from $1 to 85 cents a thousand feet, and if the fire had not taken place they say they would have made it 75 cents. The rates to be charged for electric current were not altered in any respect, and the Pacific Gas and Electric Company now has a chance to give the city, for the first time in its history, it is said, an adequate supply of electric current at a fair rate of profit. Ornamental iron posts for gas lamps will be installed free by the company on Market Street, costing $100,000.

Institute's Foreign Journey.

New York, March 6.—It is now decided that a party representing the American Institute of Electrical Engineers will visit Italy in the middle of June and proceed thereafter to England, attending the international gathering of English, American, German and Italian electrical engineers in London. This will be, in a measure, a return visit to the English and Italian electrical engineers who made the "circular tour" in the United States in 1904.

D. W. W.

Death of Henry Rustin.

The death of Henry Rustin on February 27th, briefly mentioned last week, is worthy of more than passing mention, for since the death of Luther Stieringer, whose pupil he was, Mr. Rustin was undoubtedly the foremost decorative electrical illuminating engineer in the United States. Mr. Stieringer revolutionized incandescent electric lighting as applied to decorative illumination on a large scale, particularly at expositions, and Mr. Rustin followed in his steps and extended the work by his own native ability and taste.

HENRY RUSTIN.

The exposition experience of Mr. Rustin began with the Trans-Mississippi Exposition held at Omaha in 1898, where he held the position of mechanical and electrical engineer. Here, associated with Mr. Stieringer, he planned and successfully carried out a lighting scheme which was favorably commented upon by everyone that saw it. It was at this exposition that incandescent lamps were first depended upon entirely for the illumination of buildings and grounds within the central portion, or that part commonly called the "grand court." The Trans-Mississippi was so eminently successful (to which the electrical effects contributed no small part) that it was decided to repeat it the following year, and the position of superintendent of the division of buildings and grounds, which included the electrical department, was offered to Mr. Rustin and accepted by him. The exposition in 1899 was known as the Greater America, and its electrical effects were even more beautiful than those of its predecessor.

Mr. Rustin's third exposition was the Pan-American, held at Buffalo, N. Y., in 1901, and here, again associated with Mr. Stieringer, he built up the most beautiful display of decorative electric lighting that had ever been seen at an exposition. At this exposition he departed from common practice and used 25-cycle current for all incandescent lighting. At the Buffalo exposition Mr. Rustin carried the greater part of the burden of electrical-engineering responsibility, and he showed indomitable energy as well as good judgment, tact, technical ability and correct taste.

The lighting of the Pan-American was the most notable achievement in Mr. Rustin's career, but he hoped to make at the (1904) World's Fair at St. Louis, of which he was appointed chief mechanical and electrical engineer in November, 1901, the most attractive display of decorative lighting that had ever been seen. Unfortunately, his health broke down in the fall of 1903, compelling him to leave St. Louis, giving up entirely all work, and he was not able to complete his plans. All lighting, however, at the St. Louis Fair was done, as near as possible, in accordance with plans originated by Mr. Rustin. When his health failed his place was taken by Edward B. Ellicott of Chicago. Although Mr. Rustin's plans were not carried out in their entirety, and some of the original ideas were not brought to realization, Mr. Ellicott was able, even at the late date at which he took hold of the work, to make of the Cascades and the whole central picture of the St. Louis Fair, a most beautiful spectacle.

Mr. Rustin's health continued so precarious that he was not able to visit St. Louis until November in 1904. Then, just before the closing of the Fair, he was permitted by his doctors to return to see the results of the work he had planned.

Henry Rustin was born in Omaha, Neb., in 1865, the son of one of the best-known residents of that city. He took a graduate and post-graduate course at Yale, being of the class of 1886 of the Sheffield Scientific School, in electrical and mechanical engineering. The time between his graduation and the Trans-Mississippi Exposition he spent constructing the electrical plant and lines of the Omaha Street-railway Company and in doing construction work for the Portland Consolidated Street Railway Company of Portland, Ore. After his exposition experience, in 1905, he thought himself again able to resume active work and accepted the position of chief engineer of the Omaha Water Company. He was not in good health, but held this position until his death on February 27th. Mr. Rustin died of tuberculosis. He was married in 1904 to Miss Lola Goodwin, daughter of Major Goodwin of the United States Army, in Portland. His wife and two children survive him. He was sincerely esteemed by all who had the privilege of knowing him. Mr. Rustin was an associate member of the American Institute of Electrical Engineers and a member of the Engineers' Club of St. Louis.

Tollboard Equipment of the Tri-State Telephone and Telegraph Company.

A good example of up-to-date telephone toll practice is furnished by the system of the Tri-State Telephone and Telegraph Company of St. Paul, Minn., which operates in conjunction with the Twin City Telephone Company of Minneapolis and the Zenith City Telephone Company of Duluth, Minn. This system is one of large extent as will be seen by the map (Fig. 1), covering a large part of the best of Minnesota territory and extending into Wisconsin, Iowa and the Dakotas. The heavier lines indicated on the map are the lines in operation, and the dotted lines represent proposed toll lines.

The Tri-State company was organized in 1903, and now has in operation 2,500 miles of toll lines: These include 12,000 miles of copper wire. The lines connect with 1,200 towns in the Northwest, giving service to 70,000 subscribers' stations. The president of the company is E. H. Moulton; vice-president and treasurer, L. L. C. Brooks; secretary, F. C. Nelson. The tollboard equipment, which is located at Merriam Park, St. Paul, is one of the latest types of equipment installed by the Kellogg Switchboard and Supply Company of Chicago, and it embodies many features of unusual interest. Fig. 2 is an illustration of the building in which the exchange is located.

FIG. 1. LINES AND PROPOSED LINES OF TRI-STATE TELEPHONE AND TELEGRAPH COMPANY.

What is known as the major-type multiple tollboard was installed. A feature of this board is that the appurtenances which go with it, especially in regard to the phantom and compositing circuits, are not made up of sundry parts but display a marked uniformity and standardization not often found in toll equipments of this nature. The beginning of this standardization was instituted by the Kellogg company in the equipment installed for the Kinloch Long-distance Telephone Company of Missouri, and at the time of the installation of the Tri-state equipment this standardization had been made much nearer perfection. Particular difficulties have been met in designing the coils for phantom circuits.

There are in this installation six sections of regular multiple tollboard, each of these sections being two-position solid mahogany cabinets, as shown in Fig. 3. There is in the same line an additional section which is used for the information of the operator and also for service-testing lines. There are also a ticket section and two recording sections (at the left in Fig. 3), one one-position chief operator's desk (middle of Fig. 3), and one two-position wire chief's desk (Fig. 4) completing the switchboard proper. In addition there are a composite panel and one battery fuse panel. Fig. 5 is a view of one panel of the main tollboard.

Line equipment consists of 80 toll lines at present, 150 toll answering jacks, 80 incoming toll trunks, 40 recording toll trunks and 40 lines between positions known as inter-position trunks. The lines are led into the exchange in the usual manner, making use of a main distributing frame and an intermediate distributing frame.

All of the toll and recording sections are equipped with calculagraphs. The second and third sections of the recording toll board are equipped with ticket boxes. The first position of the toll switchboard is used as an information position and is equipped with 24 order-wire circuits. This position is also equipped with an instruction circuit, which is utilized for the instruction of operators during the operation of the switchboard. There is also a messenger call key located in this position.

Position two is equipped with a service-testing circuit, and is also to be utilized as a monitor's position and is equipped with a messenger call key. This position contains mechanical busy signals for the entire equipment of the 80 toll lines. Eighty multiple toll-line jacks, 80 lamps for the toll monitor, 80 incoming toll-trunk multiple jacks, 40 mechanical busy signals and 40 spring jacks for the interposition trunk multiples, besides 10 answering jacks and 40 recording trunk multiple jacks, complete the jack equipment.

In the pilot rail below the second panel of jacks there is a line pilot lamp, having a white opal to which the toll line answering jack lamps are wired. The instruction pilot has a red opal, and another pilot has a green opal, which is used with the recording and interposition trunk circuits. There is another white pilot in the fifth panel, which is wired in connection with the monitor's lamp.

The remaining positions, three to fourteen, are used as regular toll positions, each of these positions being equipped with a repeating-coil cord circuit on the left. The remaining seven pairs of cords in each position are equipped without the repeating coil. Each position is wired for 24 order wires and a key, which is wired in connection with the instruction circuit. Each position is also equipped with a messenger call.

The right-end position of each section is equipped with a cut-in jack to be used by the supervisory operator. Each of the sections has the same toll line and incoming toll-trunk multiple equipments as the first section.

Recording equipment is as follows: The first section is used as a ticket and messenger call section. It has no cords or operators' sets. The second and third sections of the recording board are equipped as regular recording sections of two positions. Each position has six pairs of cords, each cord circuit having four supervisory lamps arranged in two rows.

Lamps on the left of each group of four are supervised and controlled by the subscriber; those on the right of each group are toll disconnect lamps and are controlled by the regular toll operators and incoming toll-trunk connections. Each position is wired for 24 order-wire circuits. Each of these positions has a regular operator's telephone set, and at the right of each section there is a

FIG. 2. EXTERIOR OF TRI-STATE TELEPHONE COMPANY'S EXCHANGE IN MERRIAM PARK, MINN.

cut-in jack which is used as a supervisor's trunk-answering jack.

Below the toll-trunk multiple jacks in each section are mounted mechanical busy signal and spring jacks, which are used as the interposition trunk multiples. At the bottom of the middle panel in each section are mounted spring and lamp jacks to be used for the toll-answering and interposition trunk circuits. Forty recording toll trunks are multipled between each position of sections two and three.

Toll lines are wired from the main distributing frame to the multiple side of the intermediate frame. From the answering-jack side of this frame, these lines are wired to the toll-line jacks in the composite panel. From these jacks in the composite panel, the lines are wired back to the multiple side of the intermediate frame. From the answering-jack side of the intermediate the lines are also cabled to the wire chief's desk, and from this desk back to the multiple side of the intermediate. From the multiple side of the intermediate these lines are wired to the multiple-

[illegible] operated as long as the [illegible] upon the [illegible] operator [illegible] number of the toll [illegible] end of the same [illegible] that line [illegible] number. [illegible] operator [illegible] with a double cut-off [illegible] cut-off [illegible] on the [illegible] being. Disconnection [illegible] order ringing [illegible] supervisory lamps, which remain lighted until the connection is taken down.

If a toll subscriber wishes a connection with a local subscriber he calls the operator and upon learning the number of the local subscriber gives this desired number to the trunk operator at the proper local exchange over a trunk line, at the same time testing the line of the required subscriber. If everything is clear he inserts the trunk plug into the jack of the required subscriber and rings. During the time the toll operator connects the toll subscriber with the incoming toll trunk jack of the number assigned Lamp supervision is provided at each end of the trunk in a manner similar to the usual simple cord circuit connection.

If a local subscriber wishes a toll connection he calls the local operator in the usual manner, designating the number or name of the toll party desired. The local operator makes a connection with the recording operator over a trunk circuit, which lights a lamp at the recording operator's position. The recording operator answers the call, and upon learning the toll subscriber's desired number tells the local subscriber to hang up his receiver, as he will be called as soon as the toll subscriber can be reached. The recording operator puts a tone test back on the local subscriber's line, thus holding the line. The recording operator calls

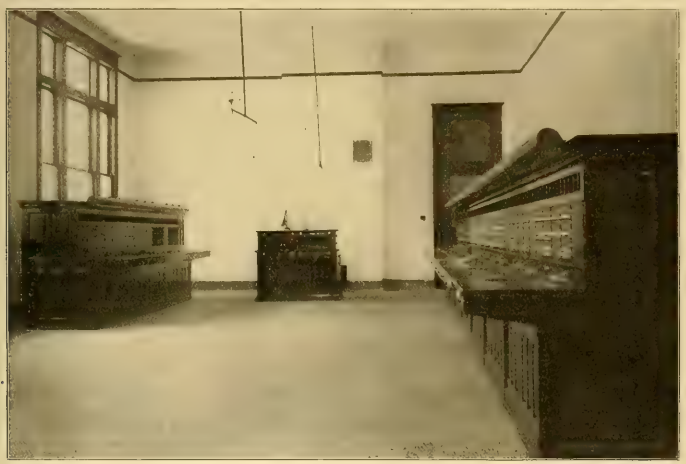


FIG. 3. RECORDING SECTIONS, CHIEF OPERATOR'S DESK AND TOLLBOARD IN TRI-STATE TELEPHONE COMPANY'S EXCHANGE.

jack busy signal in the first section of the toll board. From the answering-jack side of this frame these lines are wired to the answering jacks in the various positions of the tollboard.

The wire chief's desk (Fig. 4) is of a two-position type and has a jack frame made in three panels. The desk is equipped with all the necessary apparatus for making complete testing in any part of the switchboard or the outside lines. A voltmeter and wheatstone bridge for the testing circuit is common to both positions.

The composite panel is of the upright type, the center panel being equipped with the toll-line jacks. The plug shelf of this board is wired for 20 duplex circuits. The front of these duplex circuits is also wired for 20 simplex circuits. This board is also equipped with an operator's telephone set, listening plugs and two Morse cord circuits from the wire chief's desk.

Duplex and simplex circuits are wired to their necessary apparatus, which are mounted on a special rack in the terminal room.

Operation of the exchange is as follows: If a toll subscriber desires a toll connection he signals the exchange operator by the hand generator in his instrument. This causes the line lamp in front of the toll operator to light up, and at the same time displays a mechanical busy signal in all other positions, thereby showing the other operators that that line is busy. The toll operator then inserts an answering plug of one of the toll to toll cords into the answering jack of the line of the calling subscriber. This operation extin-

the trunk operator at the local exchange over the wire, giving the number of the local subscriber who is calling. She says to the trunk operator "tone," which denotes that the call is for a toll connection. The trunk operator then tests the multiple of this line, and upon geting the "tone test" knows the proper number has been obtained and plugs it.

The recording operator, after receiving the trunk assignment, plugs into the jack of this number in

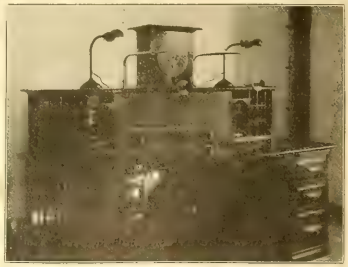


FIG. 4 WIRE CHIEF'S DESK IN TRI-STATE TELEPHONE COMPANY'S EXCHANGE.

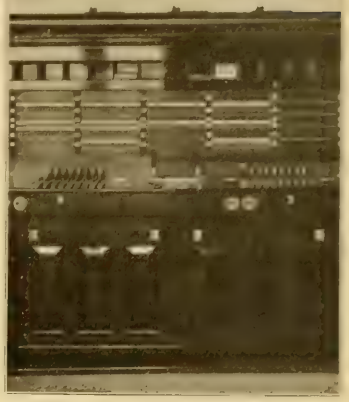


FIG. 5. ONE SECTION OF [illegible] OF THE TRI-STATE TELEPHONE COMPANY.

versa, these circuits also enabling the toll operator to connect a subscriber with the supervising operator. An instruction circuit is provided which runs from all operators to the chief operator's desk, used to give or obtain information. When an operator wishes a messenger she operates a messenger call key, which signals the ticket section. When the messenger answers the call he restores the key at the toll position to its normal position.

The chief operator has trunks running to the local board, while the wire chief is furnished with testing lines to the toll board. The toll-line circuits are so wired that by throwing a switch key all of the connections coming in on the entire board are transferred to two sections for night service. The recording trunks can also be switched to one of the recording positions.

Mercury Arc Rectifier Operating in Multiple with Motor-generator.

The Pacific States Telephone and Telegraph Company of San Francisco has a 40-ampere storage battery in use in its exchange at Alameda, Cal. Until recently this battery has been charged from an equipment consisting of a small direct-current generator driven by a single-phase motor of only sufficient capacity to charge the battery at about 30 amperes.

This company recently purchased a 20-ampere General Electric mercury arc rectifier outfit and installed it in the Alameda exchange in order to test it in commercial operation. The load on this exchange is so heavy, however, that if the battery were to be charged at only 20 amperes it would be necessary to keep the charging current on for 12 or 15 hours a day. It was therefore determined to try to operate the rectifier in multiple with the direct-current generator and charge the battery at the normal rate of 40 amperes. The generator was started up and thrown on the battery and the voltage adjusted to give about 10 amperes charging current. Next the rectifier was started in the usual way, adjusted to charge at about 20 amperes, and thrown into parallel with the generator. The generator voltage was then raised until the current through the battery was 40 amperes and the charging proceeded.

As the electromotive force of the battery rose and the rectifier current fell off, due to the higher voltage of the generator, the voltage of the rectifier was raised by means of the rheostat at the bottom of the panel. The rectifier voltage could also be varied while the rectifier was operating, by moving the compensating reactance switch, as the voltage of the generator kept the arc going while the switch passed over the dead points.

This scheme of operating the mercury-arc rectifier in parallel with the generator has been in regular operation ever since it was first tried, and the attendants are much pleased with it, as they are now enabled to charge the battery in three-quarters of the time previously required.

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CONTENTS OF THIS NUMBER.

Twenty-thousand Volt Single-phase Locomotive for the Swedish Railways. By C. Smith. Illustrated..... 191
Electrical Exports for January..... 191
Niagara Waterpower Situation..... 191, 192
Electrical Separation of Substances Having Dielectric Capacities. Illustrated..... 192
Hydro-electric Station of Plan du Var. By A. De Courcy. Illustrated..... 192, 193
Proposed Wire Ordinance in Minneapolis..... 193
Organization of Pacific Gas and Electric Company Completed. 193
Institute's Foreign Journey..... 193
Death of Henry Rustin. Portrait..... 194
Tollboard Equipment of the Tri-state Telephone and Telegraph Company. Illustrated..... 194, 195
Mercury Arc Rectifier Operating in Multiple with Motor-generator..... 195
Editorial..... 196
The Production of Nitrogen from the Atmosphere. Illustrated..... 197
Single-phase versus Direct-current Traction Discussed in England..... 197
Electricity Blamed for More Fires than It Really Causes..... 197
Operation of Shunt-wound Dynamos in Parallel..... 197
Prize Competition for Papers on Business Getting..... 197, 198
Cost of Generating and Distributing Electric Current in Chicago..... 198, 199
Pittsburg Meetings of the Institute..... 199
A Gaso-electric Car on Transcontinental Trip. Illustrated... 199
A Pleasing Myth..... 199
Interurban Roads Make Towns Grow..... 200
The Ownership of Public Utilities. By Lyman E. Cooley..... 200
9,000-kilowatt Steam-turbine Power House for Washington, D. C..... 200
Line Construction in Small Cities..... 201
Single-phase Equipment for Milwaukee Electric Railway Company. Illustrated..... 201
New Stornbaugh Guy Anchor. Illustrated..... 201
The Situation at Seaton..... 202
Elk River Power Development near Minneapolis..... 202
An Electrical Lexicon..... 202
Mackay Companies Prosperous..... 202
Telephone Engineering. By J. J. Carty. Part II..... 202, 204
Indiana Telephone Items..... 204
Ohio Telephone Notes..... 204
Canadian Telephone News..... 204
Chicago Telephone Company Pays $200,000 Back Compensation..... 204
Indiana Telephone Men Meet..... 204

DEPARTMENTS.

Correspondence..... 205, 206, 207
Great Britain..... 205
Dominion of Canada..... 205
New England..... 205
New York..... 205, 206
Southeastern States..... 206
Texas..... 206
Ohio..... 206
Indiana..... 206
Michigan..... 206, 207
Northwestern States..... 207
Pacific Slope..... 207
Personal..... 207
Electric Lighting..... 207, 208
Electric Railways..... 208
Publications..... 208
Societies and Schools..... 208
Telegraph..... 208
Miscellaneous..... 208, 209
Trade News..... 209
Business..... 209
Illustrated Electrical Patent Record..... 209, 210

DATES AHEAD.

Iowa Telephone Association (annual convention), Chamberlain Hotel, Des Moines, March 13th, 14th and 15th.
Central Electric Railway Association (next meeting), Indianapolis, Ind., March 22d.
Ohio Independent Telephone Association (annual meeting), Columbus, Ohio, March 30th.
Iowa Electrical Association (annual convention), Kirkwood Hotel, Des Moines, April 18th and 19th.
Iowa Street and Interurban Railway Association (annual convention), Kirkwood Hotel, Des Moines, April 19th and 20th.
Indiana Independent Telephone Association (annual meeting), Indianapolis, Ind., May 17th.
National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.
National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.
Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st to 23d.

LOWER passenger rates on the steam railroads are one of the well-known benefits of electric-railway competition. The recent Ohio law making two cents a mile the maximum passenger tariff in that state is a case in point. The competition of the electric lines made the reform much easier than it otherwise would have been. The lawmakers merely hastened a change which was bound to come sooner or later. A large part of Ohio has become a perfect network of up-to-date electric railways. These lines carry passengers for less on the average than two cents a mile, and it was only a matter of time until the steam roads would have had either to reduce their rates or lose their local business. A similar effect is observable in other states, although Ohio is the only one where the establishment of a legal two-cent rate has indirectly grown out of the competition. It is not strange that the steam roads are fighting the interurbans with their own weapon, electricity, for the newer roads are certainly making themselves felt as worthy foemen in the transportation business.

CHICAGO has the lowest per capita debt of any city in the United States of over 400,000 inhabitants. According to the Daily News Almanac for 1906 the amount is $28.63. Turning to British cities, where public-ownership projects have been carried to an extreme, it is seen that municipal debts have reached alarming proportions. Glasgow, for instance—the widely heralded Glasgow—has a debt of $80,000,000, or about $105 per capita—that is, nearly four times as large, relatively, as the debt of Chicago. This reckless piling up of debts on the part of municipalities is causing concern in Great Britain. It may well be taken into consideration by the voters of Chicago, who will be asked next month to sanction the issue of $75,000,000 worth of Mueller-law certificates. This $75,000,000 is much larger than the entire indebtedness of Chicago for all purposes at the present time. To be sure, it is provided that these "certificates," if issued, shall not become a general lien on the property of the city, being secured by the street railways only, but nevertheless they will represent a debt contracted by the city and will probably bring perplexity and litigation in their train.

CONVERSATION as carried on over the telephone, even under the most satisfactory condition, is not so good, in accuracy of enunciation and the perfect transmission of all the sounds and inflections of the human voice, as conversation carried on directly. It has even been said that a telephonic conversation is not much more than a medley of sounds, which, from our familiarity with its peculiarities and an ability to guess more or less accurately the gist of the speaker's words, we are enabled to interpret correctly. This is no doubt an extreme view, but it is true that the degree of correctness with which we may interpret the incoming sounds depends a great deal upon the quality of the speaker's voice, his inflection and distinctness of enunciation; and many have the happy faculty of making themselves understood much more readily over the telephone than others. But in spite of the great desirability of clear speaking over the telephone, we are not disposed to believe the assertion that has obtained some currency to the effect that people with false teeth are only able to make themselves understood with difficulty "over the wire." It is hard to understand why a person with false teeth should not possess quality of voice and inflection and enunciation sufficiently good to enable him to make himself understood with facility. The subject was recently brought up by a medical journal, in condemning the practice of telephoning prescriptions to druggists, but practical telephone men say that they have never heard that false teeth make any noticeable difference in telephonic conversation.

SMELTING by electricity has been undergoing test on rather an elaborate scale at Sault Ste. Marie, Ont., the Canadian government having appropriated $15,000 for the purpose. Dr. Héroult, the well-known French authority on the subject, visited Canada and gave the Dominion government the benefit of his experience and advice. The experiments have attracted wide attention, as readers of the Western Electrician are aware, and they now appear to have been entirely successful. The thing to be ascertained was whether pig iron and steel could be produced with economy from the magnetite ores of Algoma, some of them carrying more than what has hitherto been deemed a manageable percentage of sulphur. That both pig iron and steel could be produced from hematite ore by Dr. Héroult's process had been shown by the success of the works at La Praz in France. A telegraphic dispatch to Ottawa from Dr. Eugene Haanel, Canadian superintendent of mines, tells the story: "Successful demonstration of all points stated in my memorandum on electric smelting of Canadian iron ores requiring investigation. Output greater than figure adopted by Harbord in report of commission. Successful smelting of magnetite and desulphurization of pig. Successful substitution of charcoal and therefore of peat for coke. Consumption of electrode insignificant. Production of nickel pig of fine quality from roasted pyrrhotite. Forty tons of pig have so far been produced. Process admits of immediate commercial application. Experiments will be completed in about two weeks." The electrodes spoken of were obtained in Sweden, and the electric furnaces are of special design. The success of the tests is obviously of much importance, both from electrical and metallurgical viewpoints, for both quality and price should be favorably affected by the new process.

ON ANOTHER page we give a portion of Mr. Lyman E. Cooley's address on "The Ownership of Public Utilities" at the recent annual meeting of the Western Society of Engineers. The address is a thoughtful one and one that stimulates thought, for it exhibits a breadth of view, a disposition to look on both sides, that is refreshing when contrasted with the perfervid utterances of many of the doctrinaires who talk so freely on the subject. Mr. Cooley's conclusions are general rather than specific, but we take it that they do not run counter to the often-expressed view of the Western Electrician that industrial enterprises for public utility (such as railroads and telegraphs, street railways, commercial lighting, telephone service and the like) can best be administered at present under private ownership, with such just and equitable regulations as to character of service, length of franchise and compensation to the public as the municipality or state may see fit to impose. In short, private ownership under public control seems a reasonable solution of the problem in these United States A. D. 1906.

However, Mr. Cooley does recommend a system of free waterways to regulate railroad rates most effectually and says that we should be forehanded with our hydro-electric resources and possibilities. He gives utterance to this striking sentence: "There is enough waterpower capable of development to turn every wheel and to heat the houses and cook the food (where fuel is expensive) for all the people who can live on the soil of the United States." If this is true (and he who denies the statement is even more bold than he who makes it), we can look without dismay on the possible exhaustion of the coal supplies of the country, vast as these deposits are. At the present time we cannot transmit power economically more than 200 miles, and even for that distance only under exceptional circumstances. But who shall say that this distance may not be extended to 2,000 miles, or even to a much greater distance, in the dim future? Perhaps this transmission may be a wireless one. Perhaps smoke will be abolished, fog successfully dissipated and meteorological conditions modified. Perhaps, in the alleged language of Edison, we may live "to see the air populous with ships, to hear of many a Nautilus speeding under seas, to witness the arrival and departure of three-day ocean liners, to board trains operated at a fraction of their present cost and far exceeding those of today in speed, to discover (possibly) the secret of life in radium, and to see the automobile become the dray and carriage of the world."

Perhaps the inventor and the engineer will have wrought these material advancements by the time the economist and the statesman have settled the relation of the individual and the state. A great Future and a great Perhaps!

The Production of Nitrogen from the Atmosphere.

The recent issue of a patent to Johann Hessberger of Ludwigshafen on the Rhine, Germany, for a means for the controlling of electric arcs used in the production of the nitrogen from the atmosphere, calls attention to that very interesting problem. The history of the movement to ascertain some method by which nitrogen might be recovered, on a commercial scale, from the apparently inexhaustible source the atmosphere probably dates back to the time some six or seven years ago, when Sir William Crookes in an address to the British Association for the Advancement of Science made the alarming prophecy that it is only a matter of time before the world will be facing starvation, owing to the extraction of the nitrogen compounds from the soil to such an extent that wheat would no longer grow. He pointed out that the natural fertilizers, such as guano, would soon be exhausted, and the soil, after all having been cultivated, would become gradually poorer and poorer in nitrogen, upon which plant life depends, until the direful results he predicted would be a reality.

In his address Sir William expressed the belief that the replenishment of the nitrogen of the soil might be accomplished by the use of nitrates artificially produced, and that the power of the Niagara Falls might be used to fix the nitrogen of the atmosphere for this purpose. Although his fears have been thought unfounded, there is still the possibility of a profitable business being built up in the production of fertilizers through the agency of nitrogen recovered from the atmosphere. To do this, however, electrical apparatus of an efficient character must be made. It was not so long after Sir William's prophecy was made that a plant was actually equipped at Niagara Falls to fix the nitrogen of the air. The plant was built by the Atmospheric Products Company and made use of some very ingenious electrical apparatus. It was described and illustrated in the Western Electrician of October 11, 1902. It did not, however, develop at the rate that was expected, though it demonstrated that the nitrogen could actually be recovered in quantities.

The subject has not been allowed to rest, however, and especially in Europe much experimental work has been done along this line, using the electric arc as a means of separating the nitrogen. It will be remembered that an interesting paper on the subject was read by J. Sigfrid Edstrom before the International Electrical Congress in St. Louis (Western Electrician, October 8, 1904). The patent just issued to Mr. Hessberger is upon a method of regulating the current to the arcs in such apparatus, and a brief description of it is here given.

When either an alternating electric current or a pulsating direct current is used to feed an electric arc, it is necessary to insert a large inductive resistance in the circuit, because the resistance of the arc itself is small and continually varies in intensity. A choking coil has hitherto been used for this purpose. Although the insertion of the choking coil in the circuit prevents undesirably large currents passing through the arc, it causes a large displacement of phase, and consequently the power factor of the circuit is very greatly reduced and the efficiency is small compared to the amount of plant requisite.

Mr. Hessberger's patent is based on the fact that the power factor of the circuit can be considerably increased if, instead of the choking coil, a transformer is employed and the current from the secondary coil used to feed another arc. In this way he has obtained economically arcs which are admirably suited for bringing about combinations of the nitrogen and oxygen of the air to form compounds.

The mode of carrying out the invention can be varied, and is illustrated by reference to the two accompanying figures, in which Fig. 1 is a diagrammatic view illustrating an embodiment of the invention in which a single transformer is incorporated in the circuit, and [illegible] two transformers are [illegible] produced.

[illegible] reference to Fig. 1, [illegible] current from the [illegible] (G) [illegible] feed an electric arc (F') [illegible] through the primary coil (P) of the transformer (T), the current from the secondary coil (S) of the transformer being used to feed a second arc (F²). [illegible] the current [illegible] containing the first arc [illegible], owing to the [illegible] of the arc, a periodicity which [illegible] the periodicity of the current given out by the generator, and which would obtain [illegible] if the arc were not inserted, it [illegible] possible on account of the large self-induction created [illegible] secondary coil of the transformer to work the second arc without it being necessary to insert a choking coil into its circuit. If the transformer were not employed the power factor would be about 0.50, whereas by inserting the second arc circuit the power factor is increased to about 0.7, or, in other words, the displacement of phase is reduced from about 60 degrees to about 45 degrees.

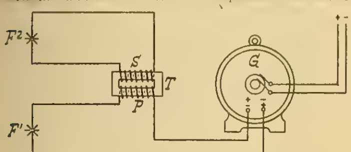


Fig. 1. Single Transformer used in Arc Circuit.

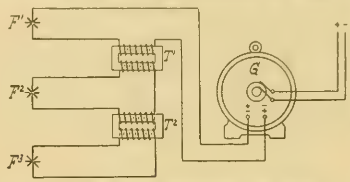


Fig. 2. Use of Two Transformers in Arc Circuit.

THE PRODUCTION OF NITROGEN FROM THE ATMOSPHERE.

A modification of this mode of carrying out the invention is shown diagrammatically in Fig. 2 and consists in passing the current which comes from the secondary coil of the transformer (T'), and which feeds the second electric arc (F²) through the primary coil of a second transformer (T²), and using the current from the secondary coil of this second transformer to feed a third arc (F³). By this arrangement also the displacement of phase is brought down to a favorable value, and the total energy given out by the generator is used up in the arcs. Similarly, a third transformer or more can be employed.

Prof. Silvanus P. Thompson recently contributed some interesting information on this subject in an address at the Royal Institution in London, and he exhibited by experiment the process for the fixation of nitrogen devised by Prof. Birkeland and developed by him with the assistance of Mr. Eyde. Prof. Thompson also gave a general talk upon the history of this interesting problem, and outlined the reasons given by Sir William Crookes for believing that the inhabitants of the earth will be hard put in no very distant period to supply themselves with the staff of life.

Single-phase versus Direct-current Traction Discussed in England.

[From the London correspondent of the Western Electrician.]

London, February 21.—The discussion on the subject of single-phase vs. continuous current for traction at the Institution of Electrical Engineers was interesting. Seldom, I should think, have two sides produced figures so diametrically opposed to each other. As usual in such cases, there was a certain amount of misunderstanding, which accounted for some of the criticisms. The advocates of single phase brought figures to show how much superior this system is to continuous current, while on the other hand Mr. Carter, the author of the paper discussed, contended that the results given were arrived at with the sole object of belittling the continuous-current motor, and that they did not represent a fair test of the relative merits of the two types of motors.

Mr. Carter very clearly stated his position in his reply, viz., that he agreed that single-phase was necessary for main-line working, but that for heavy suburban traffic direct current only was possible. However, the result was to leave the looker-on with a certain amount of indecision, which, while it lasts, will prevent other railway companies (and there are a large number of suburban lines in London with a heavy traffic) from considering the question of changing to electric traction, the more so in view of the somewhat unfavorable returns as to working expenses recently made by those companies which have electric lines. G.

Electricity Blamed for More Fires than It Really Causes.

[illegible]

overheating of [illegible]

[illegible] making a total of 77 [illegible] quarter for the United States, the losses aggregating $65,220.

Reports were received of 150 fires, losses aggregating $1,023,722, alleged to have been due to electricity, but not included in the report, as the causes could not be definitely proved as electrical, principally because the fires destroyed [illegible] evidence of their origin.

Twenty-seven fires, losses aggregating $[illegible], reported as due to electricity, upon further and more reliable investigation, were found to have been due to other causes.

Operation of Shunt Dynamos in Parallel.

A. G. K. of Chambersburg, Pa., has two dynamos which he wishes to operate in parallel. They are direct-current shunt-wound machines, one of 100 and the other 50-kilowatt capacity. He is familiar with the method of connecting shunt machines in parallel, but fears that, one being larger than the other, there will be danger of the larger machine burning out the smaller one.

ANSWER.

The size of two dynamos operating in parallel has no effect upon their ability to operate together if they are properly designed. In any case, of course, they must be brought to a uniform voltage before switching onto the bus-bars. When this is done each will take its proper share of the load. To connect the 100 and 50-kilowatt dynamos in parallel the same method is pursued as if the machines were of the same capacity, the positive and negative terminals being connected to the bus-bars through the proper switches and fuses. If the two dynamos in question have similar characteristics their load will be divided proportionately. If, on the other hand, the characteristics are dissimilar, the loads will not divide in the proper proportion, and the one with a drooping characteristic will take less and less of its share as the total load increases. If the difference is slight it may be readily compensated by means of the hand regulator, increasing or decreasing the pressure of the machine. But, if the difference is great, the fluctuations become more marked and the fuses on the overloaded machine are liable to be blown. In this case it is necessary to insert a small resistance in the armature circuit of the machine having the straightest characteristic, or the one that takes more than its share on an increased load.

Prize Competition for Papers on Business Getting.

Prizes amounting to $1,000 will be given by the Co-operative Electrical Development Association of Cleveland for the best three papers on the organization and conduct of new-business departments of central stations in cities of 50,000 population and under. This competition is open to all central-station managers and their employes in the commercial department, and it is designed to excite general interest in the forward movement now on foot to strengthen in every way the position of the electrical industry.

The prize money will be distributed in three prizes to the authors of the papers in their order of merit; first prize $500, second $300, third $200. The decision as to the winners will be left to a committee of three central-station managers, to be appointed by the president of the National Electric Light Association. The winners will be announced and the papers distributed in booklet form at the Atlantic City convention of the National Electric Light Association. All papers, in quadruplicate, must be received by the Co-operative association on

or before May 15th, and the company retains the right to make such use of any of the papers sent in as it may see fit, to further the cause.

Cost of Generating and Distributing Electric Current in Chicago.

The progress of the investigation by the committee on gas, oil and electric light of the Chicago City Council to determine what should be a fair rate to be charged for electric current to consumers has been noted in the Western Electrician. The difficulty in arriving at a fixed rate, on account of the varying conditions met with in the electric-light business, has been pointed out.

Following the statement of the Chicago Edison and Commonwealth Electric companies that they would voluntarily reduce the rate to consumers, these companies, through their attorney, W. G. Beale, have presented a proposition to the Council committee in which is outlined the position of the companies and a schedule of proposed reduced rates.

Further to aid the committee in its work of regulating rates, City Electrician Carroll has prepared a report in which he gives an estimate of what would be the actual cost of generating and distributing current for use in the City Hall and vicinity. The city's lighting plant at Fullerton Avenue is made the basis of Mr. Carroll's figures.

Repeating what has been said, that the negotiations between the companies and the city have been marked by a disposition to be fair, it will be of interest to outline the arguments and figures presented by both sides up to date. It should be understood that Mr. Carroll's report deals only with what may be considered the most acceptable consumers—the "cream of the business;" a further report which will consider all classes of consumers is to be made by Mr. Carroll and Bion J. Arnold. The estimate given herewith cannot, therefore, be fairly compared with the figures of the Chicago Edison Company for the entire city. It is what Mr. Carroll thinks he could do for a limited area near the City Hall, based on experience with the Fullerton Avenue street-lighting plant and assuming that the most desirable class of customers was secured.

For the purpose of the present estimate Mr. Carroll says that he has included everything that he thought could by any possibility be considered a legitimate charge. In addition to the regular operating expenses, he has added interest, depreciation, insurance, taxes, rent of offices, care of office, rental of pole lines, administration and office expenses pro rata of the costs of the city attorney's office, the comptroller's office, the auditor's office, the paymaster's office, the city collector's office and on the stationery used in his office.

The municipal service includes four operating electric street-lighting stations—one located at Wentworth Avenue near Sixty-third Street; one at Halsted, near Harrison; one at the corner of Rice and Lincoln streets, and one at Fullerton Avenue, near the river. The first three stations named are operating street lights on high-tension series direct-current circuits. Commercial lights cannot be operated from these three plants with the present equipment.

The last-named plant at Fullerton Avenue is operating street lights by alternating current. It is practicable to operate incandescent lights and power motors from this plant. In this power house there are located at the present time two 1,150-horse-power engines, each direct-coupled to a 750-kilowatt generator. This plant is the most modern and most economical one in the city service. The total possible capacity of these two generators is 13,140,000 kilowatt-hours a year.

"In making my estimate," says Mr. Carroll, "I assumed a 24-hour run for one of these engines and a short evening run for the other, with an output of 4,712,659 kilowatt-hours per year, this being about 35.7 per cent. of the capacity of the two engines. At the present time, we are operating from this station, 1,400 street lights, and I have recently completed a five-night test run, operating one engine, with an output of 700 kilowatts. We weighed the coal and water used, and found the cost of the coal to be a little over 0.4 cent a kilowatt-hour, and I have used this data in my estimate in computing the cost of fuel, although I believe it should be a little less, as there was considerable coal used during the day for banking and in starting the engines before they were brought up to the proper operating speed, which was included with the coal used during the test.

"The number of engineers, firemen, oilers and laborers given in the estimate is the exact number which would be required to operate the plant, and the salaries are the same as are paid at the present time.

"The estimated cost of repairs to steam plant is $1,500, although the cost for the year 1905 was only $300, and the contractor who installed these engines guaranteed that the repairs due to ordinary wear and tear will not exceed $25 per engine for each year for a period of five years. The estimated cost of repairs for the electric plant is $800, while the cost for the year 1905 was only $50.

"I have charged for rent of office and care of office the exact amounts paid for an office at 90 LaSalle Street, which is used by the electric-light inspection bureau, and in which there is more room than there is in the city electrician's office in the City Hall.

"I have charged for insurance and taxes about on the same basis that was given in the Haskins & Sells report, and in figuring interest and depreciation, I allowed four per cent. for interest.

"The land on which the plant is built is owned by the Water Department, the value of the lot being $10,650. I have charged four per cent. interest on that amount.

"I have charged up the cost of 13,557 feet of conduit, that being the distance which we will have the wires underground from Fullerton Avenue to the City Hall. I have charged this at 35 cents per duct-foot, which is about the average cost of city conduit. I have charged 13,557 feet of three-conductor cable at $997 per thousand feet, the exact cost. I have also charged for rental of poles the same amount that is paid by commercial companies.

"I have allowed two per cent. depreciation on building and stock, four per cent. on cables, wire, conduit and transformers and eight per cent. on the steam and electrical plant in the building. I have assumed that the amount charged off each year would be placed in a fund and draw compound interest at four per cent. per annum during the calculated life of the plant against which it is charged.

"This would allow a life of 29 years for the plant, against which two per cent. is charged, 18 years at four per cent. and nine years at eight per cent. This means that I have allowed enough depreciation to completely renew the steam and electric plants every nine years, the cables, wires, conduit and transformers every 18 years and the building every 29 years, supposing the apparatus to be a complete loss, and valueless for junk at the end of these periods.

"The estimate provides for 2.5 miles of three-conductor lead-encased cable and 1.8 miles of three-wire aerial cable. Calculated line loss is five per cent., the transformer loss five per cent. This is only partially an estimate. The plant is running every night, having an output of 2,810,500 kilowatt-hours a year, and the exact cost of that at the present operation is known and forms the basis of the estimate.

"There is no charge made for water, for the reason that the plant pumps its own water from the Fullerton Avenue tunnel and empties it into the river, and the amount used, as a matter of fact, should be a credit instead of a charge, as the city Bureau of Sewers is operating a pumping station at this point whose province it is to pump water from this same tunnel and empty it into the river for sewage purposes.

"The summary of cost given below shows the operating expense, the general expense and the interest and depreciation on power plant as going to make up the total cost of the output at the switchboard; this total cost divided by the kilowatt-hours per year (of the output) gives the cost per kilowatt-hour at the switchboard.

"The cost of distribution operation, plus interest and depreciation of the distributing equipment, gives the cost of distribution, which, divided by the amount of current delivered to the consumer per year, gives the cost per kilowatt-hour for distribution. This added to the cost per kilowatt-hour for production at the switchboard gives the total cost per kilowatt-hour to the consumer.

MR. CARROLL'S SUMMARY OF COST.

	Cost.	Output.	Cents Per Kilowatt Hour.
Production operating	$40,533	÷ 4,712,659	= 0.86008
General expense, taxes, insurance, bookkeeping, legal expenses, auditor, collector, paymaster	3,590	÷ 4,712,659	= 0.07617
Total production operating	$44,123	÷ 4,712,659	= 0.9362
Interest and depreciation, power plant	14,681	÷ 4,712,659	= 0.3115
Total cost at switchboard	$58,804	÷ 4,712,659	= 1.2477
Production distribution	4,770	÷ 1,883,137	= 0.2533
Interest and depreciation, distribution	3,037	÷ 1,883,137	= 0.1612
Total cost delivered to consumer			1.6622

Note.—The cost per kilowatt-hour of current delivered at the switchboard is obtained by dividing the total cost by the total output; the cost of distribution by dividing the total cost of distribution by the quantity delivered to consumer.

THE OFFER OF THE EDISON AND COMMONWEALTH COMPANIES.

In the communication of William G. Beale to the Council committee, proposing a reduction of rates for supplying current, Mr. Beale makes a statement in behalf of the Edison and Commonwealth companies. He points out that the companies are engaged in a large business and are not asking any privileges from the city. They have conducted their business in the past without any controversy with the city, and, in short, are endeavoring fairly and honestly to conduct their legitimate business under their existing ordinances, one of which has more than 40 years to run.

There are, however, certain minor things which the city could do, Mr. Beale says, to facilitate the service of the companies to the public; there are some vexatious situations which might be eliminated, without injury to anyone, and if the city is willing to take favorable action in respect to these things the companies will try to meet the city's desire for some reduction in the rates.

Mr. Beale cites some court decision as justifying the companies' rates and more particularly as showing the lawfulness of different rates adapted fairly to dissimilar circumstances and conditions. The highest charge made by the companies for supplying electricity is 20 cents per kilowatt-hour—called by the companies their "full rate"—with a discount of 20 per cent. therefrom for prompt payment of bills. This rate applies to "short-hour" business; that is, to the use of electricity for an average of less than one hour per day. It is given without any minimum time or minimum quantity limit, but under it a consumer may have installed only one incandescent lamp, and may discontinue taking electricity at will. The companies have several times been called upon to install one incandescent lamp, and have done it. They have frequently had customers cease taking electricity after only a few weeks' trial. But all their rates, Mr. Beale says, are sought to be proportioned to the cost of supply, and this cost varies widely. All sorts of conditions affect it, such as the length of time during which electricity is used, the quantity used, the time of the day or night when used, the steadiness or unsteadiness of the use, the duration and certainty of use, the location of the premises supplied, etc.

More than two-thirds of the customers of the companies in all classes of service, according to Mr. Beale's statement, take electricity from them by a form of contract, identical as to terms, under what is known as the Wright maximum-demand meter system. Under this arrangement the gross or full rate of 20 cents per kilowatt-hour is charged for a daily use of electricity not exceeding one hour, less the discount for prompt payment; but for all electricity taken in excess of an average daily use of one hour, the net rate is 10 cents. The rates regulate themselves automatically according to the customer's use of electricity. If it is used two hours per day, the average rate becomes 15 cents instead of 20 cents per kilowatt-hour, less a discount of 20 per cent. for prompt payment upon the "full-rate" portion of the bill. If the electricity is used for six hours a day, the average rate drops to 11⅔ cents per kilowatt-hour, with the same discount. These rates are all for small quantities of electricity, and regular discounts are allowed for increased quantities. Under this single form of contract referred to there are many customers (eight per cent. of all, perhaps). The companies figure that the electricity supplied to 15 per cent. of all their customers costs 17 cents per kilowatt-hour, or more, and that the electricity supplied to 40 per cent. of their customers costs 13½ cents per kilowatt-hour, or more.

Mr. Beale says that the average rate received by the companies for electricity sold during their last fiscal year, excluding from consideration electricity sold for power to street-railway companies, was 7.24 cents per kilowatt-hour. This average return has been tending steadily downward for years. Ten years ago it was 10.26 cents per kilowatt-hour. Competition carries it downward. This competition, he says, does not come from other large companies, but from the great number of small plants scattered throughout the city, many of them being isolated plants whose owners supply electricity to their neighbors located within the same block. The owner of a business building may put in an isolated plant for his own premises, and may, if he chooses, undertake to supply his immediate neighbors with electricity. The extent of this competition may be seen by reference to the last published report of the Chicago Department of Electricity (for 1904).

In the following words Mr. Beale submits the proposed reductions: "These two companies desire to meet your wishes if they can reasonably do so irrespective of your legal powers, and to that end if they can obtain from the city the concessions hereinafter referred to they are willing to acquiesce in action by the city limiting their gross or full maximum rate for the next five years to 16 cents per kilowatt-hour, with a discount of 12½ per cent. from this rate during the next two years for prompt payment of bills, and a like discount of 25 per cent. for prompt payment of bills during the following three years, thus making the net maximum rate for the next two years 14 cents per kilowatt-hour, and for the following three years 12 cents per kilowatt-hour. The companies are of the opinion that the proposed maximum rates are as low as they can now undertake to accept for the next five years. They would also be willing to lower their secondary rates to some extent, but probably not in the same proportion. For instance, during the next two years, if the net maximum rate were 14 cents per kilowatt-hour, they would expect to lower their rate for the second and subsequent hours to nine cents per kilowatt-hour, and they might even be willing in the second year to reduce the secondary rate to eight cents per kilowatt-hour. But reductions in their secondary rates would probably call for some revision of their "wholesale" schedules for large quantities of electricity in respect to which they could hardly continue after such reduction in secondary rates to allow the same discounts as at present."

"The concessions which the Chicago Edison and Commonwealth Electric companies desire from the city are few, and I think unobjectionable from the city's standpoint. They are all really in the interest of the Commonwealth company, which

holds an ordinance running for a long term of years, with some features or omissions troublesome to the company and not beneficial to the city. I am not aware at this moment that the Edison company desires any concession at all. Its ordinance rights expire in a few years, and then or previously some legal arrangement will doubtless be made whereby the property and business of the Edison company will be transferred to the Commonwealth company. There is, I think, no legal objection to this merger at the present time, but it has not hitherto been thought important. So far as the ultimate interests in the two companies are concerned, they may for all practicable purposes be properly enough regarded as one company, and therefore whatever benefits the Commonwealth company will eventually benefit the stockholders of the Edison company.

"The ordinance held by the Edison company, passed before the annexations of 1889, requires underground conductors exclusively, while the ordinance of the Commonwealth company permits overhead conductors in outlying portions of the city.

"In section 6 of the Commonwealth ordinance is a provision that 'all overhead conductors used by said company shall be protected by guard wires or other suitable mechanical device or devices.' How this provision became inserted in this ordinance I do not know, for the people who now own the Commonwealth company had nothing to do with its passage or with the Commonwealth company until long afterward. But the provision never should have been inserted, and I have no doubt that the city electrical department, if consulted, would declare it to be quite as objectionable from the city's standpoint as it is from the standpoint of the Commonwealth company. * * * The provision is an absurd one, and ought to be stricken from the ordinance."

"Another vexatious feature of the Commonwealth ordinance is the fact that it does not in express terms run in favor of 'assigns.' I have no idea that the Commonwealth company would ever wish to assign its ordinance generally, but its mortgage or trust-deed securing bonds is in effect such an assignment, and the absence of an express provision authorizing an assignment of the ordinance has heretofore frequently caused embarrassment in negotiating the sale of the company's bonds. Lawyers for prospective purchasers of bonds have objected to the absence of an express provision permitting the ordinance to be assigned, and while all such lawyers, in this city and elsewhere, after thorough examination of the laws of this state, have decided in every instance that the Commonwealth company could transfer its ordinance as security for its bonds, the question comes up anew every little while with some lawyer not previously familiar with the matter, and it has to be gone over again. The city of Chicago can have no possible interest in hindering a large concern like the Commonwealth Electric Company from borrowing money to develop and extend its enterprise, and the ordinance ought to be made assignable in express terms, so as to cover this point.

"A third embarrassing feature of the Commonwealth company ordinance is in its prohibition of the use of overhead conductors in the territory between Thirty-ninth and Fifty-fifth streets and between Armour Avenue and Lake Michigan, being, mainly, the Sixth Ward.

"It is impossible for the company to do business in that territory with underground conductors exclusively, for the business is not sufficiently remunerative to justify the expense. * * * I think there can be no disadvantage to the city in permitting the Commonwealth company to maintain overhead conductors there under reasonable limitations. This privilege is asked.

"If this entire matter can be satisfactorily arranged the Commonwealth Electric Company is willing to reduce its price to the city for the street arc lighting which it supplies from the present figure of $103 to $75 for each arc light per year. The rates for current supplied by the companies to the city for other electric lighting were materially reduced some time ago, and no further reduction is practicable at the present time."

Pittsburg Meetings of the Institute.

Telephony will be discussed by the Pittsburg section of the American Institute of Electrical Engineers, which is to hold its next meeting March 13th. At this meeting Mr. W. W. Dean will present a paper on "Harmonic Signaling," which is the topic for discussion. Mr. Dean is the vice-president and chief engineer of the Dean Electric Company, and it is well known that there is no one better prepared than he to present the subject clearly. Five-minute discussion papers will also be presented by the following-named gentlemen: S. G. McMeen, Chicago; R. A. L. Snyder, Pittsburg; L. Millheizer, Pittsburg; M. C. Rorty, Pittsburg; S. P. Grace, Pittsburg.

The meetings of the Pittsburg section have attracted considerable interest and have been particularly well attended this year, partly owing to the fact that the auditorium of the new Carnegie Technical School has been secured in which to hold them. The students of the schools are invited to attend the meetings, and they take a great amount of interest.

S. P. Grace, chief engineer of the Central District and Printing Telegraph Company of Pittsburg, is the chairman of the section.

A Gaso-electric Car on Transcontinental Trip.

With the growing necessity of steam railroads to meet the competition of electric interurban railways, the former have turned their attention to the gasoline motor car as a possible solution of the problem, and various types of these cars have been built. One of the latest of this type is the Strang gaso-electric motor car built by the Strang Gas Electric Car Company of New York. This car is making a trip across the continent, and during part of the week was on exhibition at the La Salle Street railroad station in Chicago, where it attracted considerable attention.

Fig. 1 is an exterior view of the Ogeema, as the car is named. It is an experimental one built for the use of the company's officials in making the trip, and it is smaller than the standard car, being of the width of the ordinary street car, to allow of its being switched to the tracks of street and interurban railway lines. The principle upon which the car operates is a combination of gas and electric power. In the standard car a six-cylinder four-cycle gasoline engine drives directly a 250-volt direct current generator. This generator furnishes current for two series-wound motors connected to the car axles. It also furnishes current to a Chloride storage battery of 200 ampere-hours capacity, 112 cells, type T V 11. By this arrangement the load upon the engine is kept approximately constant, as the storage battery floats upon the system. On down grades or in slowing down the generator charges the battery. When accelerating or climbing grades the battery supplies current to the motors in addition to that contributed by the generator, so that the engine is not of as

FIG. 1. GASO-ELECTRIC CAR MAKING TRANSCONTINENAL TRIP.

great power as would be required if it were to furnish the maximum power needed by the car.

Fig. 2 is a view of the engine and generator. The engine cylinders are partially opposed, being combined in two sets at an angle of 90 degrees to each other. Kerosene, alcohol or crude oil may be used instead of gasoline by a slight change of adjustment of the vaporizer. The ignition is of the high-tension or jump-spark type. The fuel is stored in a tank beneath the car floor. The storage-battery cells are placed in a cradle underneath the center of the car.

Fig. 3 is a diagram showing the essential features

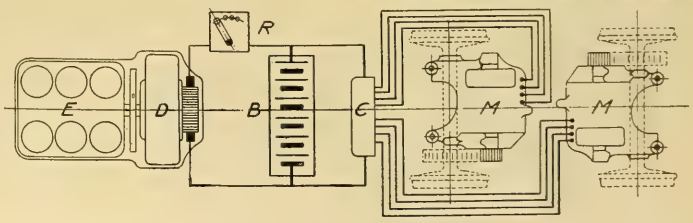


FIG. 3. DIAGRAM OF STRANG SYSTEM FOR GASO-ELECTRIC CAR.

of the Strang system. (E) is the engine, (D) the dynamo, (B) the battery, (C) the controller, (M M) the motors and (R) the starting rheostat. The electric transmission being elastic, there is always a tendency to adjust the speed of the car to that which is most suitable and economical for the primary power equipment. Moreover, the engine is provided with automatic governing devices dependent entirely upon the condition of the batteries and the consumption of current. This arrangement has nothing to do with the speed of the engine or the motors, but is simply an additional safeguard against overcharging the batteries and is entirely automatic and solely for the purpose of economizing fuel and saving the battery when the car is running light or standing still.

The switchboard is placed against the left side of the engine compartment within easy reach of the operator. It includes voltmeter, ammeter, starting rheostat and spark control. The platform at the rear of the car is equipped with a controller and a combination volt and ammeter.

The car which is making the trial run is equipped with a 50-kilowatt generator, though larger sizes will be used on types for actual service. Some interesting figures on the run from New York were given by Mr. Joseph A. Vandegrift, general manager of the company. The car

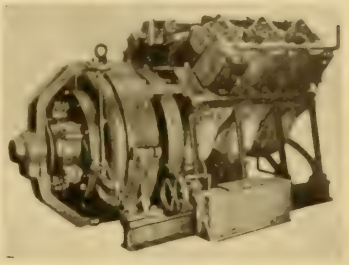


FIG. 2. ENGINE-DYNAMO SET [illegible]

Toledo at 8:15 Sunday morning and [illegible] stop of an hour and 35 minutes [illegible] reached Chicago at 5:25 p. m. Sunday, [illegible] a stop of an hour was made for dinner. The average speed was 30 miles per hour and the maximum 52 miles per hour. Between Toledo and Chicago 0.31 gallon of gasoline was used per car mile. The trip was made without attempting to make speed records but as a test of the general running qualities of the car. On speed trials the car has made 62 miles per hour on high gear.

A Pleasing Myth.

The story was current in Chicago last week that an elevated structure was to be built over the Lake Shore and Rock Island railroads in Chicago, beginning at the outskirts of the city and terminating at the La Salle Street Station. This structure was to give a large number of interurban railway lines in Northern Indiana and Illinois access to the downtown district of the city. The scheme seemed quite plausible and the idea of a "second-story" railway of such magnitude caused some little stir. It has developed, however, that the yarn was a fictitious one, originated by financial interests outside of Chicago. The plan is an interesting one, nevertheless, and would be a great means of booming electric-railway interests if it ever were accomplished. The chief objections to the project are the disinclination of the steam roads to have any such obstruction in their right-of-way and also the great cost which would be involved. The cost would be greatly increased from the fact that the steam roads enter the city over some miles of track elevation which is composed of a sand filling, in which no secure foundation for an elevated structure could be secured, and to dig through which would involve an enormous outlay.

Interurban Roads Make Towns Grow.

According to statistics recently gathered by the state statistician for Indiana, towns and cities connected by electric railways have made a comparatively greater increase in population and material prosperity than the towns and cities having steam-road facilities alone. It will be remembered that in many instances business men discouraged interurban lines on the theory that they would injure local business. The statistician's report disproves this theory and shows that towns having the additional trolley service have outstripped their less fortunate neighboring towns that have steam roads alone. This is true in the matter of increase in manufacturing as well as local business, and increase in population.

The New York Electrical Society on March 28th will enjoy a lecture by William Marconi at the Horace Mann School, Teachers' College, Columbia University.

The Ownership of Public Utilities.

Lyman E. Cooley, the well-known engineer, delivered an address on "The Ownership of Public Utilities" at the annual meeting of the Western Society of Engineers on January 2d. As the speech is rather out of the usual line of arguments for or against public ownership, the latter portion of it is given herewith:

Socialism conveys to the Anglo-Saxon instinct an ugly meaning. The Latin and Slav formulates his paper programmes and tests the issues in revolution. Anglo-Saxon institutions halt and inch along, correcting abuses, and evolving step by step under new conditions, abandoning nothing that is good or workable, not swallowing experience in idealism. Nevertheless, the last century records great changes and adaptations, so great that the road to some destination seems shorter than the way by which we have come.

Lighthouse and port dues of all kinds soon disappeared and lighthouses, charts and all aids to navigation and free harbors were soon provided at the public expense, and this policy has even been extended to the public ownership of water front and docks, as in New York.

In the first decade the state of New York granted to Livingston and Fulton the exclusive right to navigate the Hudson River by "fire and steam." Following down the century the United States Supreme Court, by a series of decisions, has established the public character of all natural waterways, even to the limit of navigation by sawlogs and fish and has recognized the public character of all waters in arid and semi-arid regions.

River and other improvements and canals, for free navigation and at the public expense, have become a part of a growing public policy. The embankment of land against overflow, the development of arid lands by irrigation, the restraint of floods by reservoirs and the conservation of waters by forest reserves, the protection and development of fisheries, the fostering of agriculture, mining and the arts, national quarantine, weather and crop service, are all developments of the century.

The postal system has grown to rural free delivery to every householder throughout the land, and in some countries has taken over the telegraph and telephone, the package express and the savings bank.

The toll road, bridge and ferry disappeared, and public parks, boulevards, sewerage systems and public sanitation, hospitals and charities have been established, and waterworks and water supplies have largely passed to public ownership.

Public baths, tenement houses, old-age pensions and insurance, have even taken root in foreign lands.

Our constitution and laws recognize individual ownership in land only, and no corporation has a right to hold more than is needed for corporate purposes.

The fundamental right of the state to control and regulate corporations and their earnings is fully established.

The education of the young has come to be regarded as peculiarly a state function, and even goes to the point of compulsion and interference with parental control. This is an outgrowth of scarcely half a century, and the human mind can hardly conceive a more radical invasion of personal rights and sacred relations in the interests of the common welfare.

What is done by the state along what may be called socialistic lines is vastly stimulated and added to by private efforts and munificence.

We have come a long way in the past century. How far are we to go in the present century? Where have we drawn the line between the benefits provided from the public purse and those supplied by organized capital? Is it not where a specific return or earning in kind comes back to the investor; and are we quite rational in assuming and fiercely contending that public utilities that pay should be controlled by corporations, while the non-paying utility is reserved for the taxpayer? Is it not, after all, largely a matter of expediency, to be decided, from time to time, according to the exigencies in each case?

In the past we have relied upon competition and the common-law right to regulate rates on the basis of a reasonable return on the proper investment to protect the public from exorbitant charges for necessary service. Is it true that this theory is not workable and is no longer tolerable, and must we fly immediately to the remedies that are not properly established in Anglo-Saxon experience and governmental systems?

Let us consider for a moment the fundamentals of our system—look into the substance of things with the X-ray of the engineer.

The state is sovereign, and the people are the state. In other words, sovereignty vests in the people. They choose to limit their agents and representatives by a written constitution and to delegate certain functions which pertain alike to other states, to a general government. This delegation can be changed by consent of the union of states, and the state itself can change its own constitution outside of the delegated functions. In the last analysis the sovereign is the aggregate opinion of the majority which is prepared to enforce its views.

All properties and rights pertain to the sovereign and of none of these can he divest himself, for that would destroy sovereignty in its essence. The citizen is guaranteed certain privileges in property—what Samuel J. Tilden called the "usufruct"—and of these he cannot be divested except by due process of law and just compensation; and what disposition shall be made of this property after death is solely a matter of statutory regulation. The General Assembly can say at its next session that all property shall revert to the state on the decease of its possessor. The same is true of an artificial person, a corporation, with a fixed term of life.

The state has for its own purposes chosen to create certain agencies designated as quasi-public corporations and popularly known as "public utilities;" such as common carriers for transportation and communication, and service corporations for lighting, heating and power. In the fundamental sense the managers of these agencies are state officers and responsible for the proper conduct of the agency, and can collect only such revenues for service rendered as are essential to conduct the business and make a reasonable return on the proper investment in the agency. By proper procedure the state can reclaim the agency at any time and it reverts at the expiration of the time limit.

The basal thought in all this is that there is no such thing as an indefeasible right, and that the will of the people when properly expressed is absolute, for that is the expression of sovereignty, and further, such sovereignty may express itself in times of distress and emergency in disregard of all forms and codes. When we go back to the fundamental principles, so-called socialism is "not in it" and designates merely a class who are little acquainted with the genius of our institutions. What we shall do from time to time is a matter of expediency for the common welfare, even to a change in the system of government itself.

The problem of the day and of the century now opening is how to better distribute and equalize the benefits of the great discoveries and inventions of the last 70 years, and those to follow, which have made this the most singular epoch in the world's history. This problem must be solved, and solved on the side of the maintenance of individualism, or the very genius of our institutions will be sapped at its vitals. The alternative is a feudal system more cruel than any in history, with lapses of chaos and eventual degeneration. It is the old story of government run by its special beneficiaries and creatures and of unlicensed industrialism and commerce that has perplexed good men throughout history from Julius and Augustus Cæsar down to our own president; that produced a Napoleon, that has made the kaiser the busiest man in Europe, and has put Witte astride the storm.

In view of some distinguished failures, and others still wrestling, I do not expect to settle this whole problem tonight. How and when it will be settled I do not know, and I much suspect that there will be problems as long as men organize in government and fail to be born with equal endowments; nevertheless, as we range over intervals of time we find progress even in governments.

I do not believe, as a student of history nor as a civil engineer, that we can turn the wheels of the mill with the waters that have gone by. We can, however, change conditions for the future. We may call in the police power to deal with what we have with us, but statesmanship deals with what is to come.

We have been careless in constituting our public-utility agencies and more careless in their supervision, but what the future has to bring forth no one could foresee and public convenience seemed urgent. The abuses have become serious and the fundamental law lying under contracts, permits and franchises is invoked for redress. The remedy is uncertain and halting, and beyond an amelioration we must permit the equities to work out and change conditions for the future.

There is, however, sufficient outlet for all the taxes we choose to raise and the sentiment for public ownership, in the undeveloped utilities about which there is no difference of opinion as to their public character, and out of these we may eventually get some corrections pending the death of existing agencies.

I would produce a system of free waterways; not less than 25,000 to 30,000 miles are feasible, on the largest scale of magnitude that the physical conditions will invite or permit. We cannot realize our economic destiny without cheaper rates for transporting much of our products over our continental distances. Railway-rate regulation cannot reach this, for it affects only that third of the gross earnings above operation and maintenance; but the new competitor is a rate regulator in itself and also stimulus to high-class traffic from the enhanced prosperity. I believe the seaboard must go to the interior if we are to stand on a par with other continents in the future, and further in order to prevent over-concentration of urban population at the coast line.

We should be wisely forehanded about our water-power development and electrical transmission. There is enough waterpower capable of development to turn every wheel and to heat the houses and cook the food where fuel is expensive for all the people who can live on the soil of the United States. Such power is akin to a fundamental resource like the air and the water, and it will lie closer to public necessity than gas or electric-light plants. This matter, now in its infancy, should be taken in hand, and out of it will come incidental regulation in many directions.

There are other avenues along which we may act wisely for the future, and while existing utilities are working out their equities we can be forehanded against the time when the agency is to be relinquished or changed for the better. We may need some regeneration, however, in our theories and practices of office-getting and office-holding before we can do more than to shut the barndoor after we find what comes out.

Make operative the laws we have, regulate wisely as we can and provide for a new order as existing equities work out. Meantime, anticipate and develop new utilities so as to avoid repeating evils now complained of.

I am an optimist, though I foresee neither the time nor the nature of the millennium. Our political system has evolved rapidly, but the material and social pace has been still more giddy and even somewhat disconcerting.

The socialistic (so-called) movement which seems now so rampant is due more to the determination of the people to "boss the situation" than to any economic principles or socialistic dogmas—a determination to subdue corporations drunk on ill-gotten wealth. For this feeling the special beneficiaries of government policies have only themselves to blame.

I do not deprecate the socialist. In a government like ours we need political activities of every class for the fullest discussion of every problem that arises, and in the solution we care little what trade-mark or brand is applied. We need not be greatly worried over the noise, for that only indexes our style of debating important issues, and the greater the vehemence the sooner the question is tried out.

Of one thing I am certain, and that is, that matters in the long run will work out as the positive majority shall wish them, and under our institutions that is the standard of right. Individualism and responsible representation will prevail, for they are the basal elements in our system, and should it be necessary every public utility will pass to the state, coal and iron mines included, every industry depending upon government favor will disappear, and our whole system of industrial organization and responsibility will be recast.

We shall remain a nation of freemen, with some doubts at times as to the definition. That is the real issue, as in the past, and we shall care little under what banner the contest is waged. "Vox populi, vox Dei," simply means that the majority is supreme, and when it ceases to be, there will be chaos and an end to things.

9,000-kilowatt Steam-turbine Power House for Washington, D. C.

A new power house and equipment has been contracted for by the Potomac Electric Company of Washington, D. C., for both lighting and power purposes. This company is a division of the Washington Railway and Electric Company, and shares with the Capital Traction Company the control of the street-railway business of the capital.

The power house in question constitutes an important feature of the general plan for extension and development adopted by the company some time ago, and will cost ultimately in the neighborhood of $1,500,000. J. G. White & Co. of New York have the contract to erect and equip it. The building is to be approximately 166 by 183 by 67 feet, and will have a steel frame, with curtain walls, which will probably be constructed of molded concrete blocks. The boiler room will contain four rows of boilers, with three chimneys, located between the second and third rows. Thus there will be two divisions of the firing floor, each serving two rows of boilers. The turbine room will be at right angles to the firing room, and will have no basement, its floor lying in approximately the same level as the boiler-room basement.

The first installation will consist of two 2,000-kilowatt and one 5,000-kilowatt Curtis turbines, with boilers and superheaters, and the building is designed for a future installation of two additional 5,000-kilowatt Curtis turbines, with their steam generators, making a power house of 19,000 kilowatts ultimate capacity. There will be galleries around all the units, connected by short bridges, to permit of easy communication, making in effect a secondary operating floor in the turbine room. All of the turbine units will generate 25-cycle three-phase current at 6 600 volts for distribution directly to the substations. Two of the 2,000-kilowatt units are already installed, one of them being equipped with an ordinary type of surface condenser. All of the remaining units, however, will have the latest type condensers, self-contained in the base of the turbines.

Controlling apparatus will be entirely contained in a switch house adjoining the main generating room, and will be distributed among three galleries. The ground floor will contain only the outgoing feeders and main generator leads. The second gallery will contain all the bus-bar compartments, disconnecting switches and static apparatus, together with instrument transformers. The third floor will contain both alternating and direct-current switchboards.

Line Construction in Small Cities.

The Electrical Review of London, which has the critical faculty keenly developed, criticized the paper of Mr. H. B. Gear of the Chicago Edison Company on "Overhead versus Underground Line," read before the Illinois State Electric Association and printed in the Western Electrician of October 14th last. Mr. Gear's suggestions, which were intended, of course, to meet actually existing conditions in American towns, were rather summarily disposed of by the transatlantic writer, who concluded with the gracefully worded paragraph:

"What with countless small transformers, countless manholes, draw-in ducts containing high-tension and low-tension cables, we fear the engineer in charge of a system such as Mr. Gear describes, if he did not 'go for his revolver,' would, at least, use 'language we cannot command,' in accordance with Bill Nye's western custom."

Mr. Gear has made a temperate reply, printed in the London paper of February 16th, and as the subject is one of practical interest, even though the attitude of the critic may not be, the greater part of it is quoted:

"It was not the purpose of the paper to discuss the relative merits of the different systems of distribution, but rather the relative advantages and disadvantages of overhead and underground construction, as applied to the typical distributing system, commonly found in American cities of 15,000 to 25,000 inhabitants at the present time.

"This typical system consists of overhead alternating current lines with transformers and poles in streets and alleys. In the business sections of such cities pole lines and transformers are usually located in the streets, and agitation is therefore prevalent among the municipal authorities looking toward the removal of the existing lines in the business portions of these cities and placing them underground.

"It was the purpose of the paper, therefore, to discuss, first, the relative advantages and disadvantages of installation and operation of overhead and underground lines; and, second, to determine whether it would be commercially feasible to replace existing overhead systems by underground construction in the average city of 15,000 to 25,000 inhabitants.

"The underground system of ducts, or 'culverts,' illustrated in the paper, was therefore intended to represent the complete equipment which would be necessary for the business portion of the average American city of the size mentioned.

"The general conclusion reached in the paper was that for such a business section, the fixed charges resulting from the underground investment would add 1.2 cents per kilowatt-hour to the cost of current when the load factor is 12½ per cent., or in a residence section of the same area but having a maximum load of 20 kilowatts instead of 125, the added cost would be about six cents per kilowatt-hour under the same conditions.

"The use of a sub-station and low-tension distribution therefrom was not considered, since the initial investment and operating expenses for such a system considerably exceed the amount required for the system described in the paper.

"The location of transformers in sewer-drained manholes where it is impossible to hang them on poles has proved very satisfactory in America, in situations where the density and amount of load do not require units larger than 30 or 40 kilowatts. For cities where the load is such as to require larger units I certainly should favor 'an all-underground system with sub-stations for the busy parts of the town, with overhead transmission to the outlying portions.'

"As to the use of the 'built-in' system for the distributing mains by which you consider that the 'risks of breakdown would be enormously diminished,' it is the experience in American practice that such is not the case, but rather the reverse is true. Indeed, in view of the ease in making changes, repairs or additions to the cable equipment and of the freedom from disturbance of street paving, it is the universal experience of American engineers that the 'draw-in' system is the least expensive in the long run.

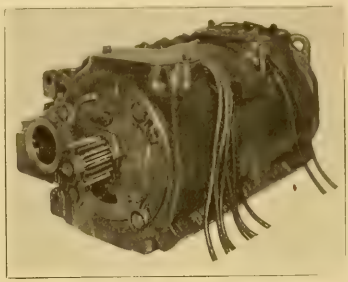
"As to the 'countless transformers, countless manholes, etc.,' which, you fear, will cause the engineer in charge to sigh for 'language that he cannot command,' the writer is familiar with a number of working installations similar to that described in the paper, but several times greater in extent, in which more than two or three cases of trouble due to faults in the underground equipment during the course of a year would be considered excessive.

"It is possible that the rate of depreciation used in figuring the increased cost of current with underground lines is a little high, but in view of the rapid growth of American cities and the progress of the electrical art, which has heretofore necessitated discarding much of our physical equipment before it is actually worn out, it is wiser to err on the safe side."

The London paper makes this rejoinder: "We were comparing American practice, as exemplified in the paper, with British methods of carrying out systems of distribution, and our main points were: That the plan of drawing distributing cables into ducts is not only expensive but useless and detrimental: that transformer boxes under the street surface have been abandoned here in new work for years past; that in this country overhead wires could not be [illegible] containing [illegible] erected, [illegible] Doubtless [illegible] Mr. Gear [illegible] overlook of [illegible] value, for a [illegible] roads we [illegible] towns and [illegible] per be carried [illegible] matter, we [illegible] and can be [illegible] at half the [illegible] end conclusion [illegible] tribution are [illegible] the side." And [illegible]

Single-phase Equipment for Milwaukee Electric Railway and Light Company.

Advantages attending the use of [illegible] road for the peculiar operating conditions of interurban trolley lines are again emphasized by the announcement that another company is about to install the system. In the South and West, where long distance trolley lines with few stops are numerous than in the eastern portions of the United States, the alternating-current system has been successfully adopted by several companies, and the latest to decide upon this method is the Milwaukee Electric Railway and Light Company of Milwaukee, Wis. This company is about to equip two suburban extensions of its lines with the alternating-current apparatus manufactured by the General Electric Company. One of these lines will extend from Waukesha to Oconomowoc, a distance of 20 miles, and the second will operate between Hale's Corners and Mukwonago, a distance of 16 miles. Both lines will be operated at a potential of 3,300 volts, and in addition the motors are designed to run on the existing seven miles of 550-volt direct-current trolley line between West Allis and Milwaukee.



TYPE OF SINGLE-PHASE MOTOR FOR MILWAUKEE INTERURBAN LINES.

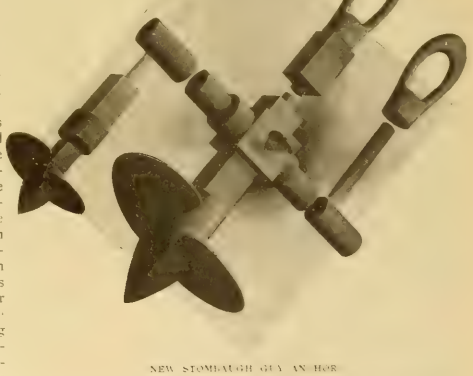
Motors to be furnished for this equipment are the standard General Electric alternating type, shown in the illustration. Each of the 10 cars comprising the initial equipment for the road will be furnished with four motors of 75 horsepower each. They are of the compensated type, comprising an armature similar to the ordinary standard direct-current bar-wound form with mica-insulated coils. The motor fields consist of laminated polepieces, over which are slipped the spools of the exciting winding. The compensating winding consists of a bar winding inserted in the pole faces and permanently connected in series with the armature winding. The 75-horsepower motor is wound for four poles and has a maximum speed of about 140 revolutions a minute.

These equipments will in general be operated as single cars, but occasionally will be run in two-car trains. For the flexible control of these train combinations the well-known Sprague-General Electric system of multiple-unit control will be used, adapted for operation on alternating current.

The compensator for use in these cars is of the oil-cooled type and is wound for 3,300 volts, on the primary, with five different secondary taps for controlling the speed of the motor. In order that the acceleration may be smooth, special devices are employed so that there will be no break in the circuit from one tap to the next during a change in speed. The speed regulation is so de-

New Stombaugh Guy Anchor.

[illegible]



NEW STOMBAUGH GUY ANCHOR.

anchor screwed in until the handles get [illegible] to the ground. Then the set screw it is [illegible] and the handles slid up to a more convenient position and the process continued to the required depth. Finally the eye is removed, the wrench pulled out, the eye replaced and the guy strand attached. The pole is anchored securely in 15 to 20 minutes.

The Havana Subway Company, which has been constructing conduits for wires, etc., throughout the city of Havana, Cuba, under a concession granted by the Havana City Council, has appealed to the American legation for a hearing in the matter of a revocation of its concession for failure to complete the work within two years. An illustration of the work being done by the company in Aguila Street appeared in the Western Electrician of November 18, 1905. The conduits are planned to provide space for all kinds of electrical conductors.

The Situation at Wheaton.

Inspection of electrical conditions in the suburban town of Wheaton, Ill., shows that the town has a municipal electric-lighting plant, but the current is supplied by the Aurora, Elgin and Chicago railway from its sub-station at Lombard, five miles distant, where the voltage is reduced from 26,000 to approximately 2,000. For a part of the way telegraph wires and the conductors used by the village are placed on the same poles with the high-voltage system. The municipal wires also occupy the poles of the telephone company. A short time ago one of these fell, causing a cross with a telephone wire. The protector at the telephone in one of the houses was not effective and failed to operate properly. The insulation of the wires in the house was ignited and fire communicated to the near-by woodwork. Prompt discovery, together with flooding of partitions due to melting of water pipe by the fire, prevented serious loss.

The question of telephone protectors has been taken up by the local management of the telephone company. The City Council is revising the ordinances and has promised to adopt one regulating the installation and maintenance of electric wiring. Gas has been recently introduced and the plumbers are busily engaged in piping buildings. In the attics of houses it is asserted that little pains is taken to keep clear of electric-light wires.

Elk River Power Development Near Minneapolis.

Surveys and engineers' estimates have been prepared for the development of the Elk River property which has been held some time by Minneapolis men, organized as the Minnesotâ Power and Trolley Company. All flowage land has been bought outright at a cost of $75,000. The work up to the present time has been done by Minneapolis people, but will now be taken up by a new organization financing the deal.

The company may decide to enter the power business only, it is said, and not attempt to enter the lighting field as a competitor of the Minneapolis General Electric Company, as it can under its ordinance. At the point selected for the improvement, the village of Otsego, 25 miles north of Minneapolis, an effective head of 35 feet can be secured. The development will call for the erection of a 36-foot dam across the river and a power house. A transmission line over a private right-of-way must be secured from the plant to Minneapolis. An initial development of 20,000 to 25,000 horsepower is planned. Power may be marketed in the smaller cities north of Minneapolis, and the development may be the means, it is stated, of bringing about trolley connection between these towns and Minneapolis.

An Electrical Lexicon.

Five numbers (of 48 pages each) of the "Lexikon der Elektrizität und Elektrotechnik" have now been issued, the complete series to consist of 20 numbers. The work is compiled by Fritz Hoppe and when completed will form a valuable encyclopedia on electrical apparatus and processes. The four numbers that have so far appeared go as far as the letter E. The subjects are taken up with considerable detail and data of practical value given in many cases. For instance, under "Akkumulatoren" (Accumulators) there are over 10 pages of reading matter and tables, besides eight illustrations showing battery plates, connections, curves of operation, etc. Illustrations are used plentifully and they are all of modern and up-to-date apparatus. When complete the series will form a valuable contribution to electrical literature, and the matter which it contains will be in the most accessible form and so arranged that it may be added to readily as advances in the art may require. The work is printed in German and comes from the establishment of A. Hartleben in Vienna.

Mackay Companies Prosperous.

The annual report of the Mackay Companies shows that the income from subsidiary companies during the period from February 23, 1905, to February 1, 1906, was $2,719,595. The Mackay Companies distributed $2,332,492 in dividends, paid out $23,186 for various expenses, and carried forward $363,917. The issued capital stock consists of $40,645,600 preferred and $41,380,400 common, the preferred having been increased during the year by $4,676,900. Among the securities acquired during the year was stock representing a controlling interest in the North American Telegraph Company, which operates in Minnesota, Wisconsin, Iowa and Illinois.

Dealing with the Commercial Cable Company, the report refers to the new Pacific cables, and says that the lines to Japan from Guam and to China from Manila will be put in operation by April 1st. The Mackay Companies, besides controlling the Commercial Cable Company and the Postal Telegraph-cable lines, is one of the large stockholders in the American Telephone and Telegraph Company.

Telephone Engineering.

By J. J. Carty.

Part II.

Another example, perhaps even more far-reaching in its effect upon the work of the engineer, is the question of whether the telephone company shall charge for its service on the flat-rate plan, or by messages, as is now generally the case in this neighborhood.

Under the flat-rate method of charging, in large cities, the more times the customer uses his telephone during the day the greater is the expense to the telephone company. This is due not only to the increased number of operators required, but also to the increased switchboard sections needed for them and to the increased trunk-line plant. By the method of flat-rate charging there is no motive for the telephone company to encourage an increase in the number of calls. For this reason a flat-rate plan would have to be so engineered and the rates would have to be so established that extension stations, desk stands, and other auxiliaries tending to make the use of the telephone easy and therefore more frequent, must be discouraged.

The existence of the flat rate in such cases would not only be attended by all of these consequences, but many others, one of which in particular is of great importance. I refer to the excessive use of the subscriber's line which such a rate engenders. The consequence of this excessive use is that the busy calls attain such serious proportions that it is difficult, if not absolutely impossible, to give satisfactory service. This trouble from busy calls has at times attained such serious proportions that engineers in various places have exerted extraordinary efforts to mitigate the evil, but without success. This difficulty having been caused by commercial methods could not be overcome by the engineer employing physical methods. The solution of this difficulty lay with the business management and consisted in the adoption of a proper system of message rates. Once such a method was put into force, all of these difficulties which I have enumerated, as pertaining to the flat rate, and many others which I have not taken the time to explain, disappeared.

While engineers were endeavoring to plan systems in accordance with the flat-rate method, difficulties were encountered at every hand. As soon as the message-rate system was adopted all of these difficulties disappeared, and many positive advantages not even suspected as residing in the message-rate plan developed. Under the flat-rate system there was every temptation for the subscriber to send as many calls as possible over one line. This, as I have already stated, resulted in overcrowding the line and was attended by bad reactions of every kind. Those having but small use for a telephone could not afford to pay the high flat rate which that method of working made it necessary for the telephone company to charge. The consequence of this was that only those having a large number of calls installed a telephone, and those having small use of the telephone made it a practice to use the telephones of their neighbors, or did not employ the telephone at all. This practice on the part of the small user was a natural one in view of the fact that under the flat rate the telephone subscriber considered that it cost him nothing to allow his neighbor to use his telephone. All of this resulted in a system largely composed of overloaded lines. Under the conditions obtaining in our large cities, the relief of an overloaded line can be obtained only at the expense of a second line, which, in most cases, meant doubling the cost of the telephone service. For this and many other reasons the desired relief could not be obtained under the flat-rate system.

By introducing into the large cities the message-rate system, and by placing proper limits on the load which should be carried upon one line, and by providing a graduated system whereby additional lines could be obtained on a basis proportionate to the amount of their use, relief from this overloading was afforded. More than this, under the message-rate system it is obviously for the interest of the telephone company to encourage the use of the telephone in every manner. For this reason it became feasible and desirable to install as many auxiliary instruments as possible. This was accomplished by providing, for those who required two or more lines, a switchboard located at the subscriber's premises, this switchboard being so constructed that as many local stations as might be required could be installed at a moderate equipment charge. Each one of these stations is so equipped that it may be connected with a trunk line to the central office or it may be connected to any of the other local stations without communicating with the central office. In this way not only was the central office substantially changed, but a very important advantage was obtained. Talking between local stations at a local or private-branch-exchange switchboard could be accomplished without any message charge, and constituted an important by-product, costing the subscriber practically nothing. This development not only reacted upon the central-office engineering and the general engineering of the plant, but also completely changed the state of affairs with reference to speaking-tube telephones, practically limiting the former speaking-tube system to special and peculiar conditions.

Considering these two examples of the method of charging which shall be followed upon toll lines and the method of charging which shall be adopted upon subscribers' lines, it will be seen that they in a most extraordinary manner affect the work of the telephone engineer. So profoundly do such considerations affect the proper engineering of the telephone plant that it must be said that good telephone engineering cannot exist side by side with a bad system of rates or with improper business methods and organizations. Nothing more forcible than the examples needs to be mentioned in order to show the intimate relations between telephone engineering and business management.

From time to time engineering methods involving new principles are brought forth. These, when found to affect the methods of the business office, should be submitted to the business management with a full and clear statement of their bearings upon the commercial work of the company. On the other hand, there are, from time to time, business proposals and commercial methods which are under consideration by the business management of telephone companies, and which, apparently, are only remotely or not at all related to engineering. In view of the many unexpected and important reactions which these proposals may have upon the engineering of the telephone plant, it becomes of the first importance that they should be scrutinized carefully from an engineering point of view, unless it is conclusively apparent that they will be without effect upon the engineers' plans.

Many other instances besides those which I have enumerated might be adduced, such as the effect of the three-minute toll-period method of charging upon the various features of suburban trunking methods, and the complicated and disastrous reactions produced by the introduction of many of the party-line systems.

Thus far I have dealt with some of the more general methods of telephone engineering, indicating briefly their nature. One of the very important features of telephone engineering consists in the design and construction of the varied machinery constituting the modern telephone central-office apparatus. A brief statement, therefore, indicating the character of the work which devolves upon the telephone engineer in connection with central-office design is pertinent.

During the 10 years just passed a revolution has taken place in the design and construction of telephone switchboards, the magnetic switchboard, so-called, having given way to the common-battery switchboard. This radical change in telephone practice made new demands upon the telephone engineer, for it became necessary for him to introduce into central-office construction certain elements which had theretofore been utilized principally in engineering work involving electric-light and power installations.

In the magneto system, signaling from the subscriber's station to the central office was accomplished by means of a small alternating-current generator turned by hand, and the current supply needed in the working of the transmitter was obtained from a few cells of primary battery located at the subscriber's station. By the introduction of the common-battery system all of this was changed. The magneto generator was dispensed with as was the primary battery, the current supply for operating the transmitter, as well as that required to enable the subscriber to signal, being drawn from a large storage battery located at the central office.

In the case of a 10,000-line switchboard, the storage battery must be capable of giving an average discharge of 500 amperes; and to insure proper working conditions it must be capable of giving a safe discharge as high as 2,000 amperes. For charging such a battery as this, suitable machines must be employed, and these must be present in duplicate or triplicate. The standard machine used for charging a battery of this type delivers 1,000 amperes.

The introduction of currents such as these and the introduction of these machines and of a large number of auxiliary machines generating currents for special purposes have resulted in the creation of a power plant at each central office, upon which the operation of the telephone switchboard and apparatus is wholly dependent. The introduction of these larger currents has necessitated most careful and refined methods of fusing and protecting the delicate telephone apparatus. These protective methods, while following the general principles of such methods in electric-light and power practice, are vastly more refined in their working and call for a hitherto unattained degree of precision in the manufacture of such apparatus.

While the storage batteries and auxiliary machinery employed in telephone power plants are far from equaling the magnitude of similar apparatus employed in electric-light and power stations, nevertheless they have become such a vital element of the successful engineering of a telephone central office that they require on the part of the telephone engineer a special knowledge of this branch of electrical engineering, which was formerly not requisite. This class of apparatus must also be considered by the telephone engineer in a special manner, for not only must it be properly constructed from the electric-light and power point of view, but peculiar conditions must be provided

for on account of the association of this apparatus with such a delicate instrument as the telephone.

Where a dynamo is to be constructed to operate incandescent lamps, let us say, certain minute fluctuations in the potential of the machine are permissible. Were such a machine, however, to be used in connection with telephone circuits, these fluctuations in potential would be sufficient to produce such constant humming in the telephone as to render it inoperative. Hence a greater refinement of the construction of these machines in this respect is imperative where they are employed in the telephone power plant.

So it is with the storage battery, where a number of telephones are supplied by current from one storage battery; even almost infinitesimal changes in the voltage of the battery might be propagated to the telephone lines connected therewith and produce disturbances. For this reason storage-battery practice from the telephone point of view presents problems which are different from those encountered elsewhere.

One of the interesting and important developments in the modern common-battery switchboards is the extensive use which has been made of incandescent lamps in signaling. Hundreds of thousands of these lamps are now used for telephone signaling, and the requirements of the telephone art have called for special refinement in the design and manufacture of these lamps.

While the common-battery switchboards as now used in all of the large central offices represent a revolution in methods as compared with the magneto system, there are certain elements formerly used in the magneto system which have persisted. Among these is the multiple-board principle. This principle, as is well known, consists in extending a number of lines to different points in the switchboard so that it is possible to connect with them at any one of these points. The multiple system is opposed to the transfer system, which is one wherein the lines are not so extended or multipled to different points, but proceed directly to a special location from which trunk lines extend to other parts of the switchboard, so as to provide for making the necessary connections. It is safe to say that during the past 20 years there has been no question of switchboard design that has been the occasion of so much discussion and controversy as that pertaining to the extent to which the multiple principle should be adopted. It is interesting to note, therefore, that no type of switchboard of any magnitude is now seriously considered which does not in a very substantial manner utilize this multiple principle.

In a self-contained central office, with relatively few trunk lines extending to other offices, it is found most economical to multiple all of the subscribers' lines to each section of switchboard. In very large cities where a number of central offices are required and where the amount of trunking between the different central offices is relatively large, the advantage of multipling all of the subscribers' lines to each section is not so apparent as in the case of the self-contained office, and this fact has led many to the conclusion that for such situations multiple boards are not adapted. But this is going farther than the fact warrants, for while it is true that the advantage of multiplng the subscribers' lines to all of the sections of the switchboard becomes less and less as the percentage of trunking increases, it is still a fact that the point is never reached where the multiple principle should be abandoned entirely.

The truth of this proposition may be easily established by assuming that in a large city all of the calls must be trunked, and that none of them are local to the office in which they originate. In such a case as this it is obvious that nothing could be gained by extending all of the subscribers' lines before each of the operators. On the other hand, it is still essential that the outgoing trunk lines should be extended or multipled before all of the subscribers' operators, and all of the subscribers' lines should be multipled before the trunk operators. While the case of an office without any local calls is one which could not occur in practice, there are situations in which the amount of local calls is so small that it will not pay to multiple the subscribers' lines to all of the subscribers' operators. Just when this point is reached is a question to be determined in each case.

Thus far the instances where it has been found possible to omit this multipling of the subscribers' lines are few, but as time goes on the number of these cases must increase; but at no time, so far as can now be seen, will the point be reached where the multiple principle itself will be abandoned. Even in the automatic switchboards, which constitute one of the most interesting of the recent developments, the multiple principle is found to be essential to the working of all types of automatic boards thus far proposed, wherever the switchboard is of any substantial magnitude.

With reference to this matter of automatic telephone switchboards, I may say that such types of apparatus have during the past few years become a matter of great interest and the subject of much discussion among telephone engineers, and as I have made a number of special investigations into this subject I think it would be of interest if I here briefly state some of the results which I have obtained.

Upon a first view of the case, the idea of using automatic machine and [illegible] labor of telephone [illegible] force, and the [illegible] accomplished in [illegible] naturally come to mind. [illegible] project for [illegible] none seem more wonderful [illegible] which, when manipulated by the [illegible] put him into communication [illegible] thousand or ten of thousand[illegible] people [illegible] over a wide area. But in order that [illegible] telephone switchboard should be proper[illegible] labor saving machine, it must accomplish [illegible] at an expense entailing less annual charges than would be required by the system which it attempts to displace. If it should be found that the [illegible] charges of operating the automatic system are equal to or greater than the annual charges of operating the manual system, then the automatic system would not be a labor saving one, and, considered from the standpoint of costs, would be a failure. Whatever merit it would have, in that event, must be looked for in some very superior result in the way of service. From this point of view I have considered the merits of the various automatic switchboard systems which have thus far been installed.

I find that, taking into account all of the factors involved, and which go to make up the total annual charges which could properly be placed against the automatic switchboard system, on the one hand, and the manual system on the other hand, leaving out of account switchboards suitable for use only in small villages and making comparison up to switchboards of 10,000 lines capacity, that the annual charges upon the automatic system are substantially greater than the annual charges upon a manual system operated on the common-battery multiple plan. From the standpoint of costs, therefore, the automatic system fails when placed in competition with the common-battery multiple board operated manually.

Having found that the automatic system could not successfully compete with the manual system in point of costs and annual charges, I made a careful investigation to determine whether the automatic system possessed any advantages of working over the manual system which might compensate for the extra annual charges which its use necessitates. For this purpose there were made about 7,500 service tests on manual switchboards and automatic switchboards operating under practical conditions in different parts of the country. The results of these tests showed that the manual system possessed a substantially greater degree of reliability than the automatic system. The difference in speed of connection between the two systems was so small as not to constitute a practical factor, the time elapsing between the start of the call and the answer of the called subscriber being in the case of the automatic system 19.9 seconds, and in the case of the manual system 21.7 seconds. These figures include the time taken by the subscriber to answer, and even this small difference of time was found to be due to the fact that the subscribers whose lines were tested answered somewhat quicker in the automatic system than in the manual system. It will be seen, therefore, from these tests that the automatic system possesses no practical service advantages over the manual system and that it contains no elements sufficient to warrant any part of the extra cost which its use involves. A full consideration of the details of the comparison of these types of switchboards would lead me far beyond the limits assigned to this paper and would only result in showing that the alleged advantage of doing away with the operators at the central office are imaginary and not real.

All of the foregoing relates to switchboard systems smaller than 10,000 lines, no automatic switchboard of larger size having been installed.

In order to determine whether for systems larger than 10,000 lines the automatic principle might be applicable, I made a study, assuming a system of 100,000 lines to be equipped with automatic switchboards, and compared this with a similar system equipped with common-battery multiple switchboards operated on the manual basis. Here again the comparison is in favor of the manual board, both in point of annual charges and in respect to the service.

In applying the automatic switchboard to this 100,000-line study, it was necessary to leave out of consideration a very large class of difficulties which crop out at every turn when the attempt is made to apply the automatic principle to the complex conditions which obtain in and around all large cities. Inasmuch, however, as the study showed that the automatic system is inferior to the manual system for a 100,000-line plant, it became unnecessary to take into account the large number of adverse factors which must be charged against the automatic plan of working. So important are these factors that it is safe to say that even if the annual charges on the automatic system were substantially less than those on the manual system, they would constitute such a serious objection to the automatic system as to bar its use.

Throughout these investigations the importance of retaining at the central office operators to receive and attend to the subscribers' calls has been emphasized in so many important and unexpected ways that I have no hesitation in saying that no [illegible] standard [illegible] telephone engineering, [illegible] quire so much time [illegible] attempt to enter into [illegible] say that it constitutes [illegible] of the telephone engineer.

Intimately connected with the [illegible] choice of material and making the [illegible] therefor is the complementary [illegible] ing or rejecting that which is offered. [illegible] ing up of the specifications must be [illegible] the utmost care so that they may be [illegible] hands of the purchasing agent and [illegible] intelligible so that any manufacturer or [illegible] skilled in the art can understand their [illegible] supply without further information the [illegible] sired. The drawing of such specifications [illegible] very great importance, for not only must the [illegible] desired be clearly described, but the language [illegible] must be such that no material other than that desired can be furnished under this specification. At the same time, while every precaution must be adopted in the specification to exclude undesirable material, great care must be exercised that undue and excessive requirements should not be specified. Otherwise the cost of the materials would be unnecessarily increased. Here, as well as at almost every turn in the work of the telephone engineer, there is no safe side. If the specification is made too rigorous and calls for material of a quality in excess of that which is demanded by the nature of the construction, loss will result. On the other hand, if the specification is drawn loosely or so as to admit inferior material, loss will result, owing to defective working of the construction in which such materials would enter.

So far as I have gone I have described the more typical functions of the telephone engineer. In addition to this there are constantly arising questions demanding special investigation. The range of these questions is almost unlimited, and their adequate treatment requires most laborious and serious effort on the part of the telephone engineer. While their range is so extended as to cover almost every field of engineering in scientific progress, and while the telephone engineer cannot be expected to be expert in all departments of scientific investigation, he is required to direct such investigations, employing, as his judgment may dictate, experts in various departments to report upon those phases of the work in regard to which they may be best qualified to speak.

Thus far I have discussed the work of the telephone engineer without particularly calling attention to his relations to the telephone organization at large. This relation can best be understood by stating that the telephone engineer in every well-organized telephone company must, in the first place, broadly determine all of the important features of the plant of the company, and he must in detail decide what shall be the nature of the construction and the method of operation of every single item which constitutes the physical property of the telephone company. If, through defective design, a telephone cable is found to be ineffective mechanically or electrically, it may be said in a properly organized telephone company that the fault lies with the telephone engineer. If, through defective design, the telephone switchboard is found to be unsuitable with respect to its maintenance or operation, the fault lies with the telephone engineer. So on through all of a multitude of items which constitute a telephone system. If, in a well organized and well-administered telephone company, the plant is not constructed in accordance with the best state of art, the fault lies with the telephone engineer.

That this must be so will be made clear by describing the method which obtains in well-organized telephone companies of getting from the board of directors the necessary appropriations for carrying out all construction and reconstruction work. Under such conditions a development study will have been made and will have been approved by the business management. The traffic department will have, from its careful watching of the extent of the available facilities, given due notice of the time at which additions, changes, or renewals of switchboard facilities may be required, all of which are presumed to have been contemplated in the broad plans already approved by the business management. The construction department will have, from its constant watching of the available cable and line

facilities, given due notice of such changes, renewals and additions as may be required in these parts of the plant to accommodate the growing business and fit in with the approved general plan. In the case of the traffic department, the demands of the service having been thoroughly studied by them and the essential data having been supplied to the engineer, the necessary detail studies, plans and specifications are prepared by him and an estimate prepared for the work required. A case will be made out setting forth the nature of the work and the necessity therefor, and an estimate showing its cost and a specification describing the work in detail will be submitted to the management, and if in proper form it will be duly approved. The estimate and specification will then be turned over to the proper department and, depending upon the nature of the construction, the work will be executed by the telephone company itself or by a contractor.

This work must be supervised as far as may be necessary by the engineer, and upon its completion he must accept or reject it. Having accepted it and having made a report to that effect to the business management, the transaction is completed. By the acceptance of the work the engineer assumes full responsibility for its efficiency.

So it is with the cable plant, except in this instance, as a matter of administrative efficiency, the superintendent of construction may submit detailed plans for the extension to the cable and wire plants, following, however, general lines which have already been standardized by the engineer. These plans and specifications having been accepted by the engineer, and the work having been passed through the regular routine, the ultimate responsibility rests in the engineer's office.

So it is with other features of the work. From beginning to end the engineer is thus placed in a position to exercise a veto power upon any adverse methods which might otherwise be allowed to creep in.

The carrying out of this estimate system in this way places final responsibility upon the engineer and recognizes in the most practical manner one of his most important functions, which is to coordinate the various elements which must be put together in such a manner as to avoid conflict and produce a consistent symmetrical organism, each part of which will be designed and constructed with due reference to the functions which it must perform and also with due regard to the functions and importance of all other elements in the system.

The importance of this co-ordinating function cannot be overestimated and it is only at some central point that such function can be exercised. Being judged from the maintenance point of view, a piece of apparatus might have qualities of a high order, but when considered with reference to its effect upon the traffic, difficulties might be discovered which would entirely overweigh the maintenance advantages. In such a case the conflicting claims with respect to the apparatus must be considered by the engineer, and his decision must be rendered with a view to producing the best net result.

Again, systems might be proposed, which, considered solely from the maintenance, construction and traffic points of view, might seem to possess all of the advantages of an ideal arrangement, but when considered from the standpoint of the efficiency of transmission might be found to involve an impairment of transmission on one hand or such increase in cable and line costs on the other hand as to render its use out of the question.

In order to exercise proper co-ordinating functions, it is essential that the engineer should be placed and should maintain himself in such relations with all of the departments of the telephone organization that he may get from them and fairly consider all of the projects and ideas pertaining to the design, operation, construction and maintenance of the plant which naturally originate in such departments when they are conducted with proper efficiency.

Viewed from this standpoint, it will be seen that while the function of the engineer with relation to the plant is of the utmost importance, nevertheless the work of the traffic, maintenance, construction and other departments has such an important bearing upon the whole question that the successful engineering of a telephone system must be regarded not only as the work of the engineer himself but as the work of all of the other departments concerned. Not only this, but what is still more important, the successful engineering of a telephone plant depends upon proper business management, as I have indicated by several striking examples. Without an intelligent, progressive and broad-gauged business management there cannot be good telephone engineering.

[End of paper; discussion to follow as Part III.]

The Pacific States Telephone and Telegraph Company has removed its business offices from the former headquarters in Bush Street, San Francisco, to the new building of the company at 140 New Montgomery Street. In the new structure the main city department will occupy all of the first floor, the equipment department will have the second floor, and the third floor will contain the offices of President H. T. Scott, General Manager Louis Glass and the division manager.

Indiana Telephone Items.

The Tobinsport Telephone Company has filed articles of incorporation with a capital of $1,000. David White, John C. Esarey and Charles Adams are the directors.

The Newton and Jasper County Telephone Company has been incorporated with a capital of $7,500. An exchange will be built in Brook with lines throughout Newton and Jasper counties.

The People's Co-operative Telephone Company of Manson, Ind., has filed amended articles of incorporation, also notice of increase of capital. This company will reconstruct its system. J. A. Curtis, A. W. Carter and T. D. Chaney are the directors.

At a meeting of the directors and officers of the Indianapolis Telephone Company it was finally decided to ask permission of the city to increase telephone rates. Auditors are now at work on the company's books securing data which will be used when the request is made. General Manager A. L. Tetu will have charge of proposed extensions. Mr. Tetu announced that the Independent interests in this and other states would seize on the present unrest in the telephone situation in Chicago to enter that city. The New Long-distance Telephone Company will not attempt to enter Chicago, but the directors have ordered new heavy trunk lines constructed to South Bend to connect with the East and West trunk lines which may enter Chicago. Orders were also issued for the construction of new trunk lines to Fort Wayne, to Louisville and to Richmond to improve the present connections to eastern points, and to Terra Haute to improve the St. Louis service. The new lines will be No. 8 and will displace the No. 10 copper wire now in use. Orders were also given to make additions to the equipment in Indianapolis to take care of the new business.

Both the Cumberland and the Princeton Independent Telephone companies have been ordered to quit the streets in Princeton and injunction proceedings are threatened. The city insists that the former company has no franchise and that the latter has failed to comply with the provisions of the ordinance granting it a franchise.

The Board of Public Works of Evansville has agreed upon the terms by which the Citizens' Telephone Company may be admitted to the city. The matter now goes to the City Council, which is said to favor the admission.

The Indiana Independent Telephone Association is formulating a plan for standardizing construction in this state. The plan is to assist the smaller companies, which are unable to employ a consulting engineer, and thus enable them to standardize their systems.

The Attica Telephone Company of Attica announces that the present system will be greatly improved. A number of rural lines will be constructed and the new line recently completed to Riverside will be extended to Independence. This will connect up three additional good towns.

The Sandbank Telephone Company of Tipton County has purchased all the poles of the Tipton Telephone Company east of the city and will stretch wires as far as Hobbs, where it will establish a station. H. C. Hackett is president of the Sandbank Telephone Company.

The directors of the West Lebanon Telephone Company have decided to improve and extend the system. New telephone companies are being organized at Ambia and Talbot, the lines to operate in conjunction with the West Lebanon system. S.

Ohio Telephone Notes.

At the annual meeting of the stockholders of the United States Telephone Company a few days ago the following-named directors were chosen: Barney Mahler, Henry A. Everett, E. W. Moore, C. W. Wason, F. S. Dickson, James B. Hoge, C. Morris, H. R. Newcomb and C. Y. McVey. The total earnings of the company for the last year were $484,034.38, an increase of $62,971.27 over the previous year. The expenses and taxes amounted to $310,605.50, an increase of $44,465.67. The surplus for the period is $61,532.23, a gain of $9,448.61. Preferred dividends were allowed to the amount of $19,515, leaving a balance or surplus of $42,017.23. Of this $41,481.24 was added to the original surplus, making $97,607.12.

The Buckeye Lake Home Telephone Company of Thurston has been incorporated with a capital stock of $10,000 by W. F. O'Gara and others.

At an early meeting the Cincinnati and Suburban Bell Telephone Company will take up the matter of placing all the wires across the canal underground. This will mean the expenditure of quite a sum of money.

The Aiken bill for the regulation of telephone rates has been recommended for passage by the committee on railroads and telegraphs of the House of Representatives. This bill provides that city and village councils may make agreements with telephone companies as to rates when a franchise is granted. In fact it will become a part of the municipal-code idea. But the bill provides that nothing shall be done regarding those companies that have already secured franchises. They will be left to fix rates through competition. Representative Hillencamp has another bill in the House that not only provides that councils may fix rates, but they are subject to review and revision every seven years. The companies oppose this bill, as it not only applies to new companies but all companies now in existence.

The February payments to the employes of the Cuyahoga Telephone Company on the co-operative plan were larger than ever before, owing to the fact that the earnings of the company have greatly increased during the last year.

Articles of incorporation have been issued to the Farmers' Telephone Company of Caldwell, which will have a capital stock of $10,000. W. E. Keith and others are interested in it.

The New Paris Home Telephone Company of New Paris has been incorporated with a capital stock of $40,000 by S. C. Richie, D. C. Dawson and others. C.

Canadian Telephone News.

From the present outlook it seems more than likely that the Dominion government does not propose to move in favor of national ownership of the telephone systems in this country. The proposal of the Bell Telephone Company of Canada to largely increase its capital stock is regarded as a sure indication that the directors have good reason to believe that they have no cause to fear an announcement of a policy of government ownership.

Politicians are discussing an interesting rumor which is in circulation in Ottawa, to the effect that a merger has been effected of the Canadian telephone companies, which, it is believed, are about to pass to the control of the big American corporation. The management of the Bell company of Canada gives a flat denial to the report, and states that the company will continue a Canadian corporation.

Following the example of the several large American railways, the Grand Trunk Railway will probably install a telephone system on all its lines. Estimates are being prepared on the cost of such a system. The company feels that a large annual saving might be effected by having its own telephone system, and, in addition, there would never occur delays on account of connection, etc. When installed this telephone system will be quite distinct from the telegraph system, and it will cost upward of $200,000. Wires will be stretched from Portland, Maine, to Montreal, Toronto, Port Huron, Detroit, Hamilton, Suspension Bridge, North Bay, Chicago and all intermediate points. W.

Chicago Telephone Company Pays $200,000 Back Compensation.

In the negotiations between the Chicago Telephone Company and a committee of the Chicago City Council, relative to a reduction of rates, franchise extension, etc., the company is now going over its books to determine what it owes the city as a result of the Supreme Court decision, which says that the company must pay three per cent. compensation on the business done in the territory which has been annexed to the city since it got its franchise. Already the company has paid to the city comptroller $200,000 to apply on the compensation due.

The company is, of course, anxious for a renewal of its franchise, which expires in three years, and to this end is ready to take up negotiations with the council committee for a reduction and adjustment of rates in consideration of a new franchise. But the committee says it will not consider any rate propositions until the matter of back compensation is settled. The committee may ask permission to go over the company's books. President Fish of the American Telephone and Telegraph Company was in Chicago last week conferring with President Wheeler and the directors of the Chicago company, and he is said to have advised paying the city $200,000 on account.

Indiana Telephone Men Meet.

The first district of the Indiana Telephone Association held a meeting in the Century Club Building, Elkhart, on February 25th, Vice-president Thorward presiding. A resolution was unanimously adopted declaring that any telephone company in the district having either direct or indirect traffic relations with the Central Union (Bell) Company shall be cut off from all traffic relations with the Independent telephone companies of the district.

The by-laws of the district association were amended so as to conform to the needs of the association, and provide for holding meetings on the third Tuesdays of January and July each year regularly, all other meetings to be at the call of the president. Twelve delegates were elected to attend the annual state meeting at Indianapolis the third week in May.

The convention was entertained by the Chicago Telephone Supply Company, whose factory is located in Elkhart. Dinner was served by the company, followed by a trolley ride to the factory.

At Raleigh, N. C., which is perhaps the only town in the country having three separate telephone systems, there is considerable agitation among the business men for a reduction in the number of systems, and it is likely that two, or perhaps all three, of the companies will be merged.

CORRESPONDENCE.

Great Britain.

London, February 21. The first of the "tube" railways taken over by the late Mr Yerkes is now ready for opening. It is the Baker Street and Waterloo railway, which connects up the terminus of the Great Western railway in the west with the terminus of the London, Brighton and South Coast railway in the south. The line will give a cross-London service which should be a great boon to travelers on the main-line systems of the two railways mentioned, and also one or two others in close proximity. The constructional details of the railway resemble those of other "tube" lines, but, of course, there are a few specialties. Thus, the permanent way is of special construction in order to reduce vibration, the sleepers being so laid that they rest on springs, so to speak. As on the Central London railway, each station has an up grade leading into it and a down-grade leading from it. The diameter of the tunnel varies from 11 feet eight inches to 12 feet six inches on curves. The length of the railway is about five miles of route, and current will be supplied from the large generating station of the Underground Electric Railways Company of London at Chelsea, which was described in the Western Electrican last year.

To commemorate the visit of the British Association for the Advancement of Science to South Africa last year, subscriptions have been secured for founding a medal to be granted annually by the South African Association for the Advancement of Science. The grant of the medal will be for research work. Up to the present nearly $10,000 is available for this purpose, and it is expected that will represent the total sum.

The meeting of the British Association for 1906 will be held at York, the town in which the inaugural meeting took place 76 years ago. August 1st is the date of commencement.

The city of London Corporation at its last meeting passed a resolution urging the government to appoint a royal commission to inquire into the whole question of electric supply. To the man who is impartial in this matter it would appear that the only advantage to be gained by such a procedure would be to give the London County Council time to prepare a scheme. At present several companies are quite prepared with detailed schemes and the delay inevitable to a royal commission—witness the traffic commission—should be considered too great to be lightly incurred.

After giving the matter its serious consideration the Metropolitan Railway Company has abandoned the idea of having uniform zone fares and will adhere to the ordinary system which has been in vogue on its lines since their inception. It was always one of the pet fancies of the late Mr. Yerkes to have a uniform fare of 2d. all round the Inner Circle, but this has now gone by the board.

I mentioned a short time ago that the new government intended to consider the popularization of our numerous canals as a means of freight carriage. An experiment is now being carried out with a gas-driven tug, the plant being a suction gas outfit, and the expenses are said to be exceedingly small. The North Staffordshire Railway Company, which owns a considerable mileage of canals, seems anxious to develop its canal traffic, but is apparently hung up for want of an efficient motive power. In spite of the gas experiments above referred to, it cannot place any faith in this as a solution of the difficulty, but looks to electricity as the most likely agent.

In a paper read before one of the local sections of the Institution of Electrical Engineers a proposal has been made that all electric-supply authorities should test, and certify as efficient, incandescent and other lamps in order that their consumers may be assured of the life and efficiency of their apparatus. It has long been recognized that inefficient lamps have been responsible for a certain retardation in the progress of electric supply, and the suggestion above mentioned as a business method might prove successful.

Bristol was the first town ever included in the area of an electric power company, much to its chagrin, as it has an up-to-date municipal electrical undertaking. Hence it is not surprising that, as three years have elapsed since the power company was formed (and it has given no supply), the Bristol corporation it seeking to avail itself of the clause in the company's act, which states that if the powers of the act are not exercised within three years a certificate may be obtained from the Board of Trade that such powers have ceased as regards any particular for which the application is made. G.

Dominion of Canada.

Ottawa, March 3.—The Department of Marine has decided to construct three space-telegraph stations on the Pacific Coast. This, it is considered, will be sufficient to cover the whole coast line if messages can be sent 400 miles.

The town of Morrisburg, Ont., has received a lease from the Dominion government of all the surplus water in the Du Plat Canal for a period of 20 years. The Municipal Council will at once proceed to develop this power in order to carry out its contract with the Canada [illegible] Steel Company.

A cable from Senator [illegible] states that he [illegible] to England and [illegible] there for the construction [illegible] which will run from Montreal [illegible] thence to the Great Lakes [illegible] be called the Canada Central [illegible] tirely by electricity, and will be the first [illegible] of electric power to trunk line purposes.

During the next three years the [illegible] Heat and Power Company will expend [illegible] on improvement and development. The general plans for the reorganization of the company's system contemplate interconnecting all [illegible] waterpower plants by means of underground cables at 12,000 volts pressure, so that the failure of the power supply from any one of the company's sources would not cause an interruption to the service. An extensive plant will also be constructed at Busson Point.

The work of developing the waterpower of Kakabeka Falls, 16 miles west of Port William, Ont., has been realized, and by June 1st the great electrical plant will be put in operation. The waters of the river are diverted into a large conduit pipe, 10 feet in diameter, which takes the water at a point three-quarters of a mile above the falls. This pipe skirts the valley of the Kaministikwia River along a ledge of hills to a point some distance below the falls, where a large forebay or reservoir is constructed to hold the water in reserve, previous to its being taken into the steel penstock, which carries the water perpendicularly 180 feet to the power house below. The original plan for the development of Kakabeka Falls calls for a head of 110 feet, but by the plan carried out by the company an additional 70 feet was secured. The actual construction of the work is almost finished. The initial installation will be 10,000 horsepower; this will be increased, as required, in units of 10,000 horsepower, until the whole power is developed at this point. The current is carried from the power house to a sub-station in Fort William on a heavy copper line at 25,000 volts. The line will be in duplicate as a safeguard against accident. W.

Winnipeg, Man., March 3.—The shareholders of the Winnipeg, Selkirk and Lake Winnipeg street railway have made the transfer of their road to the Winnipeg Street Railway Company. A new board of directors was elected, composed of those virtually in control of the Winnipeg Street Railway Company.

The annual report of the Toronto Street Railway Company shows earning of $2,744,324, an increase of $302,790, or 12.39 per cent., over the previous year. Of the total earnings the city of Toronto received over $400,000.

The Montreal Street Railway Company has purchased the Terminal Electrical Railway Company, which gives it the control of all the electric traction systems on the island of Montreal. In addition to this it gives the Montreal company an independent entrance into Montreal. The purchase price is said to be in the neighborhood of $500,000, about the bonded indebtedness of the line, the common stock being thrown in.

The British Columbia Electric Railway Company has been solicited by the people all the way between Port Moody and the city of New Westminster to build a line between Port Moody and Sapperton. General Manager Sperling has sent out an engineer to survey the proposed route and get an estimate of the cost of the construction.

The Town Council of Carberry, Man., is now arranging to install a municipal lighting plant to cost about $12,000, with room for extension.

The City Council of Calgary, N. W. T., has resolved to spend $30,000 on an electric-light extension.

Tenders have been received by the city of Winnipeg for the electrical machinery necessary for city lighting purposes. At present the city is using to full capacity the electrical generator procured to operate the new well of the water system. When this is in operation it will take the power now used for lighting purposes. This is the reason why the city is asking the Legislature for authority to issue debentures for the extension of the city lighting plant. H.

New England.

Boston, Mass., March 3.—In the Massachusetts Legislature, the committee on mercantile affairs has recommended the withdrawal of Frank J. Gethro's petition for legislation regulating telephone charges in Boston. Mr. Gethro wanted a uniform rate for telephone messages.

Dennis J. Hern's appointment as superintendent of lamps was confirmed by the Boston aldermen last Monday.

The Eben D. Jordan estate has just completed a large fireproof motor mart, covering over 47,000 square feet of land, facing on Park Square in this city. The building has garage space amounting to 60,000 square feet and is believed to be the largest and most complete structure devoted exclusively to automobiles, in America. There are three garage floors, each of which is equipped with switches from which the batteries on electric automobiles [illegible] Institute's senior and junior [illegible]

The M[illegible] [illegible] under the supervision of the state Highway Commission. This [illegible] by Governor Guild, who [illegible] said, "All public-service corporations [illegible]ting in Massachusetts are under the supervision of the commonwealth with the exception of telegraph and telephone companies. There does not appear to be any good reason why such corporations should not be under a supervision similar to that now exercised over other public-service corporations. I recommend to your (the Legislature's) consideration whether this supervision might not be [illegible] the state Highway Commission, and whether, through reasonable fees charged upon the companies for inspection, it might not be self-supp[illegible]"

Samuel B. Winchester of Holyoke, Mass., died at his home in that city on February 26th. From 1884 until 1902 he was superintendent of the electric-light station of the Holyoke Water Power Company. B.

New York.

New York city, March 3.—Voluminous information and misinformation has been published [illegible] the Interborough-Metropolitan merger. The new holding company has increased its capital from $15,000 to $155,000,000, and paid into the state treasury $77,492 as its incorporation fee. State Attorney-general Mayer has declared that the merger is a lawful combination. Mr. Mayer admits that the merger, "if carried out, will constitute a monopoly of the transportation systems," and he adds that "undoubtedly the purpose of the legislature in prohibiting monopolies was to prevent combinations that would affect prices, but in the case of railroad companies the prices are fixed, either by local ordinance or by legislative restriction. . . . If there should be any just cause of complaint the proper body to determine upon the public policy involved in such matters is the Legislature." For these and other reasons Mr. Mayer denied the application of William Randolph Hearst. The New York Times says that Mr. Mayer's contention is illogical, because "prices depends, not on the amount expended but on the quality of the service rendered."

In spite of the anti-merger agitation, however, the deal was actualized on Thursday by the necessary deposit of stock holdings, and President Vreeland of the Metropolitan system issued a statement in which he promised continually improved traffic facilities. Vice-president Bryan of the Interborough made a similar promise, but neither would go into any definite plans. The Elsberg bill, with its various amendments, is being bitterly contested. The general principle of the bill—the separate letting of contracts for future construction and operation of subways—is fairly well conceded, but the question now is whether the city "may" or "must" carry out its provision. The City Club, the New York Board of Trade and Republicans generally are working for discretionary powers. Mayor McClellan objects to the whole bill, but states in a very long letter, addressed to the Senate, that he is in favor of granting "permission" to the city to construct and operate subways in case of need. He adds that New York is not at present in a financial position to undertake such construction.

George A. Soper, Ph. D., has reported on the quality of the air in the subway to the Rapid Transit Commission. He finds that the air is good and frequently renewed, though there are more pneumonia germs in the subway than in the outside air. He declares, however, that the general sanitation is bad and that the stations and cars are dirty. On the other hand, a special investigation made at the instance of Coroner Harburger, shows that the subway atmosphere is charged with small steel particles which led to the death of two track walkers. This new disease, popularly called "subway consumption," is for the moment the general topic of conversation and newspaper comment. Dr. Soper himself has asserted "that the amount of steel dust generated by friction in the subway amounts to a ton a mile each month." The Evening Sun avers

that the discovery is not new, but demands an improvement of general sanitary conditions.

The Board of Estimate and Apportionment is seeking powers whereby it will be able to prevent the "watering" of traction companies' stocks by having the final word in application for increasing capitalization.

The Interborough Rapid Transit Company is planning to construct an escalator for the elevated station on One-hundred-and-twenty-fifth Street and Eighth Avenue. The escalator will be made by the Otis Elevator Company at a probable cost of $50,000.

The New York City Railway Company has been authorized to change the horse line in Vesey Street to an underground-conduit system.

Brooklyn Borough President Coler stated before a committee at Albany on Tuesday that he knows of an understanding "signed, sealed and delivered" between the Long Island Railroad and the Brooklyn Rapid Transit Company not to compete with each other.

At Mount Vernon, N. Y., a few days ago, the New York, New Haven and Hartford Railroad commenced the construction work necessary to convert its suburban line to electric traction. The company has sent some of its rolling stock to the Westinghouse shops at Pittsburg to be equipped with motors. The New Haven road is also beginning conversion operations at New Rochelle; and it is stated that at the New York city end it will withdraw its traffic from the Grand Central Station, and use the new Pennsylvania depot instead.

P. C. Frederick, D. Emery and R. W. Crawford of New York have incorporated as the Edward E. Cary Company, with a capital of $20,000, for the purpose of dealing in electrical apparatus.

The Board of Education is calling for tenders, due on March 12th, for the installation of electric equipment in public school No. 66, Brooklyn. The probable value of the work is $12,000. D. W. W.

Southeastern States.

Charlotte, N. C., March 3.—The J. F. Gallivan Construction Company of Greenville, S. C., has the contract for building the dam of the Savannah River Power Company at Gregg's Shoals, where a big waterpower will be developed.

If an amendment to the charter of the Maryland electric railway, now pending in the state Legislature, shall pass, it is predicted that there will result within 12 months a merger of all the electric railways in Baltimore and seven counties, aggregating 550 miles. The chief company which would be included in the merger is rumored to be the United Railways Company, with about 400 miles of tracks. The Washington, Baltimore and Annapolis is next with 70 miles.

The lower house at Washington has passed the Muscle Shoals power bill, involving one of the greatest waterpowers in the South. It is said that the proceeds of the proposed development would be over $2,000,000 annually.

The board of directors of the Louisville Traction Company has voted in favor of a $1,000,000 stock issue, which will be taken up by the stockholders at an early meeting.

More than $4,000,000 in stock issue has been voted by the directors of the Birmingham Railway, Light and Power Company, while a meeting of stockholders is called for March 30th to vote on a $1,000,000 issue of preferred stock. Of the $4,000,000 issue, $1,000,000 will be used for improvements and the remainder for the purpose of retiring outstanding bonds of a $6,000,000 issue. Several new electric lines are included in the proposed improvements.

A number of deeds for right-of-way have been filed at Jefferson, Ky., for the Louisville and Northern Traction and Lighting Company.

The town of Cairo, Ga., is just completing a municipal lighting and water system, and soon the entire city will be lighted by electricity generated at the city's plant.

The city of Louisville, Ky., will likely have an underground-wire ordinance in a short time, which, according to the estimate of the Louisville Lighting Company alone, will cost that concern about $350,000, and the total cost to all electric and telephone companies will be in the neighborhood of $1,000,000.

Notice has been given that on March 31st application will be filed for a charter for the Spartanburg (S. C.) and Glen Springs Southern Railroad Company, about 100 miles in length, and on which electricity may be used as the motive power. J. B. Lee of Spartanburg is one of those interested.

The Whitney Reduction Company, now developing probably the largest waterpower in the entire South, announces that its working force will be doubled in order to carry on work at night. A modern town will be built at the site of operations. It is estimated that the electrical development will cost three to four millions. L.

Texas.

Austin, March 3.—An electric-light and power plant to cost $16,000 is to be installed at Yorktown by Koenig & Son.

A syndicate of Kansas City (Mo.) capitalists, represented by M. W. Stanton, has applied to the City Council of El Paso for a franchise over certain streets of the city for an electric railway. The lines in the city will be part of a general system of electric railways which the syndicate has planned to build. It is proposed to build the road from the Engle dam, in New Mexico, down the valley of the Rio Grande to El Paso and south from El Paso to Fort Hancock, a distance of about 40 miles, making a line 165 miles long. It is stated that the power for the proposed road will be furnished by the Engle dam. The route of the proposed road is through the towns of San Elizario, Ysleta, Clint, Las Cruces, Mesilla, Anthony and Berino.

A hydro-electric plant is to be installed near Barstow by the Pecos Valley Light and Power Company. The electric current will be transmitted to Barstow and Pecos.

F. J. Combe and S. C. Tucker of Brownsville are preparing to install an electric-light and power plant there. The proposed plant will probably be used to provide lighting and power service also for Matamoros, Mexico, situated opposite Brownsville.

W. F. Robertson of New York has arrived at Austin for the purpose of submitting a proposition to the City Council to rebuild the dam across the Colorado River and install an electric-light and power plant for the city. Mr. Robertson says that he represents a strong syndicate of capitalists who stand ready to carry out the work if the city will accept its proposition. The nature of the proposition will probably be made public at the next meeting of the City Council. Stone & Webster of Boston investigated the proposition of rebuilding the dam, but, it is said, decline to take hold of it.

A project is on foot to build an interurban electric railway from Charleston to Ben Franklin. E. T. Pillman of Cooper is interested.

Major G. B. Beardsley is preparing to build an electric street-railway system at Mineral Wells. He has obtained a franchise from the City Council for the purpose. It is stated that the Interstate Investment Company of Shreveport, La., will finance the enterprise.

The City Council of Cleburne has granted a franchise to B. F. Bond of Jacksonville, Ill., and associates to build an electric street-railway system in Cleburne. Preparations have been made to commence the construction work in a few days.

The Houston-Galveston Traction Company is making good progress in its preliminary work looking to the construction of an interurban electric railway between Houston and Galveston. Practically all of the right-of-way for the proposed line has been secured. The power house will be located at Genoa. A branch line will run from Genoa to La Porte. Galveston Bay will be crossed either on the existing bridge or on a causeway to be built for the purpose. J. O. Ross is president of the company. H.

Ohio.

Cleveland, March 3.—Judge A. C. Thompson of the United States Court at Cincinnati has confirmed the sales of all the Appleyard properties, no opposition being made. Attorney Judson Harmon, representing the receivers, appeared before Judge Thompson and stated that $90,000 had been paid as a matter of good faith. It was advised that $120,000 should be ordered paid into the registry in order that certain receivers' certificates might be taken up, the court costs paid and the receivers' and attorneys' fees provided for. Work is progressing upon the organization of a holding company for these properties. In the meantime Albert Benham, assistant superintendent of the Cincinnati Traction Company, has gone to Columbus to take charge of the business, General Manager Theodore Stebbins having resigned to accept another position.

The merger of the Pennsylvania and Mahoning Valley, the Mahoning and Shenango Valley Railway and Light Company, the Youngstown and Sharon Railway and Light Company, with lines in Youngstown, Warren, New Castle and Sharon and connecting these places, has been completed and officers have been elected for the new company, the Mahoning and Shenango Railway and Light Company. M. S. McCaskey and Randall Montgomery will have the management of the properties.

Most of the underwriting of the Youngstown and Ohio River Railroad Company was placed in Cleveland last week. This company proposes to build an electric railway between Youngstown and the Ohio River. The officers are as follows: President, George A. Stanley; vice-president and treasurer, Warren S. Bicknell; secretary, Max P. Goodman of Youngstown. Will Christy and J. R. Nutt are members of the board of directors. They expect to begin the construction of the line early in the summer.

The Western Ohio has opened up the Findlay branch for freight and express. The cars will run from Celina to Findlay and then over the Toledo, Bowling Green and Southern to Toledo.

The Niles Electrical Company of Niles, with a capital stock of $10,000, has been incorporated by F. W. Stillwagon and others.

In a suit for damages against the People's Railway Company of Dayton the assertion has been made that the American Railway Company, which owns this property and the local roads at Springfield, has no right to operate in the state. It is alleged that it has never been authorized to transact business in Ohio.

The name of the De Mars Electric Vehicle Company of Cleveland has been changed to the Blakeslee Electric Auto Company.

The capital stock of the Findlay-Marion Railway and Light Company has been increased from $25,000 to $250,000. The president of the company is R. P. Hankey, Detroit. The intention is to build a line between Marion and Findlay to complete the line from Columbus to Toledo.

The Shelby Traction Company of Shelby has been incorporated with a capital stock of $10,000 by J. E. Will and others.

Traffic arrangements have been completed by the Lake Erie, Bowling Green and Napoleon and the Toledo, Fostoria and Findlay lines so that Findlay, Fostoria and Tiffin may be reached readily from Bowling Green. Connections have been made by which residents along the Fostoria line may reach Toledo by way of the Lake Shore Electric.

Freight equipment has been placed on the Ohio Central lines and hereafter cars will be run at regular intervals for that purpose.

The Newark Light and Power Company of Newark has decided to spend $100,000 in installing a new plant, it is said. The earnings of the company have been far above what was expected last year and the capacity of the present plants has been found much too small. Col. Meilville L. Gillette, president of the company, Congressman B. G. Dawes, and Fletcher Heath were in Columbus a few days ago in connection with the matter.

The Strang gasoline-electric car passed through Ohio over the Lake Shore a few days ago. In the depots at Cleveland and Toledo it attracted much attention. Schedule time was kept up all the way through Ohio. O. M. C.

Indiana.

Indianapolis, March 3.—The Winona Interurban Company has decided to build a spur from its main line at Milford to Lake Wawasee. The company is also preparing to furnish street and commercial lighting to the cities and towns along its route.

The directors of the Lafayette and State Line Traction Company have elected officers as follows: President, W. H. Goodwine, West Lebanon; vice-president, Ora Clark, Attica; secretary, S. G. Pomeroy, West Lebanon, and treasurer, Fremont Goodwine, Williamsport. Options on the right-of-way are now being obtained, the capital stock of $10,000 having been subscribed.

Two passenger cars in transit from Wabash, Ind., to Canton, Ohio, last week, traveled 425 miles, the route being from Wabash to Fort Wayne, to Lima, to Findlay, to Toledo, to Cleveland, to Akron, to Canton. The cars were purchased from the Indiana Union Traction Company by the Canton-Akron people.

The Fort Wayne and Bluffton interurban traction line was opened for business between Bluffton and Fort Wayne on February 27th. This new line increases the competition against the Lake Erie and Western and practically completes interurban lines between all points touched by the Lake Erie and Western in Indiana.

Indiana interurban railroad officials say this winter has been one of the most profitable seasons in the history of Indiana traction service. There has not been a day when trains have been delayed by snow.

C. S. Hernley, secretary of the Indiana, New Castle and Toledo electric railway, announces that work will be begun on the road in a few weeks.

The financial statements of the various interurban traction companies for 1905 show a notable reduction in operating expenses as compared with former years. Officials and stockholders have been striving to systematize the management of the various departments so as to eliminate all expenses not absolutely imperative. To this and other causes the aggregate average of 15 per cent. increase in the gross receipts is attributed.

The surveys of the new extension of the Indianapolis and Plainfield Coal Traction Company's line from Plainfield to Amo have been completed. This line will be used almost exclusively as a coal and freight road so as to relieve the main line of that traffic into Indianapolis. The main trunk line of the Indianapolis and Western between Terre Haute and Amo will be double-tracked shortly after it is opened for traffic.

A company headed by John E. Armstrong has been granted a franchise to construct and operate an electric-light plant in Leesburg.

The Town Board of Redkey has decided to put in an electric-light plant and is now considering plans.

Plans for the construction of the new Bijou Theater in Evansville call for considerable modern electrical equipment. The electric switchboard to be installed on the stage will be an elaborate piece of mechanism. From the main switchboard 42 switches will radiate to control separate circuits. The stage circuits will be arranged for lights of three colors, which may be blended and dimmed so as to secure all kinds of effects. S. S.

Michigan.

Grand Rapids, March 3.—The Detroit, Flint River and Saginaw Valley Railroad is securing the right-of-way for an electric road to connect Detroit and Saginaw. The company agrees to maintain a

maximum rate of fare for passengers of 1½ cents a mile. The work of grading in the townships is to be done under the supervision of the commissioners of highways.

The Battle Creek and Southeastern Electric Railway Company, which proposes to build from Battle Creek to Coldwater, utilizing the old Mansfield railroad grade, announces that it has secured a six foot right-of-way for the entire distance. The company proposes to buy its power. The field is an exclusive one, the proposed line being the only north-and-south road within a distance of 50 miles.

The Marquette County Gas, Light and Traction Company, operator of the traction system and the gas and electric-light plants at Ishpeming and Negaunee, has gone into the hands of a receiver. E. B. Finch, secretary of the company, who has been in charge of its affairs, has been appointed receiver upon application of the trustee, the Merchants' Loan and Trust Company of Chicago. The bill was filed by Granger Farwell & Co., bankers and brokers, of Chicago, holders of the bonds, amounting to $250,000, covered by a mortgage on the plants. There are also some $35,000 or $40,000 worth of local claims. These claims were in part incurred on account of the gas explosion which wrecked the Miners' National Bank Block, November 5th last.

Mayor Walter R. Taylor of Kalamazoo, who is known to be strongly in favor of the ultimate municipal control of all street railways, both city lines and interurbans entering Kalamazoo, has formulated a plan that he thinks is a step in this direction, by drafting a tentative franchise looking to the construction of a loop line to be used in common by all interurban roads in the future and securing for the traveling public all the conveniences usually found in a union station.

The annual stockholders' meeting of the Grand Rapids, Grand Haven and Muskegon Interurban will be held April 2d. It was postponed from February 2d. At this meeting it will be decided whether or not Muskegon is to have a new interurban station and freight house this year. The road has cut out mileage books on its lines and is issuing a coupon book containing $2.50 worth of fares. The book can be purchased for $2. The coupons will be good for the payment of fare on the cars at the cash rate. No amount less than 10 cents will be accepted. For the convenience of steady travelers commutation books containing 50 rides with a 30-day limit, have been issued at a rate of 1¼ cents a mile. They are good for use only in the hands of the purchasers.

Petitions for constructing two dams on the Boardman River have been granted by the Board of Supervisors of Grand Traverse County to the Queen City Light and Power Company. The company's petition for the privilege of putting poles and wires on the highway was also granted.

Citizens of St. Clair have voiced their opposition to the installation of a system to secure electric power from the St. Clair waterworks, and light from a Port Huron concern, by the commencement of an injunction suit in the Circuit Court to restrain Mayor Fred W. Moore and City Clerk W. H. Brown from carrying out the contract. They say it will cost the city $10,000 for machinery, and that the city officials are in league to wrongfully divert the money voted to carry out the contract for new municipal electrical equipment. L. W. B.

Northwestern States.

Minneapolis, March 3.—The Great Northern Development Company of Duluth, Minn., is considering a deal with the Minnesota Power and Trolley Company of Minneapolis, whereby it is proposed for the former to take over the franchises and other assets of the latter and to develop the power at Elk River and Otsego, Minn., on the Mississippi River, about 25 miles above Minneapolis.

The City Council at Fergus Falls, Minn., is taking estimates for a new concrete dam for the electric-light plant.

The Postal Telegraph-cable Company is talking of putting in a telegraph line from Duluth, Minn., to Hibbing and other Iron Range towns.

The B. S. & H. Electric Company of Minneapolis, manufacturer of electric-light machinery, has been incorporated by Frank S. Bryant and associates with a capitalization of $1,000,000. Mr. Bryant is president and P. M. Hofstad, secretary and treasurer.

The Valley Railway Company is engaged in surveying a new route for its proposed line from Green Bay, Wis., to Appleton.

Des Moines is to be the terminus of a new interurban road, which it is planned to build from Ottumwa, Iowa. Charles A. Walsh is a leading spirit in the enterprise.

The Milwaukee Electric Railway and Light Company proposes to build an electric line through Horlicksville to Burlington, Wis. R.

Pacific Slope.

San Francisco, March 3.—The City Trustees of Alameda, Cal., have admitted for consideration two ordinances, one to W. I. Morgan and the other to F. M. Greenwood, asking the right to operate a street railway on Clement Avenue.

The new contract of the municipality of Santa Ana with the Edison Electric Company calls for a remodeling of the [illegible] system. The contract is to last for [illegible] years.

The Burrard Power Company [illegible] B. C., will develop [illegible] horsepower from [illegible] Lake to be used for light, heat and [illegible] purposes. The power [illegible] will be located on the banks of the Fraser River near Port Haney.

The Nevada Power Company will [illegible] $150,000 on a plant at Bishop Creek, Cal. Additional machinery will be placed on the [illegible] power [illegible] now used.

The Board of Supervisors of Sacramento County have granted a franchise to the California Traction Company for an electric line from Sacramento to Perkins Station.

The Culdesac Milling Company has purchased a 45-horsepower turbine wheel to be installed immediately to test the water power at a site owned by the company. If it works satisfactorily, a large electric-lighting plant will be installed.

The Hume-Bennett Lumber Company has ordered a 70-kilowatt Westinghouse two-phase generator which is to be installed for lighting purposes in the new sawmill now in course of construction at Converse Basin, Fresno County, Cal. The mill will be equipped so as to cut logs 20 feet in diameter, many of which are found in the grove of Sequoias, included in the company's timber lands. A.

PERSONAL

R. R. Choate, who has been in the employment of the American Light and Traction Company for several years, has gone to Muskegon, Mich., from Madison, Wis., to take the position of sales manager of the Muskegon Traction and Lighting Company.

R. H. Carpenter has been made auditor of the Western Ohio Railway Company, vice J. H. Merrill, who resigned to become secretary of the Central Electric Railway Association. Charles F. Price, a newspaper man, has been appointed general passenger agent of the road.

William D. Pence, dean of the School of Civil Engineering at Purdue University, has resigned, his resignation to take effect in June. He will go to the University of Wisconsin, to become head of its civil engineering department, and will also be officially connected with the Wisconsin State Board of Appraisement. He has been at Purdue since 1899.

Prof. Samuel P. Langley, secretary of the Smithsonian Institution of Washington, died on February 27th at Aiken, S. C. He was 72 years old and was born near Boston, Mass. Earlier in life Professor Langley had been a practical architect and civil engineer. He was also a professor of mathematics. A number of scientific instruments were devised by him through his study of astronomy. In later years he carried out many researches in physics and aviation.

Paul Wait, a junior in the electrical engineering course at Union College, Schenectady, was killed recently by an electrical shock received while he was helping prepare apparatus for a lecture. The lecturer asked him to assist in getting the apparatus ready, and the young man accidentally received a shock from a 2,300-volt circuit. His classmates, who were watching him at the time, rushed to his assistance as he fell, but were unable, after two hours' work with the aid of a physician, to resuscitate him.

F. B. Huntington, vice-president and secretary of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., has resigned his position to become comptroller of the Chicago Terminal Transfer Company. He will have headquarters in Chicago. Mr. Huntington has been connected with the Fond du Lac company since June, 1903, and has been very successful. The company does the gas and electric lighting in Fond du Lac and operates the street railway in that city and a fine interurban road to Oshkosh. Mr. Huntington was elected vice-president upon the death recently of F. B. Hoskins.

Theodore Stebbins, who has for some years been the general manager of the Appleyard electric railways, with headquarters at Columbus, Ohio, presented his resignation some days ago, in order to accept a position with the National Civic Federation. His position will be that of special engineer, investigating public and private electric plants for information to be used by that organization. Directly associated with Mr. Stebbins will be C. E. Phelps, and together they will minutely inspect the largest electric plants in the country. The Civic Federation has as members some of the best students of civil government and reform in the country, and they are making a study of these matters in order to arrive at substantial conclusions.

Mr. Dana Pierce has been engaged by the Underwriters' Laboratories as engineer in charge of electrical work. He will begin his duties this month, spending a few days at the New York office of the Laboratories, going to Pittsburg to attend the annual conference between experts in the employment of insurance interests and those of the Westinghouse Companies, and take up his active [illegible] Dana Pierce [illegible] to be an important [illegible].

ELECTRIC LIGHTING

W. J. Garvin will install an electric-light plant at Chetek, Wis.

J. M. [illegible] of Omaha, Neb., [illegible] an electric-light plant at Bryant, S. D.

J. H. Davis & Son have been granted a franchise for an electric-light plant in [illegible].

The Malone Light and Power Company of Tekoa, Wash., has been incorporated with a capital of $5,000.

The Minden Edison Light and Power Company of Minden, Neb., has been incorporated with a capital of $20,000.

The Greeley Power and Light Company is making preparations for the construction of a new power house in Greeley, Colo.

The Superior Electric Light Company of Superior, Neb., is installing new machinery for adding a power circuit to its service.

William S. Mead, manager of the Spencer (Ind.) electric-light plant, is ready to receive bids for the remodeling of the plant, changing also from open to enclosed arc lamps.

The merchants of Reno, Nev., are said to be organizing for the purpose of erecting and operating an independent electric-light plant in opposition to the existing light company. It is said $25,000 has been subscribed toward the project.

E. G. Lanning, superintendent of the Rockville (Ind.) electric-light plant, announces that it has been decided to install a large alternator and to change the street-lighting system from direct to alternating current. Bids will be in order in the spring.

It is estimated that over $150,000 has been subscribed by leading business men of Torreon, Mexico, for the formation of a new company which proposes to erect in that city one of the most complete electric plants to be found in Northern Mexico. Machinery will be imported from United States.

The Sultepec Electric Light and Power Company has been incorporated under the laws of New York state, with a capital of $200,000, for the purpose of installing an electric power and lighting plant in the city of that name in Mexico. The directors are headed by Ashley T. Cole and Alexander Keogh of New Jersey.

The City Council of Milwaukee, Ore., has passed an ordinance granting the Portland General Electric Company a 25-year franchise. This franchise gives the company the right to plant poles and stretch wire on the streets of Milwaukee on condition that electric lights, both in private houses and for the city, shall cost no more there than in Portland.

The 1,500-kilowatt Allis-Chalmers turbo-generator unit ordered some months ago by the New York Edison Company is being erected in the North River power house on Rider Avenue, near One-hundred-and-fortieth Street, Borough of Bronx. It will operate at a speed of 1,875 revolutions per minute, generating a current of 62.5 cycles, two-phase, at 2,500 volts. The unit is designed so that it will run in parallel with other similar units or reciprocating engines.

Circulars have been sent to stockholders of the Chicago Edison Company notifying them that in accordance with previous action of the shareholders the directors have decided to make an increase of 15 per cent. in the company's capital stock. The stock will be issued at par to shareholders of record on April 21st. Stockholders not availing themselves of the privilege of subscribing and making first payment on May 1st will have their proportionate share turned into the treasury of the company. The outstanding capital of the company is now $11,839,056. A 15 per cent. increase will make it $13,614,913.

Following the lead of many other central stations in all parts of the country, the Memphis Consolidated Gas and Electric Company of Memphis, Tenn., has recently purchased a 1,500-kilowatt Allis-Chalmers turbo-generator unit, with condensing and auxiliary apparatus, for installation at Memphis. The new unit is of the horizontal parallel-flow type, designed to operate at a speed of 1,800 revolutions per minute and generate a cur-

rent at 60 cycles, three-phase, of 2,500 volts. This unit will run in parallel with other units of similar type or with a reciprocating-engine unit built for parallel operation, properly dividing the load so as to prevent surging.

A novel method of illumination by Nernst lamps is exemplified in the lighting of the general waiting room of the Pennsylvania Railroad Union Station in Pittsburg. The lamps are located in the attic space between the inner and outer skylights, so that they are invisible to the public. By means of suitable reflectors the light is projected down through the inner skylight into the waiting room, giving, so far as the distribution of the light is concerned, practically the effect of daylight.

Merchants and commercial organizations of Louisville, Ky., are completing plans for the erection of electrically illuminated arches in the business section of the city. The plan is to raise the money for erecting and maintaining the arches by subscriptions among the merchants. Each street intersection would be spanned by an arch to cost about $200, and the lighting of each would be about $50 a year, it is estimated. Eventually, it is thought, the city may take over the arches.

The Illinois Traction System, owned by the McKinley syndicate, has closed a deal whereby it comes into possession of the plant, franchise and property of the Granite City, Venice and Madison Electric Light Company of Venice, Ill. The Tri-city company owns a main plant in Venice and franchises for operating in Granite City, Venice and Madison, as well as contracts for the municipal lighting of these three cities. The new management has already taken charge. The business will be handled from the McKinley office in Edwardsville, Ill., with a representative on the ground. The McKinley syndicate acquired the Edwardsville light and power plant several months ago.

The power plant of the Dayton (Ohio) Lighting Company, which recently underwent an entire alteration with extensive additions, has been recently placed in operation again. The opening of the new power house was made the occasion of a banquet given by the company to the electrical contractors and allied electrical interests of Dayton. The new power plant, among other features, has added a 1,500-kilowatt Allis-Chalmers turbine generator unit. This unit operates at a speed of 1,800 revolutions per minute, generating current of 60 cycles, three-phase, at 2,500 volts. The condensing apparatus used in conjunction with the turbine unit was also furnished by the Allis-Chalmers Company, which superintended the erection of the unit.

ELECTRIC RAILWAYS.

In the Ohio Legislature the House has defeated the bill which proposed to give the people of Ohio cities the right to vote franchises for street railways without the consent of property owners on the streets wherein the franchises were sought. The bill was urged by Mayor Johnson of Cleveland to aid his project for a three-cent-fare street railway in that city.

The Chicago, Blue Island and Joliet Traction Company has been incorporated, with principal office in Chicago, and a capital of $1,500,000. It is proposed to construct an electric railway from Blue Island to Tinley Park, New Lenox and Joliet, Ill. The directors are W. S. Reed, J. B. Reed and J. M. Atkinson of Chicago and Charles Cooper and W. N. Harding of Indianapolis, Ind.

Notice has been given by the Pennsylvania Railroad Company to the officers of connecting lines that after January 1st of next year it will not receive freight cars which do not conform to a certain standard. Some time ago the Pennsylvania discarded several thousand cars because of their weakness; and it now proceeds on the principle that it will not haul for anybody else cars that are inferior to its own.

The Los Angeles-Pacific Railway Company, which operates a 150-mile electric railway to Santa Monica and other branch towns, has made traffic arrangements with the Southern Pacific railroad (steam) whereby shippers in the East can bill their freight through to any point on the Los Angeles-Pacific via the Southern Pacific, and the shipment will be delivered without delay. The deal has to do only with freight traffic and in nowise affects the passenger department, which will be conducted as usual. The company denies the rumor that its road has been sold, and there is no prospect of a change of ownership.

The Metropolitan Elevated Railroad Company of Chicago is seeking to extend its system so as to reach out for more suburban business toward the northwest of the city. An ordinance has been submitted to the local transportation committee of the City Council by the railway company asking for the privilege. The proposed additions include an extension of the Humboldt Park branch to the Desplaines River, where connection will be made with the Chicago and Desplaines River electric railway, which will tap an extensive and populous district in the Fox Lake region. It is also proposed to extend the Douglas Park branch from Fortieth to Forty-sixth Avenue and connect with suburban electric lines.

It is proposed to build a bridge across the Arkansas River at the top of the famous Royal Gorge, near Cañon City, Colo. The building of the bridge is suggested in connection with an interurban electric railway to be built in Fremont County, from Cañon City to Florence, and to the top of Royal Gorge. The bridge, if ever built, will be 2,800 feet above the "hanging bridge" of the Denver and Rio Grande Railroad.

The contract for the bridges and culverts of the Illinois Traction System's new right-of-way for the interurban road between East Peoria and Morton, Ill., will be let at once at the office of the chief engineer at Bloomington. On this 12-mile stretch there are 15 bridges and culverts which will be of concrete. The Missouri Construction Company has sublet the contracts for the excavation to several different companies and work has commenced.

The Rockford, Beloit and Janesville Electric Railway Company has sold its property to the Rockford and Interurban Railway Company of Rockford, Ill., which also operates the Belvidere and Freeport lines. The purchase will give the company 103 miles of electric road and extensions to Madison in the near future. The transfer took place March 1st. For the present no change will be made in the management of the Rockford, Beloit and Janesville line.

Traffic on the elevated roads of Chicago made a good exhibit for February. The Northwestern showed an increase of 4,769 passengers a day over the corresponding month of last year, the Metropolitan a daily increase of 14,393, the South Side a daily increase of 6,904, and the Oak Park a daily increase of 1,771. The average daily figures for the month of February are as follows: Northwestern, 83,572; Metropolitan, 135,570; South Side, 95,077; Oak Park, 47,167.

The Central Railway Company of Peoria, recently acquired by the McKinley interests, has accepted the ordinance passed by the Peoria City Council granting the Illinois Traction System the right to construct a bridge across the Illinois River at the foot of Walnut Street and the use of that street from the river front to Adams Street. The directors present when the ordinance was accepted were W. B. McKinley, L. E. Fischer, H. E. Chubbuck, B. E. Bramble, G. M. Lillis and Walter Barker.

The stockholders of the Schenectady Railway Company have elected a new board of directors representing jointly the New York Central railroad and the Delaware and Hudson Company. These two roads last year took over control of the Schenectady railway from the General Electric Company. The Schenectady railway is an electric line running from Albany to Schenectady. The General Electric Company acquired the road partly for the purpose of conducting experiments in electric traction. The New York Central and the Delaware and Hudson each has a half interest in the property.

PUBLICATIONS.

The Cutler-Hammer Manufacturing Company of Milwaukee is distributing a number of leaflets for insertion in its perpetual bulletins. The leaflets are descriptive of various types of rheostats, starting devices and controllers.

The first number of a bulletin entitled "Concerning Municipal Ownership," published in New York, has appeared. The bulletin is opposed to municipal ownership in all its forms, and contains many instances of failures of municipal-ownership undertakings.

One of the latest bulletins to be credited to the Westinghouse Electric and Manufacturing Company is that devoted to type-SA direct-current motors for variable-speed work. These motors permit a speed range of 4 to 1 on a single voltage, and by the simple method of field control a wide range of speed control is obtained.

A handsome hanger is being distributed among the trade by McLeod, Ward Co. of New York city. The hanger is sent out with the idea of putting before those interested different styles of the original Kinsman desk lamps, which the company manufactures, and that, too, in a manner to admit of quick and easy reference. The hanger will often save looking up things in the catalogue.

The Abner Doble Company of San Francisco has reprinted, and designated as Bulletin No. 9, the paper read by F. E. Trask before the American Society of Civil Engineers, May 17, 1905, upon the subject of "The Irrigation System of Ontario, Cal.—Its Development and Cost." The pamphlet also contains discussions on the paper by Arthur S. Hobby and F. E. Trask.

The Power and Mining Machinery Company of Cudahy, Wis. (suburb of Milwaukee), will shortly have off the press catalogue No. 4 on rock-crushing plants. This is the second edition of the catalogue. All of the matter contained in the first edition has been thoroughly revised to conform with the latest and best engineering practice. This catalogue will contain 72 pages, fully illustrated, and will be sent upon request to those interested in modern crushing plants and equipments.

SOCIETIES AND SCHOOLS.

The 1906 meeting of the British Association for the Advancement of Science will be held in York, England, beginning August 1st. The inaugural meeting of the association was held in York 76 years ago.

The Engineers' Society of Western Pennsylvania, which has its headquarters in Pittsburg, has leased a suite of rooms in the new Fulton Building, almost completed and located on Duquesne Way and Sixth Street, Pittsburg. The society will occupy its new quarters on April 1st.

The engineers in the office of the Roberts & Abbott Company, Cleveland, Ohio, have formed an association which meets monthly. The members report data which they find in technical papers, and matters of interest from their experience in the field. Messrs. Roberts and Abbott also contribute experiences. These matters are all discussed with the idea of arriving at the best conclusions upon the various subjects brought to their attention.

Interest shown in the coming convention of the National Electric Light Association to be held at Atlantic City, N. J., June 5th, 6th, 7th and 8th, is quite unprecedented at so early a date. A number of manufacturing companies have applied for membership in the association for the express purpose of securing exhibiting space at the meeting, and many others have expressed their intention to do so. The growth of membership in all classes has been considerable, and recently there have been added 28 class A members (operating companies), 38 class B members (individuals), two class C members (members of technical schools), six class D members (manufacturing companies), and one class E member.

TELEGRAPH.

Germany has completed the laying of the Pacific cable from Yanghai to Jap in the Caroline Islands. This closes a gap of more than 2,000 miles and completes the first non-English cable to completely encircle the globe. One of the distinguishing features of this cable is the fact that it is laid at the greatest ocean depth of any cable in the world—22,966 feet.

The Postal Telegraph-cable Company recently completed a direct connection with the Northern Telegraph Company, operating lines on the Bangor and Aroostook railroad. The connection adds 500 miles of pole line and 150 places in Northern Maine to the Postal system. Telegrams are now transmitted via Postal to the Moosehead Lake region and all points on the Bangor and Aroostook railroad.

A report from the Canadian commercial agent at Sydney, New South Wales, confirms the announcement that the Australian Parliament has ratified the agreement with the Eastern Extension Telegraph Company, to expire in 1915. Two space-telegraph companies are proposing to open stations and conduct business in Australia, one between Tasmania and Australia, and the other between Australia and New Zealand.

MISCELLANEOUS.

The Pittsburg Reduction Company of Massena, composed of New York and Pittsburg capitalists, has, it is reported, secured a controlling interest in the large power plant of the St. Lawrence River Power Company at Massena. It is said to be the largest deal in power property ever consummated in this country, costing between $5,000,000 and $6,000,000. The plant has developed 50,000 horsepower and it is planned to double it.

Failures to receive and send space-telegraph messages at sunrise and sunset have been noted frequently. To determine the cause of these failures tests will be made by officers in the Navy Department in charge of the stations in the United States Navy system. It has long been asserted that wireless messages can be sent by the system at night 40 per cent. better than in the daytime, especially when the sun is shining. It also is known that foggy weather is more favorable for sending and receiving messages than clear weather.

At the Pratt Street Station of the United Railways and Electric Company of Baltimore a novel method was employed this winter for obtaining a sufficient steam supply, the boiler plant being of insufficient capacity, owing to a disastrous fire and to an unprecedented growth which has taken place in the system in the last two years. The steamship Lord Baltimore, engaged in the passenger business during the summer, being laid up for the winter, was chartered, and it was brought alongside the dock at the station. Connections were

made from the steamer boilers to the engines in the power station and by this means four 250-horsepower boilers were placed at the disposal of the company.

A newspaper dispatch from Los Angeles, Cal., is to the effect that Robert Anderson, a newsboy of Venice, Cal., has discovered a process for tempering copper to the hardness of steel. It is said that he has an ax and several knives of fine quality made from copper.

The Knickerbocker Pulp and Paper Company of Plattsburg, N. Y., will install four 450-kilowatt Allis-Chalmers waterwheel-type generators and a 75-kilowatt belted exciter, recently purchased. The new outfit will be used for the electrification of the present mill at Plattsburg.

TRADE NEWS

William Vanderwalker of Boone, Iowa, has sold his electrical business in Boone to Harvey Pillson.

H. C. Frederick and W. H. Ramsden will engage in the electrical supply business in Fargo, N. D.

The People's Plumbing and Electrical Company of Grenada, Miss., has been incorporated, with a capital stock of $10,000.

The Butterfield Construction Company, formerly located at 113 Adams Street, Chicago, announces a change of address to Room 326, Reaper Block.

On account of confusion arising from the similarity of its name to that of another concern, the C. H. Wheeler Condenser and Pump Company changed its corporate name on March 1st to the C. H. Wheeler Manufacturing Company.

The partnership between Claude D. Stephens and Theodore R. Tyler, doing a consulting engineering business under the firm name of Stephens & Tyler, 960 Monadnock building, Chicago, was dissolved March 1st. Mr. Stephens succeeds to the business, with offices in the same building.

The Frevert Machinery Company have opened a salesroom and offices at 18 Dey Street, New York city, where it carries a complete line of new and second-hand metal-working tools and machines of every description. It also manufactures a line of newly designed hand-power traveling cranes, trolleys, hoists and overhead tracks, which combine many valuable improvements and new features. H. F. Frevert, the principal of the company, has had a wide experience in the machinery-tool business.

The negotiations which have been in progress over a year, by which it was proposed to merge all the largest street-car building plants of the country are said to have been abandoned. Some time ago the success of the merger seemed assured, and only two weeks ago it was announced that negotiations had reached a point when a final agreement was possible. Eastern papers now say that Kean, Van Cortlandt & Co., bankers, declare the proposed plan defunct. The new combine was to have had a capital of $56,000,000.

Coincident with the completion of the new terminal station and office building of the Milwaukee Electric Railway and Light Company in Milwaukee, a contract has recently been placed with the Allis-Chalmers Company for the installation of three Allis-Chalmers steam-turbine generating units, each of 1,500 kilowatts, 60-cycle three-phase, 2,300 volts, to operate under steam pressure of 150 pounds. There are included in this contract two 1,500-kilowatt motor-generator sets to deliver direct current at 300 volts, each consisting of a direct-current generator direct-coupled to a three-phase 60-cycle synchronous motor. The electrical machinery for this installation is to be [illegible] at the [illegible] Works of the Allis-Chalmers Company [illegible] nati. The turbines will be built [illegible] Allis shops.

Arthur Gieseler, who has been [illegible] designer of hydraulic installations for the [illegible] Works Company, of Dayton, Ohio, [illegible] whom much credit is due for [illegible] practice in this country, has [illegible] New York, with offices at 170 Broadway, [illegible] sulting engineer, and will devote [illegible] specialty of hydro-turbine power plants and [illegible] turbine pumping stations.

On February 21st the Wisconsin Engine Company of Corliss, Wis., acquired by purchase the entire plant and equipment, including patterns and drawings, of the Brown Corliss Engine Company. The old force of skilled workmen has been retained, and as there has not been any interruption in the operation of the works, the Wisconsin Engine Company is therefore prepared to engage to build Corliss engines, making unusually prompt delivery. The excellent facilities the plant now possesses for the execution of work are to be increased.

The Gould Storage Battery Company of New York city has just opened a branch office in the Crossley Building, San Francisco, Cal., to meet the demands of its rapidly increasing business on the Pacific slope. The new branch is in charge of Mr. E. C. Sharpe, a prominent engineer, who was formerly connected with the John A. Roebling's Sons Company. The Chicago office, located in the Rookery Building, has secured the services of Mr. R. H. Watson as an addition to the engineering force. Mr. Watson has been connected with the Gregory Electric Company of Chicago and is well known in the Middle West. A new addition has also been made to the force of engineers in the main office of the Gould Storage Company, located at 1 West Thirty-fourth Street, New York city, in Mr. H. N. Powers. Mr. Powers was until recently sales manager of the American Automatic Switch Company, and has likewise been connected with Thomas A. Edison and served in the engineering department of the New York Edison Company.

The Rawson & Morrison Manufacturing Company has consolidated with the Mead-Morrison Manufacturing Company of Cambridge, Mass., and hereafter the business will be conducted under the latter name. The company will continue the manufacture of the same lines of machinery as before and all the men who have made the Rawson & Morrison Company successful in the past will be retained. The company calls attention especially to its lines of hoisting engines, derrick swingers, electric hoists, belt hoists, suspension cableways, cable roads and all kinds of machinery for handling coal and other bulky material. The capital of the Mead-Morrison Manufacturing Company is $1,000,000. Eugene N. Foss is president and Willard S. Martin general manager. The company will increase its facilities for manufacturing and will develop the special features of the business which are constantly arising.

The Milwaukee Journal of February 28th says that arrangements have been practically closed for an application to the bankruptcy court for an order for the sale of the entire assets of the National Electric Company. This means that the offer recently made to the creditors through the office of Bloodgood, Kemper & Bloodgood will be accepted. Acceptances have already been obtained from creditors representing $500,000, and others are being received daily. The total liabilities on December 31st were $1,292,800, and assets, $1,410,727. John I. Beggs, trustee, in a recent letter to creditors, says he con-[illegible]

BUSINESS

[illegible] conduit [illegible] nothing.

With the opening of [illegible] the attention of [illegible] to the stock of W. [illegible] Kansas City, Mo. Mr. [illegible] line of white cedar, red cedar, [illegible] cypress poles of all lengths [illegible] location is especially well equipped [illegible] in the southwestern and western [illegible] notice.

Two 60-ton flat cars, bearing [illegible] new Allis-Chalmers turbo-generator [illegible] ordered some months ago by the Edison Electric Illuminating Company of Brooklyn, were [illegible] started on their eastward journey, to be followed by a third carload, which will complete the shipment. The Brooklyn unit is a 5,000-kilowatt horizontal parallel-flow turbine, direct connected to an Allis-Chalmers generator, especially designed to meet the requirements of its service, the turbine being built at the West Allis Works and the generator at the company's electrical works at Cincinnati. The new unit will generate current at 25 cycles, three-phase, at 6,600 volts.

The Allis-Chalmers Company of Milwaukee has been placing before the purchasing public, for some months past, its gas engines of the Nuremberg type, in capacities ranging from 300 to 5,000 horsepower and for all power purposes. An 1,800-brake horsepower Allis-Chalmers unit was recently ordered for the Crystal City (Mo.) plant of the Pittsburg Plate Glass Company. It is of the well-known four-cycle, double-acting type, direct coupled to a 1,000-kilowatt Allis-Chalmers generator. The Illinois Steel Company, Chicago, at present using a large number of Allis-Chalmers steam units of various kinds, has recently ordered two large gas-engine generating units of the twin-tandem type, 1,000 kilowatts each. These machines will be installed in the company's present power plant for lighting and power purposes.

Something new in the line of cleats for low voltage interior wiring, such as telephone, telegraph, annunciator and like circuits, is manufactured by the Blake Signal and Manufacturing Company of Boston, Mass. The cleats are disks a little over a half inch in diameter. Grooves in one side of the disk fit down over the wire or wires to be fastened, and a screw through the center of the disk passes into the woodwork, holding the wires firmly in place. The cleats are impervious to moisture and there is scarcely any breakage, which is a great saving over porcelain cleats, the company points out. As the cleats will not break under the blow of a hammer, wire nails may be used instead of screws to fasten them in place. The company also makes a line of insulated staples for low-voltage work, and it is asserted that the fiber insulation will not come off from pounding.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 27, 1906.

813,403. Thermostat. Arthur D. Colton, Chicago, Ill. Application filed August 22, 1904.

The circuit-closer part of the thermostat comprises a strip of expansible material secured at its lower end and to a base plate.

813,410. Motor Control. Charles A. Eck, Newark, N. J. Application filed May 16, 1905.

The yoke of the motor has portions of varying cross-sectional area and means for adjusting the yoke so as to cause the magnetic lines to flow through that portion of the yoke having the large cross-sectional area or through that portion of the yoke having the small cross-sectional area at will.

813,419. Selective Signaling System. Charles G. Hawley and Herbert O. Holderness, Chicago, Ill. Application filed December 15, 1903.

In an electric-signaling system are a signal circuit and a release circuit, in combination with signaling and releasing devices arranged in pairs at distant points or stations on the circuits.

813,426. Signaling System. Herbert O. Holderness and Charles G. Hawley, Chicago, assignors to the Readable Signal Company, Chicago, Ill. Application filed February 17, 1902.

The signal dial is provided with a number of display signals and an electromagnetic device for operating the dial. A concentrically arranged registering disk suitably operated and electromagnetic punches operable upon the registered disk and controlled by the signal dial complete the device.

813,472. Electric Machine. Edward J. Willis, Richmond, Va. Application filed February 8, 1905.

An armature is described, provided with a number of rods extending longitudinally beyond the ends of the element, and a number of bonds, consisting of naked wires spaced apart and extending entirely around the element upon the extended ends and each bond electrically connected with each road at each contact point.

813,512. Circuit-closer for Telegraph Keys. Herbert R. Nevens, Portland, Me. Application filed June 14, 1905.

In a telegraph circuit-closer are a circuit-closing lever and a spring arranged to hold the lever in its extreme open position and to close it when moved from the open position.

813,515. Trolley-supporting Device. Alexander Palmros, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. Application filed December 2, 1897. Renewed April 11, 1900.

A carrier for the trolley is adapted to swing around a vertical axis and to be reversed from a forward position to a rearward position, a tension spring exerting uniform tension on the carrier.

813,523. Brushholder for Motors or Generators. Frank L. Sessions, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. Application filed May 20, 1903.

A pivoted spring-held follower is formed in two parts pivotally connected together on a pivot arranged transversely of the brush, the parts being provided with means for limiting the movement of one relative to the other in one direction, and the upper one being adapted to bear against the end of the brush.

813,538. Connector for Electrical Conductors. Frederick J. Troll, Baltimore, Md. Application filed April 3, 1905.

In an electrical-conductor connector are a pair of connected parallel conductor sleeves and an enlarged insulation sleeve at each end of the conductor sleeves.

813,546. Inclosed Safety Device for Fuses for Electrical Installations. Wilhelm Fellenberg, Charlottenburg, Germany. Application filed April 28, 1904.

A safety device for fuses consists in a combination of fuse wires, non-conductors upon which the wires are coiled and partitions between the wire coils.

813,560. Telephone System for Central Stations. Gustaf Lambert, Charlottenburg, Germany. Application filed April 16, 1902.

The system comprises a loop-conductor line connected to the central station, an electromagnet in one branch of the loop and an electromagnet on the other branch. A selective means actuated by the second electromagnet and means to short circuit that electromagnet by the actuation of the first electromagnet until the call is answered, complete the apparatus. (See cut.)

813,568. Incandescent Lamp Socket. Robert R. Miller, Grand Rapids, Mich. Application filed January 3, 1905.

Mechanical elements of a lamp socket are set forth.

813,582. Electric Storage Battery. Harris H. Porter, Providence, R. I., assignor to the Rhode Island Electromobile Company, Providence, R. I. Application filed September 21, 1903.

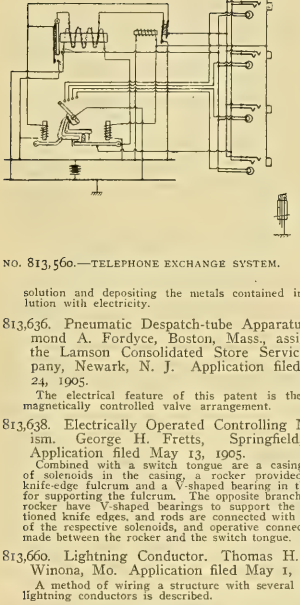
A separating device for the successive plates consists of a thin layer of wood having parallel vertical grooves arranged alternately on its opposite sides. Between them are plane surfaces substantially wider than the grooves, each surface being directly opposite a groove on the other face of the layer.

813,610. Clockwork Electricity Meter. Hermann Aron, Charlottenburg, Germany. Application filed January 13, 1904.

In an electric meter the clockwork mechanism, comprising the movable element, is made the basis of the patent.

813,620. Process of Extracting Gold, Silver, Etc. Joseph A. Comer, Los Angeles, Cal. Application filed January 2, 1904.

The process of extracting gold, silver and other metals from ores consists in subjecting the crushed ores to a solution of the cyanid of potassium, drawing off the solution from the pulp mixed therewith, impregnating with air the solution and sedimentary deposits suspended therein, separating the sedimentary deposits from the



NO. 813,560.—TELEPHONE EXCHANGE SYSTEM.

solution and depositing the metals contained in the solution with electricity.

813,636. Pneumatic Despatch-tube Apparatus. Edmond A. Fordyce, Boston, Mass., assignor to the Lamson Consolidated Store Service Company, Newark, N. J. Application filed March 24, 1905.

The electrical feature of this patent is the electromagnetically controlled valve arrangement.

813,638. Electrically Operated Controlling Mechanism. George H. Fretts, Springfield, Mass. Application filed May 13, 1905.

Combined with a switch tongue are a casing, a pair of solenoids in the casing, a rocker provided with a knife-edge fulcrum and a V-shaped bearing in the casing for supporting the fulcrum. The opposite branches of the rocker have V-shaped bearings to support the last-mentioned knife edges, and rods are connected with the cores of the respective solenoids, and operative connections are made between the rocker and the switch tongue.

813,660. Lightning Conductor. Thomas H. Miner, Winona, Mo. Application filed May 1, 1905.

A method of wiring a structure with several grounded lightning conductors is described.

813,682. Thermopile. Meyer Wilderman and Robert L. Mond, London, England. Application filed August 14, 1905.

A method of manufacturing thermopiles is described in the patent.

813,689. Indicating and Recording Device. William H. Bristol, New York, N. Y. Application filed May 6, 1905.

Mechanical features of the recording element of an electrical recording instrument are set forth.

813,710. Relay. Hemming Johansson, Stockholm, Sweden, assignor to Aktiebolaget L. M. Ericsson Co., Stockholm, Sweden. Application filed July 21, 1904.

Electromagnetic coils have an insulating block associated therewith, a contact being secured at each end of the block. An armature is adapted to alternately engage the poles of the electromagnetic coils and to press the contacts together.

813,730. Storage Battery. Adolph Müeller, Berlin, Germany. Application filed July 30, 1904.

A battery plate support consists of perforated covers provided with lateral loops and having pins inserted through the loops. The relation of the loops is such that the pins lock the covers together.

813,775. Electromagnetic Motor. Murray Cheever, Boston, Mass., assignor to the E. Howard Clock Company, Boston, Mass. Application filed February 20, 1905.

In a magnetic motor are an electromagnet, a lever, an armature for the magnet carried by the lever and adapted to be moved by the attraction of the magnet, a shaft, a ratchet mounted on the shaft, a second lever mounted for engagement and operation by the first-named lever, a pawl carried by the second lever and arranged to engage the ratchet intermittently, a stationary pawl arranged to engage and hold the ratchet while the lever-carried pawl is out of engagement therewith and means for engaging the pawls alternately.

813,794. Apparatus for Forming Sheet and Plate Glass. Harry J. Hays, Pittsburg, Pa., assignor to Edward F. Hays, trustee, Pittsburg, Pa. Application filed August 9, 1904.

A table having a rolling surface is provided with a roller adjustably mounted above and out of contact with the rolling surface, means for propelling the roller along the table and for positively revolving the roller as it is propelled along the table, means for passing an electric current through the table and the roller and means for cooling the table.

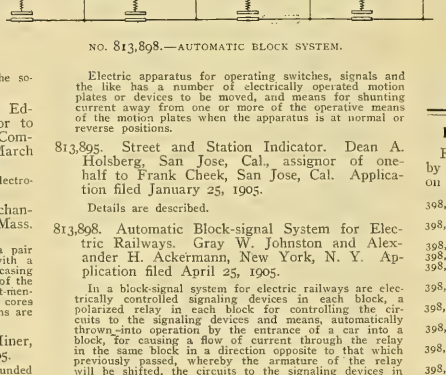
813,840. Insulated Rail Joint. McLeod W. Thomson, Altoona, Pa., assignor of one-half to Andrew Morrison, Pittsburg, Pa.; William Paton Thomson and Samuel Garver Thomson, executors of said McLeod W. Thomson, deceased. Application filed April 10, 1902.

An insulated rail joint having opposite splice bars, the halves of the bars on the same side of the joint being respectively insulated and uninsulated, is described.

813,879. System of Control for Electric Motors. Charles D. Gilpin, Cleveland, Ohio, assignor to the Electric Controller and Supply Company, Cleveland, Ohio. Application filed October 6, 1905.

The system includes a motor, a reversing switch or switches, a body of resistance having controlling switches, and actuating means for the switches, with a master controller having connections for governing the operation of the reversing and the resistance-controlling switches, and being connected to the apparatus by but two conductors.

813,882. Electric Switch and Signal Apparatus. Lawrence Griffith, Yonkers, N. Y. Application filed November 5, 1904.



NO. 813,898.—AUTOMATIC BLOCK SYSTEM.

Electric apparatus for operating switches, signals and the like has a number of electrically operated motion plates or devices to be moved, and means for shunting current away from one or more of the operative means of the motion plates when the apparatus is at normal or reverse positions.

813,895. Street and Station Indicator. Dean A. Holsberg, San Jose, Cal., assignor of one-half to Frank Cheek, San Jose, Cal. Application filed January 25, 1905.

Details are described.

813,898. Automatic Block-signal System for Electric Railways. Gray W. Johnston and Alexander H. Ackermann, New York, N. Y. Application filed April 25, 1905.

In a block-signal system for electric railways are electrically controlled signaling devices in each block, a polarized relay in each block for controlling the circuits to the signaling devices and means, automatically thrown into operation by the entrance of a car into a block, for causing a flow of current through the relay in the same block in a direction opposite to that which previously passed, whereby the armature of the relay will be shifted, the circuits to the signaling devices in the same block will be varied and a different signal will be displayed. (See cut.)

813,909. Automatic Electric Block System. Albert M. Mott, Hampton, Iowa. Application filed June 26, 1905.

A switch box contains a switch, a rotary member, a spring-pressed pawl carried by the rotary member engaging the switch, a guide bar arranged vertically within the box and a plunger extending within the box held by the guide bar, the plunger imparting motion to the rotary member.

813,914. Wireless Electric Signaling System. Ragnar H. Rendahl, Berlin, Germany. Application filed August 19, 1905.

A receiver is described which embodies for wireless-electric signaling a condenser inserted in parallel to the indicator, the capacity of which condenser is at least twice as large as that of the indicator, and the damping of the indicator circuit is so diminished by the diminution of its ohmic resistance that a diminution of the degree of coupling between the indicator circuit and the receiver circuit within certain limits has for a consequence an increase of the intensity in the indicator circuit.

813,931. Annunciator. James A. Wotton, Atlanta, Ga. Application filed May 16, 1904.

An annunciator comprises an armature and an indicator carried thereby and a magnet arranged with its axis parallel with the axis of the armature, the magnet having poles projecting from its coils. The poles have their axes also parallel with the axis of the armature and capable of operating the armature, the magnet with its poles being removably mounted so that it may be withdrawn without disturbing the armature of the indicator.

813,933. Automatic Recording Device. Adolf Abraham, Neuhaus-on-the-Oste, Germany. Application filed September 20, 1905.

In an automatic-recording device are an indicator, a clockwork, a movable disk and a chain moving together with the disk. The disk is provided with a scale, a magnet to hold the chain to the disk and a lever operated by the indicator to guide the chain on the disk.

813,975. Wireless Telegraphy. James F. King, Washington, D. C. Application filed January 8, 1903.

The method of receiving wireless-telegraph messages consists in normally impressing local generator currents on two branch circuits, causing the currents in the circuits to set up opposing magnetic fields, one of which is normally stronger than the other, and causing received oscillations to act to vary the normal relation between the field. (See cut.)

813,996. Means for Electrically Connecting Railway Rails and the Like. John M. Atkinson, Chicago, Ill., assignor to the Rail Joint Company. Application filed March 15, 1904.

An improved angle bar for connecting railway rails comprises an angle bar having a shallow recess formed in a bearing of the angle bar adapted to engage the rail, the recess containing a high conductor of electricity deposed in permanent molecular connection with the comparatively low conductive body of metal of the angle bar.

813,998. Insulating Rail Joint. Bancroft G. Braine, New York, N. Y., assignor to the Rail Joint Company. Application filed October 31, 1903.

Combined with a bolt having a head at one end and a screw thread at the opposite end are of an intermediate

NO. 813,975.—SPACE-TELEGRAPH APPARATUS.

sleeve of insulation hugging the bolt and washers at the ends of the sleeve and having recesses at the sides toward the sleeve.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on March 5, 1906:

398,814. Electrical Tramway. H. T. Blake, New Haven, Conn.
398,833. Printing Telegraph. F. H. W. Higgins, London, England.
398,906. Arc Lamp. W. L. Silvey, Lima, Ohio.
398,907. Electric Arc Lamp. William L. Silvey, Lima, Ohio.
398,912. Method of Manufacturing Screws and Bolts by Electricity. E. Thompson, Lynn, Mass.
398,913. Electrical-welding Machine. E. Thompson, Lynn, Mass.
398,914. Electric Metal-working and Welding Machine. E. Thompson, Lynn, Mass.
398,926. Electric-current Regulator. J. W. Balet, New York, N. Y.
398,927. Electric-current Regulator. J. W. Balet, New York, N. Y.
398,963. Crossing Conduit for Electric Railways. I. W. Heysinger, Philadelphia, Pa.
399,016. Stretcher for Mechanical Telephone Line Wires. A. W. Butterworth, New York, N. Y.
399,019. Process of Electric Welding. C. L. Coffin, Detroit, Mich.
399,052. Secondary Battery. E. R. Knowles, Brooklyn, N. Y.
399,054. Electric Arc Lamp. G. M. Lane, Asbury Park, N. J.
399,057. Interrupter for Electric Circuits. I. C. Lecoultre, Lausanne, Switzerland.
399,059. Electric Motor. O. Lugo, New York, N. Y.
399,084. Couch for Applying Electrical Treatment. J. B. Schmalz and J. B. Faulkner, Norfolk, Va.
399,088. Dynamo-electric Machine. William L. Silvey, Lima, Ohio.
399,091. Electric Railway. H. W. Smith, Newark, N. J.
399,092. Electric Car. H. W. Smith, Newark, N. J.
399,128. Self-winding Electric Clock. F. W. Brainerd, Chicago, Ill.
399,134. Electric Lamp Fixture and Switch. L. W. Dillon, North Attleborough, Mass.
399,135. Electric Switch. L. W. Dillon, North Attleborough, Mass.
399,137. Electrical Store Service Apparatus. R. N. Dyer, East Orange, N. J.
399,147. Regulator for Dynamo-electric Machines. J. F. Kester, Terre Haute, Ind.
399,154. Automatic Telegraphy. J. O'Neil, New York, N. Y.
399,155. Electrical-railway Signaling Apparatus. H. J. Palmer, Brooklyn, N. Y.
399,163. Electric Signal for Engine Shafts. J. C. Ricketson, Milwaukee, Wis.
399,168. Electric Cigar-lighting Device. W. Tag and S. C. Smith, Philadelphia, Pa.
399,209. Electric Amalgamator. J. H. Rae, San Francisco, Cal.
399,212. Dynamo-electric Machine. I. H. Robertson, Rutherford, N. J.
399,218. Regulator for Systems of Electrical Distribution. L. B. Stillwell, Pittsburg, Pa.
399,219. Method of Regulation for Systems of Electrical Distribution. L. B. Stillwell, Pittsburg, Pa.
399,224. Electric Regulator. F. C. Wagner, Ann Arbor, Mich.
399,228. Circuit-closer for Railway Car Telegraphs. G. I. Hopkins, Manchester, N. H.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVIII. CHICAGO, JANUARY 17, 1906.

Progress of the Chicago Drainage Canal Power Development.

Another year will see the completion of a large portion of the Chicago Drainage Canal power development, and it is hoped that by January 1st next some 15,500 horsepower will be available at the West Forty-eighth Avenue sub-station in Chicago. This power is to be generated at a power plant located about one mile below the city limits of Lockport, Ill., not far from Joliet.

Between the controlling works at Lockport and the power house [illegible] shown more clearly in Fig. [illegible] low floor of the [illegible] spillways through the water will pass [illegible]

Inspection of Fig. [illegible] of the development at the power [illegible] wall of the headrace channel [illegible] power house [illegible] side of which [illegible] house itself. From the [illegible] directly to the turbines. [illegible]

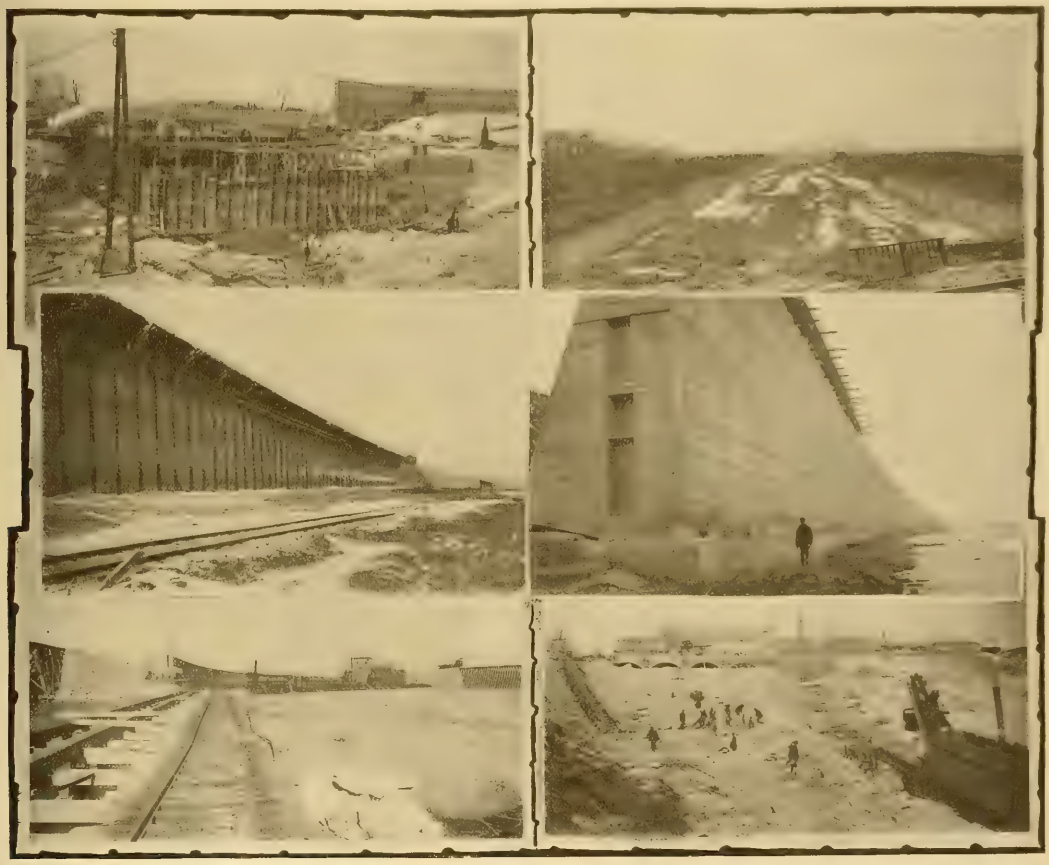


Fig. 1. View Across Foundation of Power House.
Fig. 2. View at End of Headrace Near Controlling Works
Fig. 3. Section of Core Wall Not Yet Filled In.
Fig. 4 Section of Concrete Wall of Headrace
Fig. 5. View of Both Core and Concrete Walls of Headrace
Fig. 6. View of Tailrace Looking Toward Power House

PROGRESS OF THE CHICAGO DRAINAGE CANAL POWER DEVELOPMENT.

Lake Joliet (a widened portion of the Desplaines River) the bed of the river has a considerable slope, which is being utilized by the Sanitary District for the power development. To use this difference in level an artificial waterway or headrace, inclosed between walls of concrete and filling, has been nearly completed from the controlling works at Lockport to the site of the power house. The power house itself has not yet been built, but the foundation and spillways are well along, and the work of excavating the tailrace below the power house is being pushed as rapidly as possible. A number of late photographs of the work have been secured and are reproduced herewith, together with some drawings showing the constructional details.

Fig. 1 is a view across the foundation of the power house. At this point a total head of 34 feet is available, part of which has been obtained through the excavation of the deep tailrace below basin, and also of the headrace proper, for some 1,000 feet back from the power house, are of solid concrete 40 feet high. They are massive in construction, being six feet wide at the top and 16 feet at the bottom.

Fig. 4 is a view of a section of the concrete wall of the headrace. The remaining portion of the headrace up to the controlling works at Lockport is enclosed part of the way by concrete walls and part of the way by a core wall with rock and earth filling. Fig. 3 is a view of a section of the core wall on the river side of the tailrace. The core wall is composed of a comparatively thin center or core of concrete, one side being filled in with broken rock to give the necessary weight. Stone for the fillings and for the manufacture of concrete is to be had in any quantity from the excavations of the drainage canal.

Natural rock formation is utilized to support the containing walls at the upper part of the headrace or the portion to be first equipped. This plan shows the relative location of the various units, transformers, etc., and also the paths of the conduits, which are shown in dotted lines. The first assignment of electrical machinery, which has already been ordered, will consist of four 4,000-kilowatt waterwheel-type Crocker Wheeler generators. These machines are three-phase, 60-cycle, and will develop 6,600 volts. Besides these there are two 350-kilowatt exciter sets ordered for the first installation, these to be driven by their own hydraulic turbines. The generators are to be mounted on self-aligning shafts with self-oiling bearings. The apparatus will be contained in a room having walls of white glazed brick.

Fig. 7 is a transverse section of the power house showing one generator and the transforming and distributing apparatus. The main switchboard is to be located on the second floor of a compartment separate from the main generator room. Im

mediately back of the switchboard will be the vertical compartments for the high-tension conductors. Back of these will be located the field-switch structure and compensator.

On a floor above the switchboard it is planned to install the oil switches, mounted directly above the high-tension bus-bar compartments. On the main floor, beneath the main switchboard, will be located the transformers and transfer boards. Four transfer boards will be required for the first part of the installation. Their panels are to have each three single-pole single-throw hook-type switches of 450 amperes capacity, 6,000 volts, three single-pole double-throw hook-type switches of 450 amperes capacity, 6,600 volts, and three connecting bars between the jaws of the single and double-throw switches.

The high-tension bus compartments in the second gallery are to consist of two four-inch enameled-brick walls three feet high and 142 feet long, intersecting at frequent intervals with eight-inch cross walls 18 inches high, on which the 44,000-volt insulators are to be mounted. The space between these two side walls will be divided into three compartments by building two barriers of soapstone 1½ inches thick and 20 inches high, running lengthwise.

The generator armatures will be connected to the transfer boards by two three-phase cables of 300,000 circular mils for each pole. The primary side of each bank of transformers will be connected through the series transformers to the top switches on the transfer boards with stranded-copper 600,000 circular-mil cables. The secondary sides of the transformers will be connected through two oil circuit-breaker switches in series to the 44,000-volt bus-bars in the second gallery, with stranded-copper cables of No. 0000 gauge.

The transformers themselves are to be set in banks of three, as shown in the plan (Fig. 9). Each transformer will have a capacity of 4,000 kilowatts. They take the 6,600-volt current from the generators and raise its pressure to 44,000 volts for transmission to the Chicago sub-station, a distance of about 30 miles.

The power house will be served by an electric traveling crane having a capacity of 40 tons.

Hydraulic equipment is to consist of an individual waterwheel for each unit. The wheels will be mounted on a horizontal shaft, at the right and left of each wheel being a curved draught tube, which tubes lead into the spillways shown in Fig. 6. The draught tubes are placed in line in each compartment of the structure.

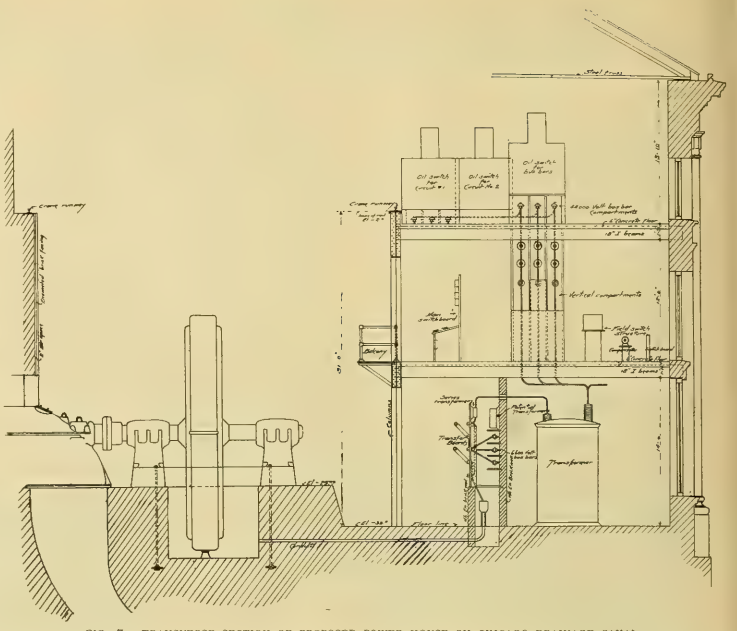


FIG. 7. TRANSVERSE SECTION OF PROPOSED POWER HOUSE ON CHICAGO DRAINAGE CANAL.

The power house itself will be built of concrete blocks and will be, when completed, 350 feet long, and an imposing structure.

At some future time it is believed that a deep-waterway or ship canal will be constructed to connect the Great Lakes with the Mississippi and that considerable use will be made of the canal as a transportation medium. If these plans are developed a lock of some kind will be necessary at the power house, as shown in the plan (Fig. 8). Fig. 8 also shows the enclosed bay and the power-house tailrace. The Illinois and Michigan Canal already has a lock at this point, as shown on the diagram.

When the power is developed, duplicate transmission lines will conduct the three-phase current to the Chicago sub-station, where its pressure will be stepped down for use in Chicago and other mu-

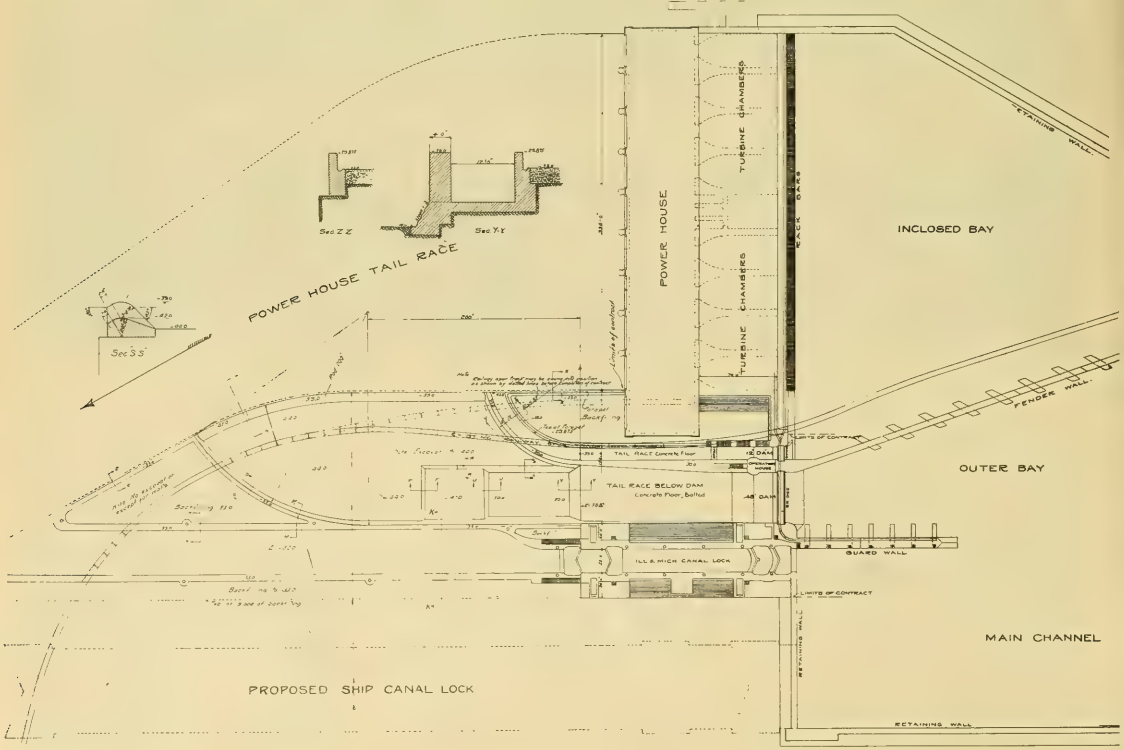


FIG. 8 PROGRESS OF THE CHICAGO DRAINAGE CANAL POWER DEVELOPMENT.—PLAN OF POWER HOUSE AND VICINITY.

nicipalities within the Sanitary District. The transmission-line towers will be 54 feet six inches in the clear above ground and 52 feet 2½ inches to the top of the highest pins. Two conductors will be carried on the top cross arm and four on the lower cross arm. The material of which these towers will be constructed is open hearth medium steel

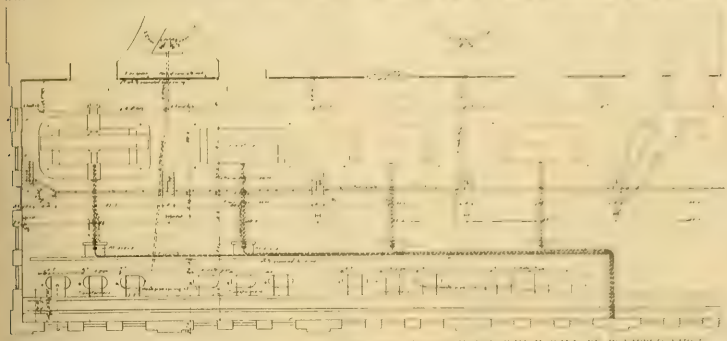


FIG. 9. PLAN OF THE HALF OF THE CHICAGO DRAINAGE CANAL POWER HOUSE WHICH WILL BE EQUIPPED FIRST.

They will be of square cross-section—3½ feet square at the bottom and two feet at the top.

Arc-lamp Posts May Be Beautiful as Well as Useful.

Designs for practicable electric-lamp posts for street and boulevard lighting were on exhibition last week at the Art Institute in Chicago. The Municipal Art League offered prizes of $100, $75 and $50 for the best three designs, and a large number of drawings in water color were entered in the competition. In judging the various designs, cost and utility were considered as well as artistic merit. It was specified that only one light was to be used and that the total height to the center of the light was to be 18 feet. The materials specified were bronze or fine cast-iron. Each design was signed in cipher, by which it could be identified by Mr. James W. Pattison, secretary of the Municipal Art League, after the jury had awarded the prizes.

Illustrations are shown herewith of the three prize winning designs and also of several others having various meritorious features and showing widely varying conceptions on the part of the competitors as to what constitutes a practicable and artistic lamp support.

The first prize was won by Arthur Gunther, a student at the Art Institute in the designing class. This design (Fig. 1) exhibits elegance and accuracy of proportions that would make it an ornament to any street or boulevard. There are no extravagances shown in the decoration, the ornamental work beneath the bracket harmonizing well with the other parts of the post without being obtrusive. The lamp itself hangs in the open, with the trimming of the lamp would be made more difficult than necessary. The wide band around the globe is another objection, as it would obstruct the distribution of the light very materially.

To the right of the prize winners in the illustration are two designs by a Chicago architect which are deserving of consideration. The one shown at Fig. 4 is particularly noteworthy in that it is an abandonment of the classic style and is characteristic of the art nouveau. The characteristic features of the new art are the curious curves which are exhibited most plainly in the ornamentation on the base—entirely unlike anything found in the Grecian-Roman forms, from which present-day architectural designs are principally derived. The other of these two designs (Fig. 5), while it is not an abandonment of the classic style, is striking from the substantial and massive lines upon which it is constructed.

Proceeding to the next design in the group (Fig. this design is as well worked out as the first, with the exception that its cost would probably be slightly more. The shade over the light adds greatly to the beauty of the design.

The third prize was awarded to Enoch M. Vognild, a student in the Art Institute. Here is exhibited a different type from the two preceding ones. Many, for purely esthetic reasons, would award the first prize to this design (Fig. 3). It is simple, yet it displays a certain elegance which no amount of ornamentation or "frills" could enhance. It also has the advantage of not being expensive to construct. But it has certain practical disadvantages which make it undesirable. The post is 18 feet high—a straight clear column with no steps for the lamp tender and no projection of any kind against which a ladder might be rested. So that

Fig. 1. First Prize. Fig. 2. Second Prize. Fig. 3. Third Prize. Fig. 4. Example of Art Nouveau. Fig. 5. Simple, Massive Design. Fig. 6. A Thoroughly Practical Type. Fig. 7. Example of the Highly Ornamental.

LAMP-POST DESIGNS ENTERED IN CHICAGO MUNICIPAL ART LEAGUE COMPETITION.

American Street and Interurban Railway Association.

Since the reorganization of the American Street and Interurban Railway Association at the Philadelphia convention last September, the membership has

has been increased by 54 new names, and the total membership now includes over 250 electrically operating street and interurban railway companies, in all parts of America. The association now includes all forms of lighter traction and does not, in its new constitution, design to exclude any possible developments of the gasoline motor. Some heavy electric traction interests are also coming in, in the form of the Long Island Railroad, the New York Central Railroad, the New York and New Haven Railroad and the Pennsylvania Railroad, these corporations being indirectly represented through the membership of the many street-railway systems which they own or control. The annual dues vary from $15 to $600, according to the traffic returns of the constituent corporations.

In accordance with the co-operative scheme of the reorganization, the various affiliated associations are working together harmoniously, and it is confidently expected that work of much value will be accomplished before the next convention, which will be held in the fall at some point in the Middle West, probably Columbus, Ohio.

Roussel's System of Typewriting Telegraphy.

After several years of experiment, Willis J. Roussel of New Orleans has developed a system of mechanical telegraphy which, he asserts, can be supplied at a cost barely exceeding that of a typewriter, and which will perform satisfactorily the work for which it is designed. The United States Patent Office has issued to Mr. Roussel several patents covering the system. The inventions consist of a transmitter, Morse register and electrically operated typewriter. The messages can be transmitted in both the Morse signals and ordinary letters, the typewriter printing the telegrams ready for delivery upon receipt, while the Morse register records the signals on a tape. The transmitter will, it is said, permit of an average minimum speed in transmission of 90 words a minute without any strain on the part of the operator.

"There is no branch of invention," says Mr. Roussel, "which has been more neglected in the way of improvements, than mechanical telegraphic transmission. Since Morse introduced the 'key' and 'sounder' system, some 60 years ago, this art has remained practically unchanged. A few inventors have endeavored to substitute mechanical devices for this purpose, but it appears that their efforts have not met with success, and this for various reasons. Some inventions are very costly and complicated, requiring efficient manipulation and maintenance, which renders them impractical from a commercial standpoint, while others have aimed to secure great speed in transmission, which is practically impossible on long circuits. In a telegraphic circuit you have but one wire to transmit every different signal or letter of the alphabet, and to actuate this current so as to give the instrument the necessary impulse to register each and every letter or symbol is a proposition not easily solved."

The success of such a system rests on the cost of equipment to the users, so that it can be liberally applied wherever a telegraphic service is wanted. It must be considered that such inventions must necessarily be worked in pairs, i. e., the sending and receiving office must be equipped with the same instruments. This doubles the expenditure, as well as the office force, and naturally if the cost of such apparatus is prohibitive, and expert electricians are needed to operate them, there can be no economy, but on the contrary an increase in the expense of handling telegrams. With Mr. Roussel's invention this has been specially looked after. Each instrument can be operated separately. He can equip a station or office commensurately with the amount of business it will be called upon to perform. Anyone can operate and to actuate this current so as to give the instrument the necessary impulse to register each and every letter or symbol is a proposition not easily solved."

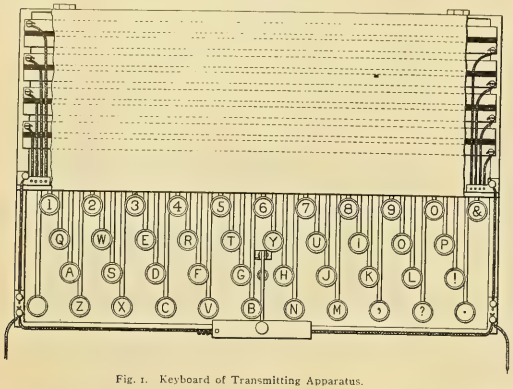


Fig. 1. Keyboard of Transmitting Apparatus.

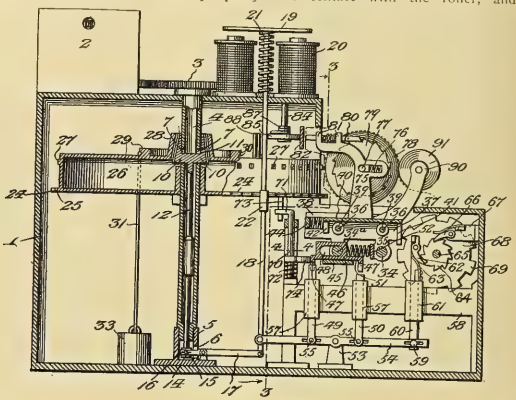


Fig. 2. Typewriting Receiver.

ROUSSEL'S IMPROVEMENT IN MECHANICAL TELEGRAPHY.

erate and care for the apparatus without any previous knowledge of telegraphy.

The transmitting device, which is shown in Figs. 1 and 3, is provided with a keyboard similar to that of a typewriter. The depression of a key will revolve a disk having contact poles that cause the armatures of the receiver to vibrate, as the tape is being drawn through the sounder, and the dots and dashes are traced by the fountain attached thereto. With the printing of telegrams in the ordinary letters, the operation is somewhat similar, although requiring a differently constructed receiver. This receiver is built on the principle of a typewriter (see Fig. 2) which prints from a typewheel. The disks, as they are energized by the depression of a key on the transmitter, cause the armature to release the typewheel, and the motor travels the wheel the distances at which the various letters are brought into contact with the platen of the typewriter, and after printing the letter it is mechanically returned to its original starting point. There is also a mechanism by which the paper is brought into alignment at the end of each line, as well as one for the spacing between words and the changing of the line when completed. These instruments are combined to work either on a telegraph line or wireless circuit, making it possible to meet all emergencies required in the transmission of messages by electrical currents. Fig. 4 shows the attachment by which the message is recorded in Morse characters on a strip of tape.

Taking up the transmitter a little more in detail, by consulting Figs. 1 and 3, it will be seen that the invention consists in providing a transmitter having a keyboard which is preferably similar to that employed in connection with typewriters, and each key of which is connected in a novel manner to a rotary disk having contact plates upon the periphery of such lengths and so spaced apart as to indicate in the Morse alphabet the character designated upon the key connected therewith. These contact plates are electrically connected with one wire of the circuit, while a contact roller bears upon the periphery of the disk normally at a non-conducting point, and is electrically connected with the other wire of the circuit. It is therefore obvious that when the disk is revolved by depressing the key all parts of the periphery will contact with the roller, and the proper combination of dots and dashes will be promptly and quickly transmitted.

Fig. 2 is a vertical section through one of the typewriter receivers. A motor on top of the casing continuously rotates the gear, which is connected to a tubular shaft. A wheel is mounted loosely upon the shaft, carrying on its periphery projecting type. The wheel may be locked to the shaft by means which are operated by an electromagnet.

The magnets (20), when energized will attract the armature (19). This will cause a rod (18) to slip downward, compressing spring (21), and lever (17) will slide the sleeve (11) upward into engagement with the serrated face of the cone (28). The sleeve and cone will be placed into engagement before the pawl is pressed downward out of engagement with the teeth (24) on flange of the typewheel (26), and therefore the wheel will be held against movement and the motor (2) stopped until the downward movement of armature is stopped. As soon as the limit of this movement of the armature has been reached the pawl will become disengaged from the teeth, the continued movement thereof being permitted by a spring cushion which is interposed between the ends of the spindle (12). When the teeth are released from the pawl, the motor will promptly rotate the wheel (26) and cause the flexible strip (31) to be wound upon the grooved flange (29), thereby raising weight (33). Simultaneously with the lowering of rod (18) and the operation of the typewheel the plunger (49) is drawn downward and plunger (50) is pressed upward. The teeth of the ratchets (47) are so shaped that when plunger (50) comes upward into contact therewith it will force the ratchets longitudinally, and thereby raise the weight. Rod (60) is also moved upward with plunger (50), and pawl (62) is caused to slip over a tooth of the ratchet wheel

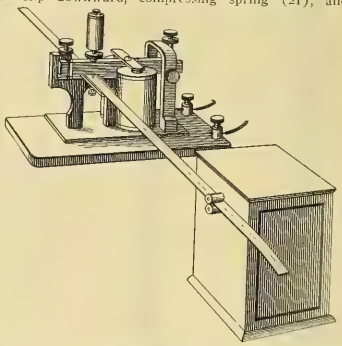


FIG. 4. MORSE RECORDING DEVICE FOR MECHANICAL TELEGRAPH.

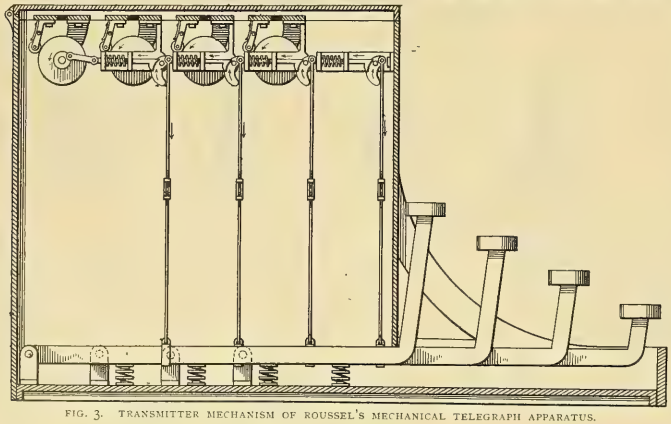


FIG. 3. TRANSMITTER MECHANISM OF ROUSSEL'S MECHANICAL TELEGRAPH APPARATUS.

(64). The part will be held in the position with the typewheel rotating, until the dog has been returned to its normal position by the spring and the circuit has been broken between the wire carrying the current. As soon as the circuit is broken, the plunger (20) throws the armature away from the magnet, and the pawl comes into engagement with a tooth just prior to the removal of sleeve (11) from engagement with the cone (38) and stops the action of the motor until the sleeve and cone have become disengaged. The motor is stopped for a sufficient period by the pawl to permit the platen (78), with the paper thereon, to be thrown against the type (27), which has been brought into proper position in relation to the platen. This movement of the platen is secured in the following manner: When rod (18) moves upward, propelled by spring (21), the outer end of lever (51) is swung downward and draws pawl (62) with it. As this pawl is in engagement with the ratchet wheel (64), it will cause the cam wheel (68) to rotate, and one of the projections (69) will come into contact with the front flange (41) of the base plate (40) and force it and the platen inward, thereby compressing the springs (43). This entire operation takes place during the time in which the type wheel is held by the pawl, and as soon as the sleeve drops out of engagement with the cone the weight will return the wheel to its normal position, such movement being permitted by the spring pawl, which allows the teeth to slip under when moving downward.

Rubbish Incinerating Plant for Lighting Williamsburgh Bridge in New York.

Light for the Williamsburgh Bridge in New York city is now being furnished by a new rubbish-incinerating plant at the foot of Delancey Street, the plant being under the joint control of the bridge and street-cleaning departments of the city. The plant is not strictly a garbage-burning plant, only the more combustible materials collected by the street-cleaning department such as waste paper, boxes, discarded furniture, etc., being used under the boilers.

The station as described in the Iron Age comprises two detached brick buildings located at the foot of Delancey Street under the Manhattan span of the Williamsburgh Bridge. The larger contains the rubbish-handling machinery and the boilers and their incinerators; the smaller contains the engines, condensers, generators, storage batteries, switchboard, etc. Fig. 1 is a plan of the incinerating plant showing the relative location of the apparatus.

There are two Stirling boilers of 200 horsepower each, one having 74 square feet of grate surface

FIG. 1. PLAN OF RUBBISH-INCINERATING PLANT FOR LIGHTING WILLIAMSBURGH BRIDGE IN NEW YORK.

and the other 113 square feet. Each has 2,000 square feet of effective heating surface. Each boiler is provided with an incinerator arranged to consume the rubbish. Provision is made for firing either boiler with coal in the usual way if its incinerator should become disabled, or if it should be impossible to deliver the rubbish for a time. Generally speaking, the boilers are set in the usual way, the incinerating furnaces merely serving as an addition to the unit. There is no change in the construction; the gases of combustion pass from the incinerator through the boiler furnace and tubes to the stack. The grates burn from 30 to 40 pounds of rubbish per hour per square foot of surface and the evaporation from and at 212 degrees is 1½ pounds of water per pound of fuel

down the ramp on the inside and out at the front.

Occupying the center of the building and extending from the front wall to the top of the firing platform is an endless inclined belt conveyor, 178 feet long by four feet wide, built by the Jeffrey Manufacturing Company. The apron is made up of flights of steel, No. 12 gauge, double headed, each six inches long by four feet wide. Each flight has a side guard six inches high, so shaped at the ends as to permit turning of the sprocket wheels without leaving an opening between.

Fig. 2 shows a cross-section through the incinerators.

The incinerator is a fire-brick arched chamber 13 feet long by four feet seven inches wide and six feet high. The fire brick lining is laid up independent of the red-brick outer walls, so as to leave an air space between. The tops of the cells and flues are made of arch fire brick and the space between the side walls and arches is filled with clean ashes. On the stoking side of the furnace are cast-

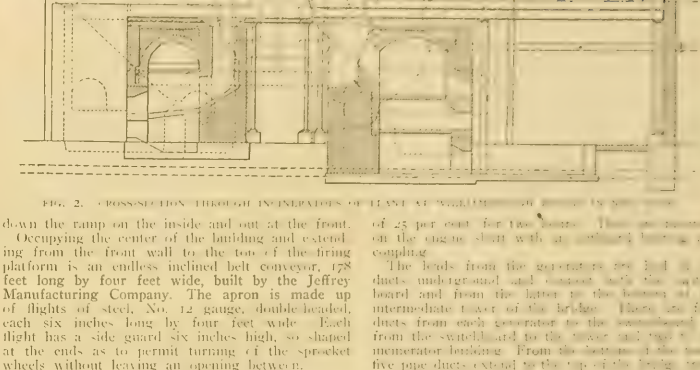


FIG. 2. CROSS-SECTION THROUGH INCINERATORS OF PLANT AT WILLIAMSBURGH BRIDGE IN NEW YORK.

iron fronts that carry the guides for the doors. The door is arranged to lift vertically in grooves and, is balanced by cast-iron weights hung on chains passing over grooved pulleys. The flue dampers are made of fire tile banded with iron and work in grooves built in the masonry and are lifted by chains and differential pulleys.

Combustion in the boilers is nearly perfect so good in fact that it is impossible under ordinary working conditions to detect any smoke issuing from the top of the stack. When the rubbish is delivered damp, or possibly wet, there is perceptible a slight yellowish smoke from the stack, but this is never dense, no matter what the weather may be.

Generating apparatus is contained in a building

of 25 per cent for the [illegible] on the engine shaft with a [illegible] coupling.

The leads from the generators are led [illegible] ducts under the [illegible] board and from the latter to the bottom of the intermediate floor of the bridge. There are four ducts from each generator to the switchboard and to the power and light in the incinerator building. From the bottom of the latter five pipe ducts extend to the top of the firing floor. Provision is also made for lighting both buildings.

The plant was designed by H. de B. Parsons, consulting engineer to the Department of Street Cleaning, and erected under his supervision.

Statements have been made to the effect that electricity obtained through the destruction of New York's garbage would be sufficient to light its streets and public buildings. As a matter of fact, however, by an anti municipal ownership publication, the plant of the Williamsburgh Bridge consumes one-fifth of the available combustible garbage and its capacity is taxed to the utmost to light the bridge. The two roadways of this bridge have a combined length of three miles. It is readily seen, then, that the total combustible garbage would light but 15 miles of roadway, a very small distance as compared with the 900 miles of streets in New York.

Adjustment of the D'Arsonval Galvanometer, for Ballistic Work.

Frank Wenner recently read a paper before the New York meeting of the American Physical Society describing a method of adjusting a D'Arsonval galvanometer so that it could be used for ballistic work. The following brief description of his method of procedure is of interest:

The coil is stripped of its dampers, so that its motion is but little damped when on open circuit. The relation between the coil constant, the suspension constant, the strength of the field, the moment of inertia of the coil and the resistance of the coil is so adjusted that the coil comes to the zero position in the least time without swinging past it. It is also desirable to have the period of the coil as large as 15 or 20 seconds. To make the period as large as this often requires the use of a small suspension or an increase in the moment of inertia of the coil. Unless the coil has a very large moment of inertia in proportion to the copper in it, or swings in a very weak field, adjustment may be completed by putting the proper resistance in series with the coil. This resistance may be determined by using different values and observing the swing of the coil past the zero when released from a certain deflection. If resistances are plotted as ordinates and the swings past the zero as abscisses, the point where the curve meets the "0" axis gives the resistance.

With this adjustment the ballistic constant is e (base of Napierian logs) times as large with the coil on closed circuit as when on open circuit. The constant may be determined by the standard method, a condenser and standard cell or from its figure of merit and the free period of the coil. The galvanometer may be used either on closed or open circuit work with the same constant except the factor e. When used in condenser work the coil may be quickly brought to the zero by closing the coil circuit. When used on closed circuit work, such as in testing and induction experiments, the coil returns to the zero position without overswing in about as fast as readings can be taken, and reduced

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CONTENTS OF THIS NUMBER.

Progress of the Chicago Drainage Canal Power Development. Illustrated 211, 212, 213
Arc-lamp Posts May Be Beautiful as Well as Useful. Illustrated 213
American Street and Interurban Railway Association 213
Roussel's System of Typewriting Telegraphy. Illustrated. 214, 215
Rubbish Incinerating Plant for Lighting Williamsburgh Bridge in New York. Illustrated 215
Adjustment of the D'Arsonval Galvanometer for Ballistic Work 215
Editorial 216
Illuminating Engineers Discuss Gas Mantles and Luminous Arcs 217
Large Gifts to Institute Building Fund 217
Power of Chicago Council to Fix Electric-light Rate Questioned 217
Susquehanna River Power Development 217
Recent Development with the Oscillograph. Illustrated 218
99-year Law Has No Value to the Chicago Street-railway Companies 218, 219
Moore System of Electric Tube Lighting. Illustrated 219
Small Power Motors. Illustrated 219
A New Design of Direct-current Fan Motor. Illustrated 219, 220
Alcohol in the Arts 220
Obituary.—Deaths of William W. Ames, Franklin Brooks, Prof. Popoff and James Partridge 220
Tourcoing International Exposition 220
A Self-exciting Alternator. By E. F. Alexanderson. Illustrated 221, 222
An Attractive Catalogue. Illustrated 222
St. Joseph River Dam and Power Project to Be Carried Out 222
Municipal Water Plant Too Expensive 222
Book Table 222
Bell's "Electric Power Transmission" 222
Herrick's "Electric-railway Handbook" 222
Books Received 222
Alarm Gongs for Patrol Boxes 222
Telephone Engineering. By J. J. Carty. Part III. (Discussion.) 222, 223, 224
Frivolous Use of the Telephone in Washington, D. C. 224
Shopping by Telephone 224
Ohio Telephone Notes 224
Telephone News from the Northwest 224
Indiana Telephone Items 224
Telephone Men 224
New Companies 224
Independent Telephony in Western Massachusetts 225
General Telephone News 225
Manufacturers and Dealers 225

DEPARTMENTS.

Correspondence 225, 226, 227
Great Britain 225, 226
New York 226
New England 226
Southeastern States 226
Ohio 226
Indiana 226, 227
Michigan 227
Personal 227
Electric Lighting 227
Electric Railways 227, 228
Power Transmission 228
Publications 228
Societies and Schools 228
Automobiles 228
Miscellaneous 228, 229
Trade News 229
Business 229
Illustrated Electrical Patent Record 229, 230

DATES AHEAD.

Central Electric Railway Association (next meeting), Indianapolis, Ind., March 22d.

Street Railway Association of the State of New York (next meeting), Elmira, N. Y., March 29th.

Ohio Independent Telephone Association (annual meeting), Columbus, Ohio, March 30th.

Iowa Electrical Association (annual convention), Kirkwood Hotel, Des Moines, April 18th and 19th.

Iowa Street and Interurban Railway Association (annual convention), Kirkwood Hotel, Des Moines, April 19th and 20th.

Indiana Independent Telephone Association (annual meeting), Indianapolis, Ind., May 17th.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st to 23d.

WHEN KEATS wrote his famous line, "A thing of beauty is a joy forever," he could not have had the remotest idea that it might, in the future, be aptly applied to such a utilitarian device as an arc-lamp post. To be sure, Sir Humphry Davy had made his classic demonstration of the electric arc; but who could dream, in the early part of the last century, that a practical arc lamp would be invented, to be followed by its adaptation to a scheme of street lighting which would make all predecessors "pale their ineffectual fires"? But the poet's beautiful thought, beautifully expressed, is, nevertheless, as applicable to the support of a modern arc lamp as to a Grecian urn. Unquestionably, the lamp post should be as beautiful as it is practicable to make it. We therefore take pleasure in commending the work in this direction of the Municipal Art League, and in calling attention to the recent prize competition, of which an account is given on another page.

THE NUMBER and extent of railroad accidents in the United States form a characteristic of the national life which every thoughtful American views with dismay. Every reasonable precaution which will make railroad travel more safe should be welcomed and adopted. The subject is one which has a constantly increasing importance to the electric-railway man as the electrics encroach more and more on the field hitherto held by the steam railroad, or creates new fields for itself. But it is the steam railroad, of course, which is responsible for the greater part of the serious accidents which give the United States such an unenviable notoriety.

In Indiana a few days ago there was a conference between the state railroad commission and the signal engineers of the railroads which may have results of some importance. The meeting had particularly to do with crossing accidents, in which, of course, the signal men are particularly interested, and was attended also by a number of interurban traction men, who are also concerned in the matter of railroad crossings. Considerable discussion was devoted to "derails." These are safeguards placed where one railroad crosses another. They are set, automatically or otherwise, so that a train approaching while another is on the crossing will be derailed and a collision averted. Some of the railroads have placed what are called "guard rails" at the side of these "derails," thus preventing the ditching of a train. Complaints have come to the commission that these "guard rails" take away the usefulness of the "derail" by preventing the ditching of the train and often allow the engine to bump along on the ties and into the train on the crossing. Under these circumstances the question is, How far back from the crossing should the derails be placed? The commissioners insisted that the law implied that they should be placed 500 feet distant from the crossing, while the engineers asserted that 300 feet was sufficient, 500 feet of derail being unnecessary and expensive. To this the commissioners retorted that a certain railroad had proclaimed it to be cheaper to kill a few people now and then and pay damages than to lay 500 feet of derail or elevate tracks. The commissioners told the engineers that the guard rail would have to be done away with except in cases where special permission is granted the railroad to use them at crossings.

Complaint was made to the commission by the interurban men because the present law compels interurban roads to put in at their own cost interlocking switches when they build across steam lines, but does not require the same of steam lines when they cross interurban lines. The electric railways will insist on a change in the law so as to operate alike or divide the expense between the two roads outside of cities.

It was shown that during 1905 89 persons were killed and 1,782 injured from causes beyond their own control, and 265 persons killed and 2,027 injured by reason of their own carelessness, on the steam lines in Indiana, and that $37,548.93 was paid in damages by the companies. And during the same period one person was killed by the interurban cars from causes beyond his own control and 60 injured, while 39 persons were killed and 4,286 were injured by reason of their own carelessness, while the companies paid $96,061.30 in damages. The commission regards these statistics as significant, as well it may. Not only is the number of deaths and injuries on the steam roads excessive, but the damages exacted seem to be too small in comparison with what the interurbans were made to pay.

ONE good feature of the recent decision of the United States Supreme Court in the Chicago street-railway case is that the much-talked-about 99-year act is laid away, in practical effect at least, in the limbo of things that were. Anything that helps to clear the traction situation in Chicago is a blessing, and the talk about the alleged 99-year extension had become, in fact, rather tiresome. The Supreme Court now finds that the 99-year Act was constitutional, but it extended only to the corporate life of the companies. It did not extend to a single one of their franchises existing at the time it was enacted or since passed, nor did it limit the right of the City Council to grant franchises for street railways on such conditions as to time and location as it might see fit. The title to every street occupied by the railroads in the city of Chicago today is to be determined by the terms of the franchises under which such title originally was granted. Many of these franchises have expired; others will expire in a few years. All doubt or threat caused by any alleged 99-year extension is now removed, and the situation is simplified to that extent.

Almost simultaneously with the Supreme Court decision came the making public of the Dalrymple report, which Mayor Dunne first sought so eagerly and then so resolutely tried to suppress when he had it and found that it did not chime with his theories. However, the Chicago City Council got the report despite the mayor. But Mr. Dalrymple's views had become known notwithstanding the mayor's secretive policy, and so the publication of the report causes no surprise. In brief, Mr. Dalrymple holds that while "it is now an accepted principle in Britain that all public utilities, such as water, gas, electric light, street railways, etc., be under the control of the municipality," and while his sympathies are entirely on the side of municipal ownership, he is convinced that in Chicago a serious attempt should be made to arrive at a settlement with the street-railway companies. The present companies should be merged in one, with one fare, no downtown loops and no trailers. Present equipment should be mostly thrown in the scrap heap and a new and modern system built. The new operating company might have a franchise of, say, 20 years, the city to have the right to purchase at, say, five-year intervals. A percentage of gross receipts should be paid into the city treasury. Complete annual reports should be made.

But if the companies prove unreasonable, start the municipal system on each line as the franchises expire. But, says Mr. Dalrymple, "I should be sorry, however, were you forced to take such a step, as, speaking generally, I should say, from my knowledge and experience of what it means to operate a municipal street-railway system, that the municipalities of the United States are not yet quite ready to successfully undertake this work."

As to practical operation, no other system should be thought of at the present time than the overhead trolley. To install the underground trolley for any extent would be a "scandalous waste of money." If a municipal system is adopted, the management should be vested in a small committee of the City Council, chosen without regard to politics, the executive duties to be lodged in one permanent officer. Power might be purchased at first.

Such is the Dalrymple report, in essence. There is nothing startling about it—nothing that adds to the knowledge or gaiety of nations. But the advice is honest and, in the main, good, and the mayor would have done himself more credit by accepting it than by pouting over it as he did.

But speculations as to what the mayor might have done are now of little value. The question is now "up to the people," who will vote next month on the proposed authorization of $75,000,000 worth of Mueller-law certificates to finance municipal street railways in Chicago.

Illuminating Engineers Discuss Gas Mantles and Luminous Arcs.

The monthly meeting of the Illuminating Engineering Society was held at the Edison Auditorium, New York city, on Friday, March 9th, with President L. B. Marks in the chair. It was reported the membership now numbers 192, of whom 90 were out of town, and there are 18 pending applications. A suggestion was being considered to meet in the new United Engineering Building when completed. E. L. Elliott, the secretary, announced his resignation and changed places with Dr. A. H. Elliott is one of the managers of the society. The possible organization of a branch of the society for Chicago was reported.

John Campbell, president of the Electric Auditing Company, Boston, reported that an informal meeting to organize a Boston branch would be held on March 20th, with a probable membership of 60. The papers read at the New York meeting would be discussed.

Victor Rettich of New York read a paper on the "Inverted Incandescent Gas Burner," in which he described the various existing types of downward lamps. Inventors, he said, were imitating the electric bulb and had not paid sufficient attention to the nature of the mantle. In New York the problem of using inverted lamps was considerable, because the 23-candlepower gas was delivered at a low pressure, whereas in Europe the candlepower was 14 and the pressure higher. The inverted lamp acted admirably in the hands of experts, but somehow the American user had not taken kindly to it, and the New York fire underwriters opposed it because sundry fires had been traced to particles of hot carbon falling from the mantle. The defects of the downward incandescent lamp were:

1. Danger of falling particles
2. Carbonization
3. Flashing back.
4. Delicacy of mantle suspension.
5. Flickering light at low pressure.
6. Discoloration of chandelier arms.
7. In many cases it is difficult to attach lamps so that they will be gas tight when set in the required direction.
8. The methods of gas regulation are too coarse, a much more delicate way being required.
9. Liability of breaking mantles when glassware is removed.
10. There are variations in the diameters of globe rings so that the glassware is not interchangeable with the different makes of burners.
11. There are variations in the means of affixing mantles to burners.
12. Too much heat is thrown off in proportion to the amount of gas used. He thought that ultimately a good reliable lamp would be evolved that would use three cubic feet of gas per hour and give 60 candlepower, or 120 candlepower with reflectors.

E. L. Elliott, New York city, next read a paper on the "Luminous Arc." He remarked that from the soft charcoal sticks of Davy to the modern compressed carbon was a long stride in arc-lamp methods, and another stride was seen in the use of the copper-plated carbon rods for the so-called "flaming" arc. Although the invention of the enclosed arc lamp was not theoretically an improvement, yet its higher practical efficiency drew attention to the fact that there was such a thing as quality in light as in everything else. With improved methods of measuring illumination, the shortcomings of the enclosed arc were becoming more generally recognized.

Research had perfected the carbon with reference to withstanding disintegration, and experimenters were now looking in an entirely opposite direction, and it was found that there was a higher illuminative efficiency from incandescent gases than from the incandescence of amorphous carbon. This fact was recognized as long ago as 1836 in England, but it had been recently rediscovered by Bremer. By introducing salts of calcium into the carbon, the arc itself was rendered luminous. These salts both lowered the resistance of the carbons and allowed the rods to be farther apart. This type of lamp had been designated as "flame-arc," though it would be more scientific to call it the "luminous arc." The resulting light was of different quality and very good for exterior use. The old blue light was easily absorbed in foggy weather or in the smoke-laden atmosphere of cities. Carbons could be made to produce different colors, and the white luminous arc was as near to sunlight as any chemical light could be.

The speaker declared that the luminous arc lamp was five times more efficient than the enclosed-arc type. The price of the carbons was higher, but the cost of carbons per candlepower-hour was the same [illegible] lamp and [illegible] Bremer had devised a lamp [illegible] above the other [illegible] different makes [illegible]

Mr. Elliott [illegible] lamp with the carbons inclined [illegible] increasing upon such a lamp [illegible] 1,200 to 1,600 hours.

Four leading types of luminous arc lamps were placed on exhibition.

W. S. Kellogg, New York city, read a paper on "Illuminating Engineering from the Architect's Standpoint." He said that the improved intrinsic brilliancy of modern lamps was leading to a waste of light. The manufacturers used to say, "We will give you the same light for half the money," but now most of them are saying, "We will give you double the light for the same money." There was need for an improved method of rating.

It having been decided to discuss the three papers together, George G. Ramsdell, president of the Ramsdell Inverted Lamp Company, said that he was as optimistic about the inverted incandescent mantle lamp as Mr. Rettich was pessimistic. E. C. Brown (New York) said he had used the first inverted lamp ever imported into the United States, and the mantle lasted eight months. After some heated argument, Mr. Brown was forced to admit that he did not now use the inverted lamp extensively. In fact, he had only one such lamp in use.

Dr. Clayton H. Sharp of the New York Electrical Testing Laboratory said that the action of the gas mantle and the action of the luminous electric arc were identical. In the former the flameless heat of the Bunsen burner was converted into light by the mantle, and in the latter the continuous hot gases of the arc were converted by the metallic earths. The composition of the mantle was restricted to about 99 per cent. of thoria and one per cent. of ceria. Professor Nichols had suggested that the action was catalytic. Professor Rubens of Berlin had investigated the distribution of energy radiated by the mantle, and as the temperature of the burner and the mantle were about the same, there was little loss of energy. He thought that the luminous arc lamp, as at present used on Broadway, was having a bad effect on general electric lighting.

Dr. Edward L. Nichols, professor of physics, Cornell University, said that in all cases of luminescence (i. e., in fluorescence and in phosphorescence), the presence of two elements was necessary. Temperature was the controlling factor, for some bodies luminesced at the temperature of liquid air, and others in the Bunsen flame. The light from the gas mantle extended over a wider strength of the spectrum than any other artificial illuminant.

W. D'A. Ryan, General Electric Company, Lynn, Mass., produced diagrams of the light curves of the Magnetite, Bremer, Excello, Siemens and Bausch lamps. The first four gave a good horizontal distribution of light and were suitable for street use.

It was decided to meet in New York on the second Friday in each month, except that the next meeting will be on April 12th. D. W. W.

Large Gifts to Institute Building Fund.

T. C. Martin, chairman of the land and building fund of the American Institute of Electrical Engineers, announces some large and important contributions to this fund, the object of which is to raise $200,000 for the land in New York city on which the United Engineering Building, given by Mr. Carnegie, is now being erected. The total cost of the land is $540,000, and the obligation is divided between the Electrical, Mechanical and Mining Engineers.

Mr. Clarence H. Mackay, president of the Postal Telegraph-cable Company, has given $5,000 to the fund, accompanied by the expression of his interest in the building as a center whose facilities will be available to the various bodies of telegraphers. Mr. U. N. Bethell and Mr. J. J. Carty, members of the committee, have advised it, on behalf of the American Telephone and Telegraph Company, the Western Electric Company, the New York and New Jersey Telephone Company and the New York Telephone Company, that these corporations have jointly contributed $25,000 to the [illegible]

Power of Chicago Council to Fix Electric-light Rates Questioned.

At a meeting of the Council committee on gas, oil and electric light [illegible] Commonwealth companies [illegible] error in the voluntary [illegible] submitted by his company [illegible] week previous. By [illegible] shown that it costs the company [illegible] watt hour and upward to supply [illegible] its customers.

Mr. Beale then said to the committee: "It is my opinion that you cannot regulate the rates for electric light only so far as the company [illegible] that you should. In other words, you cannot touch our rates under the present statute unless we agree to it. On a large part of our business it costs us right up to the present maximum rate to supply current, and if the rate were lower we would be supplying the current at a loss. My position is that we cannot be compelled to supply any considerable percentage of our consumers at a loss."

The assistant corporation counsel thought that the city can fix a rate below the cost of production of current furnished to a large number of consumers. He said: "It costs more to furnish current to certain classes of consumers than it does to others, and the company admits it is now furnishing electricity below the cost of production in a number of instances. The only thing to be considered by the committee is whether the company can produce and distribute electric current at a maximum price decided upon with reasonable profit to the company upon its investment—considering the business of the company as a whole. The courts have rendered opinions in conformity with my view."

City Electrician Carroll and Consulting Engineer Bion J. Arnold were instructed to proceed with their inquiry regarding what would be a just maximum rate, upon the theory that the corporation counsel's opinion is correct.

Susquehanna River Power Development.

A bill introduced in the House of Delegates at Annapolis, Md., amending the charter of the Susquehanna Power Company is said to be the forerunner of a plan for the consolidation of the several power plants along the Susquehanna River. The bill, if it passes, will permit the company to increase its capital stock and give it power to acquire property and change the location and designs of any part of its system of works, and also to construct and operate industrial plants. One part of the measure authorizes the company to use its powers and franchises to establish all such works, plants, properties, rights-of-way and transmission lines which may be required for its corporate purposes.

The authorized capital of the company is now $12,000,000, and much of the stock has already been issued. Joseph W. Marsh of Pittsburg is president of the company and John Gilmor of Baltimore secretary.

The company owns large tracts of land in Maryland and Pennsylvania along the Susquehanna River, and it is proposed to build a power plant on the stream at a point on the stream at a point about 35 miles from Baltimore. Work has never been started on the dam to be built across the stream, which, it is said, will be about a mile long and 75 feet high.

Just above the Susquehanna Company's property is that of the McCall Ferry Company, whose projects have been fully described in the Western Electrician. This concern is likewise in the power business, but has not yet put its plant into operation.

Recent Development with the Oscillograph.

Much interest has been evinced of late in the electrical instrument known as the oscillograph. This device may be most readily compared to the indicator of a steam engine, and the photographic reproduction of the wave form produced by its action (the oscillogram) has its most exact counterpart in the indicator card. Various methods have been devised by different manufacturers to provide a satisfactory method of observing or recording the wave forms of rapidly varying electric currents and pressures. The oscillograph about to be described is a compact form of the vibrating-loop type, manufactured by the General Electric Company of Schenectady, N. Y.

This oscillograph, which was described in its experimental form in the Western Electrician of February 3d, is similar to a d'Arsonval galvanometer, in that it has a current-carrying circuit, located in a powerful magnetic field. The part corresponding to the moving coil in the galvanometer is replaced by two small moving strips, which also act as a suspension, and carry the mirror.

In a light tight box is placed a three-element galvanometer of this design. Fig. 1 shows the parts with box removed. Combined with this are devices for viewing or photographically recording current and electromotive-force waves. Each galvanometer element, or vibrator, consists of a single loop of very fine ribbon suspended vertically in a powerful magnetic field. The terminals of the galvonometer are the ends of this loop, which is held at its lower extremity by an adjustable pulley.

With the exception of the magnetizing coils, each galvanometer element in the set of three is entirely complete and can therefore be easily insulated. Each set of vibrating strips is exposed on all sides when removed from the containing cells, so that any required adjustments or repairs are most conveniently made. Adjustments are further provided, so that even if the vibrating mirror is imperfectly attached, it is possible to bring the image of the mirror into the desired place on the photographic film. The containing cell is filled with damping liquid, and the vibrating loop or strips are made of hard drawn silver, with a silvered glass mirror. This latter is usually 80 by 20 by 10 mils, large enough to be easily handled, and producing a better photographic record than a smaller mirror. Unless high period is absolutely essential, the manipulatory advantages of the larger size outweigh other considerations.

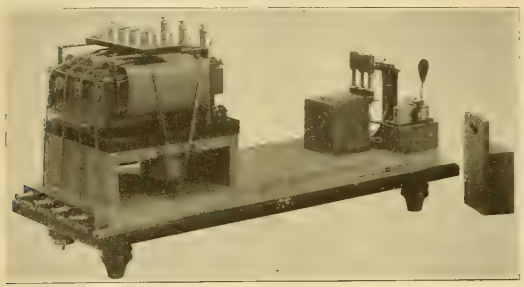


Fig. 1. View of Internal Arrangement of Oscillograph Parts.

The optical system is shown in Fig. 2. A source of light, usually an arc lamp, is thrown by a lens upon the prisms (P1) (P2) (P3) and by them to the oscillatory mirrors (VM1) (VM2) and (VM3). From these mirrors the rays are reflected horizontally to the photographic drum at the opposite end, or to the synchronous mirror (SM), from which they are reflected upward to a surface where they can be observed or traced.

The vibration of these oscillatory mirrors produces three lines of light, the amplitude of their vibration measuring the strength of the current or electromotive force. To produce a wave photographically, a drum carrying a sensitized film is revolved in the path of these light rays, thus forming the abscissæ of the projected wave.

The same shaft which carries the photographic drum operates a set of contacts which actuates a shutter interposed between the arc-light source and the condensing lens. This shutter-operating mechanism is so arranged that the shutter is open during one revolution of the drum. Devices are provided so that this shutter may be adjusted for opening at any instant, or for opening at the joint in the film. In the latter case the shutter opens just after passing the joint in the film and closes just before reaching it. This mechanism is used when the time of the occurrence of the phenomena under consideration can be governed. When this cannot be controlled by the operator, the shutter is arranged to open at any instant and close after one complete revolution without regard to the joint in the film.

For viewing recurring waves, as has been stated, a so-called sychronous mirror is provided. This may be easily swung into position by a lever without removing the photographic recording device. The synchronous vibration of this mirror, which is oscillated by a cam driven by a synchronous electric motor, provides the necessary range of action along the axis of abscissæ, and thus an image of the wave form. The vibration of the mirrors having been adjusted so as to have a suitable amplitude, and the synchronous mirror being moved through a suitable angle during one complete cycle, the point of light on the screen will move through a path similar to that obtained when the wave is plotted to rectilinear co-ordinates. As the mirror returns to its original position a shutter automatically cuts off the light and does not allow it to pass until the mirror again moves in the direction first indicated. This prevents admission of the light to the surface when the mirror is not moving in the proper direction.

Such an apparatus is useful in studying the action of the various phenomena in electric circuits having not more than 5,000 or 6,000 complete vibrations per second.

99-year Law Has No Value to the Chicago Street-railway Companies.

The Supreme Court of the United States has given its decision in the famous 99-year case, involving the question of the length of life of franchises granted to the Chicago City Railway Company and the Chicago Union Traction Company, the latter being really the North and West Side companies. The 99-year act of the Illinois Legislature of 1865, the Supreme Court decides, extended the corporate life of the street-railway companies but has no bearing whatever on the franchise relations between the companies and the city of Chicago. The rights which these companies have to the streets of Chicago are therefore limited strictly to the terms of the franchises granted at various times.

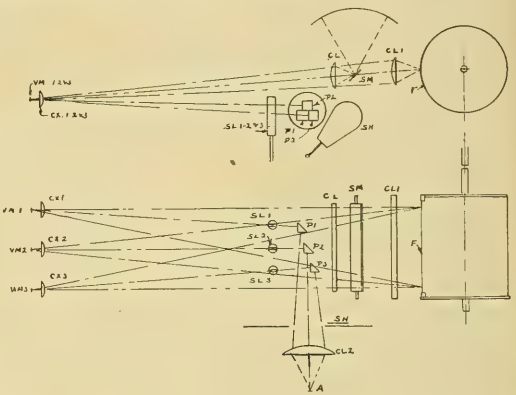


Fig. 2 Optical System of Oscillograph.

The decision of Judge Grosscup is reversed in its entirety. Three of the justices dissent in the ruling decision, the opinion of the other six, including Chief Justice Fuller, is clearly shown in the following paragraph from the syllabus:

"Corporate privileges can only be held to be granted as against public rights when conferred in plain and explicit terms. The ambiguous phrase of the act of 1865, 'during the life hereof,' does not operate to extend existing contracts for a term of 99 years, or limit the right of the city to make future contracts with the companies covering shorter periods."

On many of the important streets the franchises have already expired. Others will expire in a few years, while some of the franchises for cross-town and outlying lines will not expire for five to 10 years. As fast as the North Side franchises and a few other 20-year grants expire the streets and rails revert to the city without any monetary consideration.

The early ordinances for a long time merely were amendments to that of 1858, so on a great many trunk lines on the South and West sides of the city the right of operation expired in 1883 or thereabouts. This condition of affairs applies to practically the entire trunk-line system in the central part of the city, exclusive of the North Side. The original ordinance, however, provided that the company should remain in possession of its rights to the streets until the city bought it out. The Supreme Court now has declared, as to all the original lines owned by the Chicago City Railroad Company on the South and West sides and transferred to the west division company and through that dormant organization to the Union Traction concern, that the city now is in a position where it can buy up the tracks, cars, power houses and every other method or means of operation at a price to be fixed not by the street-car companies but by a definite system of arbitration as fixed by the old ordinance of 1858, which wisely protects the city's interests.

The court now says that the City Council of Chicago may go ahead at once, take possession of the street-car systems controlled by this old ordinance and pay for them an arbitrated sum without the slightest regard to capital stock, bonds, or any fictitious values whatsoever.

Whether the city will now attempt to acquire the street railways and operate them under municipal ownership or whether it will use its victory as a means of getting the most favorable terms from the existing companies in exchange for new and definite franchises remains to be seen. Mayor Dunne's $75,000,000 Mueller-certificate ordinance, the proceeds from which (if valid) it is proposed to use in acquiring the lines, will be voted on at the spring election.

In the matter of internal troubles of the Union Traction Company the jurisdiction of the Circuit Court is sustained, the legality of the appointment of the receivers for the Union Traction Company is approved, and the Supreme Court finds there was no collusion between the traction company and its creditors.

Other important matters are effected by the decision. It is known that the traction companies have staked a great deal in their claims under the 99-year act. Now that these claims are worthless the Union Traction Company may not see its way clear to lowering the La Salle and Washington Street tunnels. This it agreed to do at its own expense if the city would grant it the privilege of changing from cable to trolley operation. Now, however, the city may have to do the work if it is done at all.

On this point the Chicago Tribune says: "It is possible the Supreme Court may decide the Van Buren Street Tunnel case against the city and thus prevent the lowering of the tunnels. If it does not the city will have to do something itself. In local financial circles the idea is that the decision means the end of the Union Traction Company. It is expected to step down and out and allow the underlying companies to take back their property again, now that it has found that property is not so valuable as it thought. It is still in the hands of receivers, and these receivers have a lot of debts on their hands, but little else. If the Supreme Court stands by its decision after the petition for a rehearing is heard the only recourse of the Union Traction creditors will be an application for a stock assessment."

Simultaneously with the Supreme Court decision came the much-talked-of Dalrymple report. This is the report which James Dalrymple sent to Mayor Dunne following the Scotch traction expert's visit to Chicago to advise Chicago's mayor in the matter of acquiring and operating the street railways. Mayor Dunne refused to make public the report, but Mr. Dalrymple's views on the subject were pretty well known and have been printed in the Western Electrician. From the duplicate report sent to the council it is plain to see that Mr. Dalrymple would not advise municipal ownership in Chicago under present conditions. He advises making terms with the companies with the view of ultimate city ownership. Mr. Dalrymple gives at length an outline of the methods employed by the city of Glasgow in operating its street railways.

As bearing on the question of municipal ownership, City Attorney Smulski of Chicago in his annual report to the council warns against an impending danger. He says that 700 lawsuits for

personal damages were filed against the city last year and settled at a total cost of $900,000. He believes that the damage suits would increase more than twelvefold under municipal ownership. He points to the street railway companies of the city, with their most carefully prepared system of defense by a trained corps of men, and with all pay out annually $2,000,000 in damage claims. Under municipal ownership he believes this figure would be greatly exceeded, and he warns the council to give the matter due consideration.

Moore System of Electric Tube Lighting.

For many years Mr. D. McFarlan Moore has been at work perfecting his system of vacuum-tube lighting. His progress has been steady, and it is now contended that the Moore electric light is thoroughly commercial.

One of the distinctive and important attractions at the recent Madison Square Garden Electrical Show was the installation of a Moore tube. Fig. 1 shows the Madison Square Garden installation. This large and well known lobby was formerly lighted with rows of incandescent lamps around its cornice and on the ceiling, and therefore it was possible to make careful measurements of the old and new methods of illuminating the same area. The Moore tube is 134 inches in diameter and 157 feet long, and is the most imposing vacuum tube ever constructed. This was done by hermetically sealing it together in sections, and it was erected complete in about two days' time. The air within it was then pumped out and a special secret gaseous conductor inserted in its place and the tube was finished. The necessary apparatus for making such an installation such as gas fires, the pump, etc., is said to be thoroughly practical and simple.

The maker asserts that the Moore tube is now giving at least three times as much light for the same consumption of current as can be obtained from the incandescent lamps formerly used. The tube requires, according to the company's figures, 1,335 watts, from which it produces 1,045 candlepower at 1.8 watts per candlepower, or 14 candlepower per lineal foot of tubing. The incandescent lamps required 5,361 watts to produce 1,002 candlepower. In other words, it is asserted that the Moore tube is producing about twice as much light, yet requires one-third less current in this specific instance than that of the incandescent lamps.

But aside from the operating cost the tube has many other advantages as a system of illumination. The light from the tube is soft and steady without any blinding glare, its diffusion factor is exceptionally good, its color can be changed as desired over a very wide range, the cost of installation of the tube is comparatively small and it eliminates about 90 per cent. of the wiring.

FIG. 1. MOORE LIGHTING TUBES IN LOBBY OF MADISON SQUARE GARDEN.

It is said that 75 per cent. of the incandescent lamps in commercial operation are used as integral parts of rows or lines of light, and in a large majority of cases such lamps are placed in comparatively speaking inaccessible places and therefore the true commercial rating of incandescent lamps should be not 3.1 watts per candlepower but 4.5 watts per candlepower, and in many cases six or eight.

The efficiency curve of the Moore tube is practically a straight line leading to infinity and it does not lose 25 per cent. of its candlepower in a short space of about 400 hours. In the tube there are no troubles from efficiencies falling rapidly, due to blackening, or the expensive replacing of lamps due to broken filaments; neither does the tube demand expensive voltage regula-

FIG. 2. TERMINAL BOX OF MOORE LIGHTING SYSTEM.

with the length of the tube, which in turn varies with the size of the apartment to be lighted. The actual current which flows through the gaseous contents of the tube varies directly with the intensity of the light required, which can be made almost of any desired brilliancy from two or three candlepower up to 20 candlepower per foot. But the amount of current also varies with the color desired, since lights of certain colors are more efficient than other colors and therefore less current is required. When a rich yellowish color is desired, somewhat similar to that of the incandescent lamp, about 0.3 of an ampere flows through the tube and there will result a luminosity of about 15 candlepower per foot.

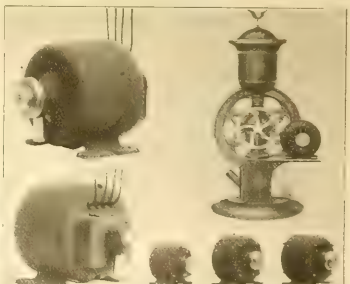
It is obvious that for many varieties of business a system of illumination of this character will be particularly suitable. For example, a large department store is using the light on account of the fact that it will permit of colors being matched as exactly as when done in daylight. It is also adaptable to art galleries.

The Moore electric light is manufactured by the Moore Electrical Company of 52 Lawrence Street, Newark, N. J.

Small Power Motors.

The Westinghouse Electric and Manufacturing Company has lately perfected a line of motors for light power service, such as operating sewing machines, dental apparatus, coffee grinders, small ice-cream freezers, phonographs, sign flashers, moving window novelties and hundreds of other adaptations. The smaller sizes may be attached to an ordinary incandescent-lamp circuit, furnishing a profitable day load for lighting companies.

These motors follow very closely the design of the well-known Westinghouse fan motors. They are built for both alternating and direct-current



Direct-current Motor of ¹/₄ Horsepower with Pulley Attachment.

110-Volt Direct-current Motor ¹/₄ Horsepower.

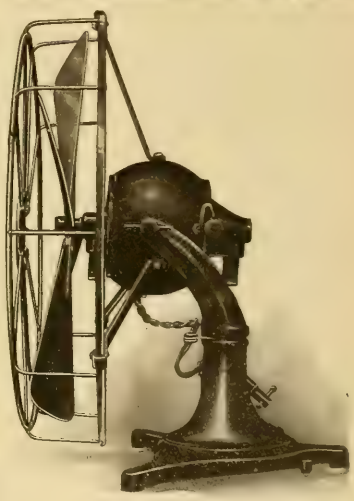
Alternating-current Motor of ¹/₄ Horsepower Driving Coffee Grinder.

Induction Motors of ¹/₂, ¹/₃ and ¹/₄ Horsepower.

SMALL POWER MOTORS.

A New Design of Direct-current Fan Motor.

The Western Electric Company is presenting for the season of 1906 a new design of direct-current fan called the Universal. This fan embodies not only all of the desirable features of the old 12 and 16-inch desk and bracket fans but also has many new and distinctive features. The new fan is manufactured in one type and one size



UNIVERSAL ELECTRIC FAN ARRANGED FOR DESK.

only. The design is such that the fan can be easily converted into a desk or bracket type without the use of an adapter, which is a loose part easily lost.

The accompanying illustration shows the form of base construction and the pleasing appearance when used as a desk fan. With the addition of no extra parts it may also be mounted on the wall as a bracket fan. The motor is mounted on trunnions, which permit of 30 degrees depression and 15 degrees elevation. The base construction allows the fan a rotation of 120 degrees in a horizontal direction.

An exhaustive investigation of the construction of blades has led to the adoption of the 15-inch fan. The blades are pitched so that a maximum efficiency is reached, which greatly increases its usefulness beyond that of other fans not having the proper principles embodied in their construction.

The motor is spherical and entirely enclosed—a construction which does not permit of the collec-

tion of dirt or dust. The armature is of the slotted type, substantially constructed, and has a commutator so designed as to withstand long and continuous service. The field coils are elliptical in shape, machine-wound and especially insulated for the service. The brush-holders are of the cartridge type, designed to avoid the possibility of excessive brush pressure on the commutator, and fitted with carbon brushes. The fan is designed so that the brushes may be adjusted, inspected or renewed without removing the bearing bracket.

An arrangement of a switch in the base permits of the following speeds: 1,480, 1,100 and 750 revolutions per minute. The rheostat is constructed of an iron spool, heavily coated with porcelain, upon which is wound the best quality of German silver wire embedded in and completely protected by a coating of white enamel.

Alcohol in the Arts.

Prof. Elihu Thomson, electrician of the General Electric Company, recently made a statement before the ways and means committee of the House of Representatives in Washington, pleading for free alcohol in the arts and sciences. Among other things he said:

The importance of cheap alcohol as a fuel for internal-combustion engines is not so generally realized as it should be. The increasing use of this type of engine, operated generally by gasoline as a fuel, is evident to everyone. By it there is furnished a power for all purposes which requires the minimum of attendance during the operation of the engine and no preparation before starting. As an engine for farm purposes the explosion-type or internal-combustion engine is ideal, and its general application to automobiles is already an evidence of its great convenience and effectiveness.

The use of gasoline as the fuel of such an engine is, however, subject to some disadvantages as compared with the employment of alcohol. In the first place the possible supply of gasoline is limited and its increasing use must inevitably result in a very undesirable increase in price. It is a sort of by-product of the oil industry, and its price has already increased and will probably continue to increase. This is particularly true for the higher or better qualities. Gasoline is more volatile than alcohol, having a much lower boiling point, and is therefore proportionately more dangerous, especially in warm weather. The flame of burning gasoline is a highly luminous flame, one which radiates heat rapidly, whereas the alcohol flame is a faint blue or an almost non-luminous flame, which does not radiate heat to any great extent. The consequence of this is that a mass of burning gasoline will radiate sufficient heat to set fire to things at a distance from it, while heat from burning alcohol goes upward, mostly in the hot gases which rise from the flame.

The case may be illustrated by comparing the flame of the burning pine log in an open fireplace with that of ordinary gas mixed with air in an open fireplace. The flame from the burning pine log contains sufficient carbon to radiate the heat freely into the room from the fireplace, whereas the blue flame from the gas requires the assistance of a radiator heated thereby, generally known as a gas log, often composed of minerals, such as asbestos and the like, made red hot by the blue or non-luminous gas flame. On this account alcohol is a safer fuel than gasoline, as the gasoline can set fire by pure radiation where alcohol would not. Gasoline, as well as kerosene, has the great disadvantage that it floats upon and is distributed by water. It is a well-known fact that it is comparatively useless to attempt to extinguish burning gasoline or kerosene by the use of water alone. The use of water may, in fact, be a positive disadvantage in floating the burning material over considerable places and spreading the fire. Not so with alcohol, which mixes with water in all portions, and which is at once diluted and prevented from remaining combustible.

We have recently tested at the works of the General Electric Company in Lynn a Deutz alcohol engine—a type of engine made in Germany especially for use with alcohol—and the results have been such as to prove without doubt the entire suitability of alcohol, if cheap enough, as a fuel for internal-combustion engines. This particular engine is to be sent to the Island of Cuba and coupled to a dynamo for lighting. It will be operated with the cheap Cuban alcohol, which is, I am informed, sold there at about 12 or 15 cents a gallon. A few gallons of this alcohol was obtained and used in our tests and it was found to be a high grade spirit containing 94 per cent. alcohol by volume and six per cent water, or about 90 per cent. alcohol by weight. While it is not methylated or denatured, there is no question that the behavior in the engine of denatured or methylated spirit would be identically the same as with the pure-grain alcohol.

To obtain this sample of Cuban alcohol it was necessary that we pay an import tax of $4 a gallon, with other charges, which made the cost of material used in testing enormous as compared with its actual value in Cuba; and I may here remark that, as, in testing an engine of this kind, a considerable quantity of alcohol will be used, manufacturers in the United States would suffer a considerable disadvantage in building such engines as compared with those in a country where methylated spirit, untaxed, is obtainable. In fact, the cost of material for testing the engines is probably a sufficiently strong deterrent just now to prevent the manufacture being taken up in the United States. The Island of Cuba is, however, an excellent field for the use of such machinery on account of the low cost of alcohol.

It may be mentioned here that our experiments developed the fact that alcohol is suitable as a motor fuel even when it contains as high a percentage as 15 per cent. of water. Notwithstanding the fact that the heating value of alcohol, or the number of heat units contained, is much less than that in gasoline, it is found by actual experiment that a gallon of alcohol will develop substantially the same power in an internal-combustion engine as a gallon of gasoline. This is owing to the superior efficiency of operation when alcohol is used. Less of the heat is thrown away in waste gases and in the water jacket.

The mixture of alcohol vapor with air stands a much higher compression than does gasoline and air without previous explosion, and this is one of the main factors in giving a greater efficiency. It follows from this that, with alcohol at the same price as gasoline, the amount of power developed and the cost of the power will be relatively the same so far as the fuel itself is concerned, but on account of the higher efficiency of the alcohol, less cooling water is required, or a less percentage of the heat of combustion is communicated to the cylinder walls of the engine. The exhaust gases from an alcohol engine carry off less heat. They are cooler gases.

It is well known that the exhaust gases from a gasoline or kerosene engine are liable to be very objectionable on account of the odor. In our tests of the Deutz alcohol engine there was absolutely no such objection with the alcohol fuel, the exhaust gases being but slightly odorous, or nearly inodorous, and what odor there was was not of a disagreeable character. Our experiments with the burning of alcohol as a motor fuel also showed us that alcohol possesses a considerable tolerance as to richness, or the reverse of the mixture in the engine, and that even when there was considerable excess of alcohol for the air the exhaust was not disagreeable in odor, a condition which with either gasoline or kerosene leads to a smoky, badly smelling exhaust. The importance of a fuel which does not produce disagreeable exhaust gas is greatest in the case of stationary engine of considerable power, as in that case the exhaust is emitted in one locality and may become a source of nuisance. This has often been experinced with gasoline or kerosene engines and has tended greatly to limit their application, particularly in densely built-up sections.

There is just now the beginning of a large development in the application of the internal-combustion engine to the propulsion of railway cars on short lines as feeders to the main lines. In this case, an ordinary passenger railway car is equipped with a power compartment at one end, in which power compartment there will be installed an engine of, say, 200 horsepower of the internal-combustion or explosion type. The growth of such a system is liable to be hampered in the near future by the cost of gasoline as a fuel, and the difficulties in using kerosene are still quite considerable. Especially is the exhaust likely to be offensive. In this case alcohol, which could be produced in unlimited amount, could be substituted.

A large number of agricultural products are easily capable of being converted into alcohol, and such products as are unmarketable, either from overabundance of crops or defective growth or damage are still available as sources of supply. Hence each agricultural district would be able to supply itself with all the motor fuel needed and at the same time produce for other districts. Inasmuch as alcohol can be stored in tanks for an indefinite period without change in its nature, any surplus production of alcohol can easly be taken care of. Speaking with a prominent beet-root sugar manufacturer, he gave it as his opinion that from the waste of the beet-root sugar industry alcohol could be produced at a cost of about 10 or 12 cents per gallon. It is probably true that from other agricultural wastes, such as fruit parings, fruit partly decayed, surplus corn, etc., a cost equally low might be realized.

It is easily possible to convey alcohol by a pipe line and its very limpidity or liquidity facilitates the process of pumping it through a line. It is reasonable to infer that, freed from tax, there is no possible substitute for this valuable fuel which could be supplied at such a low cost. It may be mentioned in conclusion that the efficiency—that is, the ratio of the conversion of the heat units contained in the fuel into power—is probably higher in the alcohol engine than in engines operated with any other combustible, and doubtless, on account of the comparative newness of the alcohol engines there is still room for some improvement in that respect.

OBITUARY.

James Partridge.

James Partridge, manager of the Sandusky (Ohio) plant of the National Carbon Company and a prominent and respected citizen of that city, died very suddenly in his office on March 10th. Death is ascribed to heart trouble. Mr. Partridge, who was 52 years of age, was born in Birmingham, England. He came to Sandusky from Pittsburg in 1890, and with J. S. Speer organized the Partridge Carbon Company. Through some valuable patents the plant did a thriving business, and in 1899, when it was purchased by the National Carbon Company, Mr. Partridge was retained as manager and had given his attention to the business since. The deceased gentleman was a thirty-second degree Mason. He is survived by a widow and two sisters, Mrs. Henry Russon and Mrs. James Bird, both of Cleveland.

Professor Popoff.

The Electrical Times of London published the following in one of its February issues: "So many unpleasant things have been happening in Russia that perhaps it is not surprising that it has passed unnoticed that the death of Prof. Popoff of wireless-telegraph repute, occurred at St. Petersburg as long ago as the middle of last month." Assuming this news to be true, Russia has lost one of its best-known electrical scientists and inventors. Alexander Popoff was professor in the Emperor Alexander III. Electrical Institute of St. Petersburg and was prominent in the development of space telegraphy. He made several improvements in the art, one of the latest being a "self-decohering coherer," which is a modification of the original glass-tube filings coherer. With this coherer no tapping was required to restore the high-resistance state.

Franklin Brooks.

Franklin Brooks, who died at his home in Elizabeth, N. J., on March 5th, was a well-known expert in mica mining, having traveled over the greater part of the world in the interest of the mica industry. He was a member of the firm of Eugene Munsell & Co. of New York and had charge of the mica-mining branch of this firm's business. He was also vice-president of the Mica Insulator Company of New York and Chicago. Mr. Brooks was 51 years of age. He had been a director of the Union County Trust Banking Company in Elizabeth since its formation. He was president of the Mattono Club and a member of the Elizabeth Club and of Trinity Episcopal Church.

William W. Ames.

William Winslow Ames, the electrical head of the Montclair (N. J.) Light and Power Company (before it was absorbed by the Public Service Corporation), died on March 7th at the age of 45. Several years ago Mr. Ames was connected with the work of wiring the Brooklyn Bridge.

Tourcoing International Exposition.

The city of Tourcoing, France, is organizing an international exposition of textiles, electricity, machinery, mechanical works, tools, hardware, social economy, etc., to open on May 1, and continue to September 30, 1906. It will be under the patronage of the president of the republic and of the French government. The cities of Tourcoing, Roubaix and Lille (Nord Department) are so close to each other that they may be considered as one city of nearly 600,000 inhabitants. The Nord Department, with 1,870,000 inhabitants, is the wealthiest in France, paying, as it does, one-fourteenth of the total taxation, and having a budget superior to some of the smaller European states. The district has a constant need of American products and goods.

The total commerce between the United States and France, as shown by figures compiled by the Bureau of Statistics of the Department of Commerce and Labor, of Washington, amounted, in the fiscal year 1905, to about $166,000,000. Therefore Americans might do well to take advantage of this exhibition, inasmuch as England, Belgium and Germany are to be represented. Moreover, the French are going over to electrical machines and appliances in manufactures, harnessing the rivers in the republic for manufacturing purposes. This alone is indicative of possibilities for American manufacturers of electrical appliances.

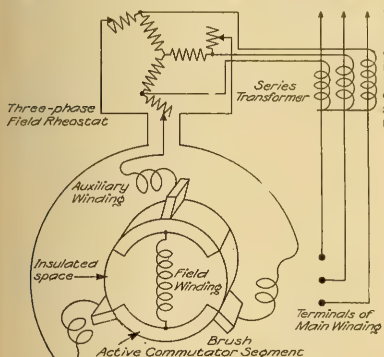
Under the ruling of the French government, exhibits are free from import duties, and special reduced freight rates are allowed on the French railroads and on the French steamship line. The awards will be diplomas of grand prize, and of gold, silver and bronze medals. Henry G. Bayer is a special commissioner of the exposition, with offices at 47 Barclay Street, New York city.

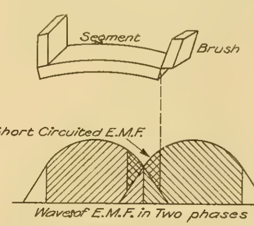
A Self-exciting Alternator.[1]

By E. F. Alexanderson

The self-exciting alternator designed by the author does not use the multi-circuit arrangement of the field, but can be considered as a development from the old principle of rectifying commutator of early experiments. A novel feature of the machine is the automatic voltage regulation accomplished by a special application of the field rheostat. While in ordinary generators the field current is controlled by hand regulation, this machine employs a three-phase field rheostat in which the voltage drop is automatically cut down to the desired extent by a three-phase current forced through the rheostat in opposite direction to the field currents. The current used for reducing the drop in the rheostat is taken from a transformer connected in series with the armature circuit. In this way the field current is regulated with respect to the power factor as well as to the amount of current taken from the generator.

A general diagram of the author's type of alternator is shown in Fig. 1. The exciting current is generated in an auxiliary three-phase winding placed in the same slots as the main armature winding. The terminals of this auxiliary winding are





DETAILS AND CONNECTIONS OF SELF-EXCITING ELTERNATOR.

connected to three sets of brushes that bear on a rectifying commutator of special type. This commutator has one active segment per pole, covering practically two-thirds of the pole-pitch, the remaining one-third of the arc being insulated. Each alternate segment is connected to one terminal of the field winding, and the remaining segments to the other. By this arrangement it is possible to make the commutation independent of the reactance which is inherent in the ordinary type of field winding, and the whole process of commutation is carried out in the stationary circuits before the current enters the field.

The voltage generated in the auxiliary winding is sufficient to supply current for excitation at full inductive load; and the excitation is adjusted to the proper no-load value by a three-phase rheostat inserted in the neutral point of the auxiliary winding. Automatic compounding is accomplished by means of a series transformer connected to the rheostat; the transformer sends a current through the rheostat in a direction opposite to the field current, thereby eliminating the voltage drop in the rheostat. The elimination of the voltage drop in the rheostat changes over more or less of the field current from the rheostat to the series transformer. The secondary current of the series transformer is in phase with the line current, while the field current is practically in phase with the voltage. The amount of boosting in the field circuit will therefore depend not only upon the value of the secondary current, but also upon the power factor of the load. A function of the rheostat, which is just as important as the field control, is its influence on the commutation. As far as commutation is concerned, the full resistance of the rheostat may be considered as always being in circuit, although the larger part of the field current may flow through the series transformer.

As the phenomenon of commutation with this kind of rectifying commutator is entirely different from that with the ordinary multi-segment commutator of a direct-current machine, it may be of interest to enter somewhat further into the theory of commutation in the new type of alternator. In order to understand the operation of the commutator it must be borne in mind that the field winding carries a continuous current in spite of the fact that the impressed voltage is of a pulsating character. The only fluctuation that can occur is the quite negligible pulsation needed to induce a voltage large enough to overcome the ohmic resistance of the winding. The current in the three phases of the exciting circuit is not an alternating current [illegible] formed a part [illegible] current [illegible] over the [illegible] exciting circuit [illegible] brush has [illegible] greater [illegible] and run [illegible] the [illegible] that the current [illegible] brush which enters the segment [illegible] value of the direct current [illegible] other brush must be reduced [illegible] zero. Commutation should occur [illegible] at the moment in which the [illegible] equal in the two phases undergoing [illegible]. If we imagine that one of the brushes [illegible] segment when the voltages are [illegible] brush would yet be carrying a part of the field current, and the current would suddenly be interrupted and changed over to the other [illegible]. If the stationary circuit has a high reactance, the sudden change of the current would induce [illegible] age between the brush and the segment, and [illegible] cause a spark. The moment of commutation should, therefore, be delayed to such an extent that the difference in voltage between the two phases begins to force a cross current through the completed circuit formed by the two phases and the rheostat. As soon as the two brushes are in contact with the same segment they naturally divide the field current; but the cross current which is superimposed on the field current will weaken the current in one of the phases and strengthen it in the other phase. If, therefore, the cross current is half as large as the field current at the moment of rupture, one of the phases will carry the entire current and none will pass through the brush which is leaving the segment. In this way complete commutation has taken place just before the brush leaves the segment, and consequently no sparking will occur. The time which is required for the cross current to reach the value of one-half of the field current depends upon the reactance and resistance in the external-stationary circuit.

From the preceding it is evident that whatever be the values of these quantities, a position can be found for the brushes where commutation will occur without sparking. But it is also evident that a slight variation in the position of the brushes may cause severe sparking if the circuits are not properly designed. If the circuits consist of a winding with a very small resistance and high reactance, a small difference in voltage will cause a large cross current to flow between the two phases, and this cross current cannot be broken suddenly without sparking. In order to obtain successful operation of the commutator, the generating circuit should be designed with as little reactance as possible, and with a considerable amount of resistance.

Since this machine has been developed the question has often been asked, why a rectifying commutator cannot be used for direct-current generators when it has been so successful in this particular application. One reason for its success when used for field excitation is that the presence of the rheostat in the stationary exciting circuit introduces a resistance which prevents the flow of an excessive current when two brushes are in contact with the same segment. A rheostat is used in the field circuit of any generator; and although it consumes a considerable part of the exciter voltage it is not objectionable, on account of the small power involved. Another reason for the success of the rectifying commutator when applied to field excitation is that the field current is generated by a magnetic flux large enough for the total output of the machine, permitting the auxiliary winding to be designed with a small number of turns and low reactance.

Discussion (in Abstract).

Prof. A. E. Kennelly, Cambridge, Mass.: The first dynamo-machines were, of course, separately excited, and it was considered a great step to make them compounding. As soon as the alternators came into the field, it was considered much more difficult to make them self-exciting, on account of the direct current required by the field, whereas the armature produced alternating current. Self-exciting is considered more important than to render them compounding, because in the case of alternators it was not the I.R. drop to be compounded, but the I.Z.; a two-dimension problem instead of a one-dimension problem, and therefore [illegible] of ind[illegible] compound[illegible]

I [illegible] of very great [illegible] and [illegible] could [illegible] would maintain itself at [illegible] degrees, but I felt [illegible] pen when it got out in the country [illegible] in the coal mine. One of my friends [illegible] in charge of the plant, gave me a good deal of reassurance and said, "That is all right, I will look after it." The machine was put out with a fairly competent electrician to handle it and it started off and worked pretty well. In the course of a few months I learned the machine was still doing its work, but the man who had formerly sharpened picks was running the plant. I concluded what was needed to run the dynamo was not an electrician, a man who knew something about curves, but a man who could handle it in a good, vigorous, practical way.

The plan which has been given this evening certainly overcomes a good many of the difficulties which were encountered in that first method of compounding, which had many limitations and objections. There is one feature which is involved in operation along the method described, and that is that the machine is self-exciting. Variations in the general voltage, and particularly variations in speed, are immediately transmitted to the exciter. In many cases that is not particularly objectionable; in others it is a source of objection, particularly in cases of emergency. In running plants driven by waterwheels, where the speed regulation may be subject to considerable variations and where in case the governor does not work readily all the load goes off suddenly, there may be a considerable increase in speed, and there is apt to be a very much greater increase in voltage than there would be if the excitation is derived from a separate exciter driven at constant speed and independent of the variations in the speed of the main generator. This is because the exciter voltage is increased at the same time. This, however, is an element which is inherent in all self-exciting machines. On the other hand, a falling speed, due to heavy load, reduces the exciter voltage at the very time when it is most needed. I know of various places in which the exciter has been driven directly or indirectly from the main generator, so that its speed is subject to such variations in the service, has not been found satisfactory and in which separate excitation from an exciter at constant speed has been found acceptable.

W. L. R. Emmet, Schenectady, N. Y.: I have seen this device working under very trying conditions and the performance of it is astonishingly good. I think the final results produced are very largely due to the care with which Mr. Alexanderson has worked out the proportioning of everything concerning it. The method of commutation shown has been experimented with in Schenectady before, with promising results, and the principles, as is obvious from the diagram, are very simple. I have seen a machine of this kind suddenly thrown on heavy inductive loads more than its full-load capacity without a sign of sparking on the commutator and without an appreciable flicker in the lamps. It is the quickness of its action which is astonishing, and the nature of the arrangement is such that it is capable of application to any size machine, because it can be arranged in multiple circuits with no more current in any one circuit than is used on small machines.

A. S. McAllister, New York: If the phase position of the voltage generated in the auxiliary winding depends on the mechanical position of the winding and the phase position of the voltage in the series transformers is fixed, then at non-inductive load these voltages add at a certain angle and at inductive load they add at a different angle. A change in the angle seems equivalent to a change in the position of the brushes, and I would ask if this change has any effect on the commutation on full, on non-inductive and full-inductive load.

Mr. Alexanderson: The difficulty seems to be

1. Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers, New York, January 26, 1906. Mr. Alexanderson is electrical engineer for the General Electric Company, Schenectady, N. Y.

to make the machine commutate properly for no load and non-inductive load, because the voltage impressed on the commutator is not of the same phase relation to the machine voltage at no load and full load. The field is distorted by the armature reaction to approximately the same angle as the voltage impressed on the commutator is ahead of the voltage of the auxiliary winding. Therefore the position of the brushes with no load is nearly the best position on non-inductive load. At inductive load the voltage of the series transformer combines with the voltage of the auxiliary winding in a straight line, and at the same time the armature reaction combines with the field excitation in a straight line, and there is no reason whatever for any displacement.

An Attractive Catalogue.

The 1906 catalogue of W. N. Matthews & Bro., 203 North Second Street, St. Louis, contains 32 pages beautifully illustrating the advantages of the Stombaugh guy anchor and the Kearney cable clip by numerous half-tone cuts. The accompanying illustration shows the cover, the original of which

AN ATTRACTIVE CATALOGUE.

is in three colors, pleasingly designed and well printed. The catalogue should prove of interest to electric-light, street-railway and telephone companies, as it contains interesting data pertaining to the construction of pole lines. It will be mailed on request.

St. Joseph River Dam and Power Project to be Carried Out.

After several years of disagreement among the people at Berrien Springs, Mich., who took sides between the old Chapin and DuShane dam companies, the village has made a contract with the Berrien Springs Power and Electric Company, in which C. A. Chapin of Chicago is interested, and the building of the dam will be commenced in the early spring. In order to build the dam at the point selected it will be necessary to flood the 15-acre racetrack, owned by the village. In exchange for this property the waterpower company agrees to pay off the $10,000 in bonds owed by the village. The company will supply the village, free, in perpetuity, with current for 25 arc lights, pump 50,000 gallons of water daily for the use of the village, and sell electric current to commercial users at a rate somewhat lower than the price in South Bend, Ind., where the Chapin company has other interests.

Municipal Water Plant Too Expensive.

A correspondent of the Western Electrician on the Pacific Slope sends the following: "The City Council of Santa Rosa, Cal., has authorized Mayor Overton to sign a contract with the Santa Rosa Lighting Company for pumping water and lighting the streets for an indefinite period for $833 a month. It costs the city almost twice that sum under the present arrangement, whereby the municipality operates its own pumping plant, and pays the company something like $500 for lighting alone. The company will install a new plant and use electricity for operating the pumps. The city now uses steam power."

BOOK TABLE.

ELECTRIC POWER TRANSMISSION. By Louis Bell. (Fourth edition.) New York: McGraw Publishing Company. 1906. Pp. (6 by 9 inches), 721, with 341 illustrations. Price, $4.

Three years have elapsed since the publication of the third edition of Dr. Bell's work upon power transmission, and the development in the art has been such that this, the fourth, edition embodies much that is new and interesting. The book has been thoroughly revised and additional material added. The chapters on elementary principles, general conditions of power transmission, properties of alternating currents, alternating-current motors, line constuction, etc., are naturally practically along the same lines as in the last previous edition, but in taking up waterwheels and hydraulic development, auxiliary and switchboard apparatus, power-station apparatus and the treatment of commercial problems it is found that noticeable advancement has been made, and much of the subject matter is new.

The steam turbine has suddenly come into prominence, and it is natural to expect that this form of prime mover will be given an important place under "Engines and Boilers," which is the case. Under "Waterwheels" the later forms of apparatus are described, especially in the matter of the utilization of very high heads and in the constructional details of governing apparatus. A particularly good chapter is that upon "Auxiliary and Switchboard Apparatus," under which category is placed a wide variety of apparatus just as vital to the operation of the station as the generating apparatus, and which has probably seen greater changes in the last two or three years. The chapter on "Distribution" is also one meriting special attention. Taken as a whole, the book is fully up to the high standards set by previous editions.

PRACTICAL ELECTRIC RAILWAY HANDBOOK. By Albert B. Herrick. (Second edition.) New York: McGraw Publishing Company. 1906. Pp. (4½ by 6½ inches), 460, with 329 illustrations. Price, $3.00.

This is the second edition of the handbook, which has been revised and expanded to introduce new matter in accord with the developments in electric traction. The use of formulas and mathematics has been restricted as far as possible. The book is on this account of the more value to the practical man, who is not often a mathematician. New methods of testing have been introduced wherever possible, as have also data on the latest types of apparatus. The single-phase system has received some attention, though perhaps not as much as its importance warrants. To be brief, the book contains useful information on electric-railway practice from the coal pile to the application of the electric current in the car motors. It is of convenient pocket size, and well bound in leather.

BOOKS RECEIVED.

"The Universal Electrical Directory, 1906." By J. A. Berly. Published by H. Alabaster, Gatehouse & Co., London. Price, 18 shillings.

"Management of Accumulators." By Sir David Salomons. Published by the D. Van Nostrand Company, New York. Price, $2.50.

Alarm Gongs for Patrol Boxes.

Now that Chicago's police force is to be enlarged and improved, having had placed at its disposal increased funds through the raising of saloon license fees, Chief of Police Collins and City Electrician Carroll are planning to reconstruct the police alarm and telephone system of the city. The present police telephone apparatus, which affords communication between patrol boxes in the streets and police stations, is not efficient. If the finance committee will appropriate about $36,000 for the purpose, the entire system may be rebuilt, to include, also, a series of alarm gongs on the patrol boxes.

If the present plan is carried out, anyone discovering a burglary could call up the nearest police station by telephone and state the facts. Then, at the station, a series of contacts would be pressed, causing the gongs at the patrol boxes nearest the scene of the disturbance to sound. This alarm, it is hoped, would attract the attention of one or more patrolmen on beat, who could step to the box and get their orders by telephone. By this means much valuable time would be saved in the pursuit of malefactors.

After a two-day session in Toronto, Ont., the International Waterways Commission adjourned on March 8th, having reached an agreement regarding Niagara Falls by which both countries will take all precautions to save its scenic beauty. The American commissioners desired a report of the commission which might form the basis of a treaty between Great Britain and the United States regarding the waters of Niagara Falls. This the Canadians declined unless specially instructed by the government. The next meeting will be held in Washington, April 24th.

Telephone Engineering.

BY J. J. CARTY.

PART III.

DISCUSSION (IN ABSTRACT).

Thomas D. Lockwood, Boston: I want to congratulate the Institute, and incidentally the essayist of the evening, upon the fact that this paper is such an expressive one, that it tells us so much, and yet there is not a single formula in it, and no diagrams. To have a paper which is so clear, so extremely lucid, so perfectly instructive, and yet have no formula or diagrams in it, is, in these degenerate days, a very remarkable thing indeed, because, as I believe, the favorite plan now is to get a lot of abstruse formulæ and about 10 diagrams and build a paper around it.

When we have given credit and honor and glory to the man, such as he who invents the electric speaking telephone deserves, I think there is a great deal to spare for those who have perfected the telephone business and have made it what it is today.

When I knew him [Mr. Carty] first he had not long graduated from Thomas Hall's electrical laboratory on Bromfield Street, Boston. He became a telephone man and presently the manager of the operating room of the Boston exchange. He and I were intimate for a while and mutually helped one another. I watched his career with almost the same interest that I watched my own. (laughter). By and by he went with the Western Electric Company for a while. I recollect a paper which he read before this Institute upon "Electrostatic Induction and its Action in Telephone Circuits, Switchboard and Cable Circuits." That is one of the classical papers in the archives of this Institute today; it made its mark at that time and has never been forgotten. After a short time in the manufacturing business, he returned to the telephone business proper, with the New York Telephone Company, and almost the first thing he did there was to see that it was impossible—and to see it in a way that no other man had seen it—that good talk could be had through a line with a great many electromagnets in it. He did not see then that it might improve a line to have a good many electromagnets in it if you only put them in the right place, if you have the right number per wave length, but he did see that it was a bad thing to have electromagnets in the telephone line, if there were the wrong number and in the wrong place.

In the study of this problem he and I became associated again. He made the invention of what was subsequently known all over the world as the Carty bell. I think the name is unfortunate, as it was more of a circuit than a bell, and the bell was only incidental. I was the unfortunate who drew the patent, and between us we managed so well to look after it that when it came into court the patent was first sustained and then it was not. However, it did its work; it enabled people to talk on a party line with many stations—that was something which had never been done before.

Between ourselves, I do not mind telling you that some of the great inventions have had courts sit down on them because the courts could not get it through their heads what the invention was. That is the reason we inventors have to get it through our heads first, and then get it through the heads of the patent lawyers, and then through the heads of the experts, and that usually finishes it.

The 15 years which Mr. Carty gives as the life of the central-office switchboard to me suggests there is some sort of annuity table which would give this figure. He certainly does not err on the side of smallness. If anything, I should rather be inclined to say that the average life of the telephone switchboard is even less than 15 years. Mr. George Wilkinson has said that the progress of invention and of planning is such in the telephone switchboard as to make it old and effete before it is in use 10 years. He estimated the life of the switchboard as from 12 to 14 years; and I should be inclined rather to say that Mr. Carty had given you a high figure rather than a low one.

When Mr. Carty replies, I hope he will explain what he means where he uses some phraseology which rather puzzles me, although I have no doubt I should know all about it. It is in regard to using the two-number method of calling, where he says: "When we consider what would happen to the present toll board at Cortlandt Street, operating on the recording basis, using the two-number method of calling, if, by some change in business plans, the particular-party method in use extensively in many other localities were adopted." (Western Electrician, page 183, bottom of third column.) This phrase, I am sure, I ought to know all about, but I do not, and would like to know what the two-number method of calling is, and also what the particular-party method of calling is.

The message rate, I understand, prevails nearly altogether in New York. It prevails in nearly every other city. Of course, that is, to use a much abused expression, the only "common-sense" method, and it is surprising that we were so long coming to it. The only answer to the puzzle is, I suppose, that we have to begin the business ourselves, that the telephone people of the early

days learned the business as they went along, and as they found the American plan in the hotel business had succeeded in this country, there was no reason why the telephone should not do so. Thirty-seven years ago, when I came to this country, the American plan prevailed almost exclusively; you would pay so much per day, your room was at your disposal, and you could get three meals, and if you did not use the room or take your meals, you paid just the same. The same evolution which occurred in the telephone business has come in the hotel business, and now there are as many hotels on the European plan as on the American plan.

President Wheeler: I have no hope or expectation of equaling Brother Lockwood as a story teller, but I have one thing which is worth mentioning, and I think it serves very well to show the great growth of electrical work of all kinds. When I left college I was employed by a man who had the rights to the telephone system in New York city, and he was feeling rather pleased because he had just succeeded in inducing someone to buy these rights from him for $10,000.

Prof. M. I. Pupin, Columbia University, New York: As was the case with the preceding speaker, I feel very highly honored to have been asked to take part in this discussion. I have often been credited with a great deal more knowledge on telephoning than I really possess. I confess that—by people who do not know much about telephone engineering; but when real telephone engineers seem to be under the same impression, I really feel flattered, but I must still insist on my belief that I am not a man who knows much about telephone engineering.

My friend Mr. Carty was the first man who started me in the study of telephony. It was about 10 years ago when I heard his famous paper on electrostatic induction. Up to that time I had nothing but sad experiences with the telephone. We had one in the laboratory in Berlin which we used for calling the janitor. I thought that the instrument was a scientific curiosity, but of not very much importance. At that time telephony was not much of a system in Berlin, and when I came to New York I found it was in about the same state here; but, hearing Mr. Carty's paper, and believing that it was a very interesting matter to study, I took it up and found, for the first time, that telephony was really a most interesting scientific study from a physical and mathematical point of view.

When you consider that before long a man will be able to telephone to any part of Manhattan Island for five cents, you cannot help thinking that this new art of telephone engineering is an institution which is distributing one of the greatest blessings of modern times. It is almost incredible to believe that for five cents you can talk to anyone on Manhattan Island who has a telephone. In a certain sense this new profession is a philanthropic institution; its aim is very lofty, because it is striving to establish one of the best means of keeping peace among men, by maintaining a community of interest among men, and every institution, every religious creed has to charge something for the distribution of the blessings of Heaven—it costs time, it costs money, and it costs a great deal of work and thought to organize an institution of that kind and maintain it.

If you should ask me this moment what constitutes a telephone engineer, I would not be able to tell you, any more than I could before. To be sure, the same thing is true of every kind of engineer. Take a telephone engineer, or any electrical engineer. What is he? Is he a good mathematician? No; not necessarily. A good physicist? No; not necessarily. A good chemist? No. In fact, if you talk to them, you will find how ignorant these fellows are on any specialty. But if you are a mathematician or a physicist and you feel that you know a great deal more than they do in regard to mathematics and physics, just try to work off a poor theory on them, and you will find you cannot do it. They somehow have the knack of seeing through a thing a certain way and arriving at conclusions, the methods of which are beyond the comprehension of ordinary men; they are experts, specialists. An engineer is a man who knows a little of everything that bears upon his profession, but he knows it very well. He does not pay much attention necessarily to specialties, but he knows absolutely the relation of things to each other; he must have a wonderful perspective of things that are in his profession. I once asked Mr. Carty what, in his opinion, would be a very good course for a man who wanted to take up electrical engineering, and he said: "Well, spelling and grammar and rhetoric and physics and chemistry, not very much of the latter two, a little, and that is all; but let him have every one of these things extremely well done, and then teach him to have good manners, know how to behave and deport himself with men; teach him how to form a proper attitude of mind, and then perhaps some day he may become a telephone engineer."

As far as the electrical side of telephone engineering is concerned, we have the following great problems: Insulation, isolation and lamination. These are the three great things that the electrical telephone engineer has to contend with. You cannot have your electrical circuits or the magnetic [illegible] your electrical circuits and [illegible] no matter how [illegible] switchboard and [illegible] well you [illegible] very indifferent.

In ordinary electrical engineering, if you [illegible] in your connector and [illegible] good pressure, it is good enough, but in telephone engineering that is often not good enough. Nothing but soldered joint will do. A loose contact in ordinary electrical engineering [illegible] no harm, as the voltage is high, and it does not matter if it has a slightly loose contact; but in telephone engineering, where the voltage is excessively light, the slightest loose contact may cause a great deal of trouble.

In telephone engineering you work to the limit to a greater degree than you do in any other form of electrical engineering.

The power-transmission electrical engineer desires as high permeability in iron as possible, and the telephone engineer, on the other hand, wants the permeability to be low, not above a certain upper limit. If we had the permeability of 1,000 at the lower limit, very many of the most sensitive telephonic apparatus would be impossible, and long-distance telephony would, in all probability, be out of the question, but the Creator has given a microscopic lower limit within which the permeability of the iron is only 200 or less. It is this limit which the telephone engineer had to discover, and he must be constantly on his guard not to extend his operations outside of this limit.

B. Gherardi, Brooklyn: There is one phase of telephone engineering which Mr. Carty has necessarily only touched upon briefly. This is the engineering which, as a matter of administrative efficiency, should be done in the various executive departments of the organization. The most conspicuous examples of these are the engineering which must be done in the department under the control of the superintendent of traffic, and in the department under the control of the superintendent of construction. The engineering done in the traffic department is in charge of an engineer usually designated as the traffic engineer, who has reporting to him a sufficient number of assistants to do the required work. This engineer is charged with responsibility for a large amount of work, which, while essentially engineering in its character, is nevertheless so closely related to the detail methods of operation in use in the traffic department, and the detail administration of that department, that to have it done in the office of the chief engineer of the company would require that the chief engineer should keep complete records in all detail of matters going on in the traffic department and be familiar to the last detail with a vast number of administrative questions concerning that department.

One of the functions of the traffic engineer is to watch carefully the growth of the business with reference to the requirements for additional equipment of all kinds for switchboards, and a proper length of time in advance to make a report stating that additional equipment is required, and recommending the extent of such equipment. As giving an idea of the complexity of this function alone, I might say that the following are some of the factors which the traffic engineer has to watch in connection with each large switchboard in the system:

The number of subscribers' lines available in the multiple.

The number of switchboard positions available for subscribers' operators.

The number of switchboard positions available for trunk operators of various classes.

The number of incoming trunk cords available for incoming trunk lines of various classes.

The number of call-wire circuits available for calling circuits.

The arrangement of answering jacks so that it may be possible to give all operators at the switchboard proper loads.

In addition to these items in the switchboard itself there are all of the various items concerning the information desk, the assistant manager's desk and the manager's desk—elements of the plant which are of the utmost importance in connection with an efficient operation of the system as a whole.

The report recommending additional switchboard equipment is made to the superintendent of traffic, and if approved by him is transmitted to the chief engineer. The report if in proper form gives the essential facts upon which the recommendation is based and enables the chief engineer to pass promptly on the matter. As will be seen by this routine, the chief engineer does not necessarily have to concern himself with the detail affairs of the traffic department, while at the same time he is not relieved of the responsibility in regard to the amount and character of plant provided.

Another very important function of the traffic engineer is to watch the constant growth of the business trunked between various offices and handled over toll lines between various sections of [illegible]

[illegible] are checked up, and then again the [illegible] is finally with him.

In cases such as this where the [illegible] of the construction department and its engineering work are efficient, the principal work of the chief engineer in connection with such cases is to see that the plans proposed fit in with the general studies and general scheme of development. He also sees that the plans provide for the use of standard materials or materials appropriate to the particular situation in question.

An important function of the construction engineer is with reference to the rights-of-way necessary to carry out contemplated pole-line construction. Such rights-of-way are so intimately associated with the final planning of the construction that they must be obtained prior to the preparing of actual plans of the work. At the same time the rights cannot be obtained without careful engineering consideration as to what such plans should be. Hence it has been found that in a large company the rights-of-way had best be handled by the construction engineer, and the right-of-way work is a very important part of his duties.

From an engineering point of view, I think it is safe to characterize the development of an organization having engineers in the construction and the traffic departments as one of the important steps which lead to efficiency of the operating organization as a whole.

C. P. Steinmetz, Schenectady: Telephony has always appeared to me a very fascinating matter—to consider how the speech sound can be transmitted over long distances by current so minute that only with the most sensitive oscillograph has it been possible to record them on the photographic film. There is, however, one very important and instructive feature in telephone transmission for the consideration not only of the telephone engineer but of the electrical engineer in general—both the transmission of power and the transmission of speech are essentially electrical transmission of power. There is, however, an entirely different purpose involved, and therefore different methods are used and different results obtained.

In electric power transmission the problem is to deliver at the end of the line as large a percentage as possible of the power which has been sent into the transmission line. In telephone transmission this is not the problem, but the problem is to deliver at the end of the line the electric power with a relative proportion as nearly the same as the relative proportion of the harmonics of the complex wave sent into the line by the telephone. Herein consists the great difficulty of long-distance telephone transmission. If it were only the question of delivering power to operate the telephone over the telephone line it would be a very easy problem. The telephone is such a sensitive apparatus that we could easily transmit from San Francisco to New York enough power, and could even throw in a transatlantic cable, and could still get enough power to operate a telephone from San Francisco to New York and London, that is, to hear a sound, but not to understand. You could transmit sound, but you could not transmit articulation; that is, these higher harmonics of the current wave which constitute the difference between the different sounds of the different letters. To transmit the electric power of the electric current so as to destroy this articulation as little as possible, that is, to retain as far as possible the relative proportions of the different components of the complex current wave which the telephone or microphone sends into the line—that is the problem of telephony; but the question of efficiency does not come into consideration. The question of power delivered is immaterial, because the amount of power is negligible; it is a question of eliminating destruction or deterioration of the wave,

especially, with which the telephone has to deal. It is very instructive for the electrical engineer to hear discussed the problem of power transmission, in which the purpose is so different from that with which we are familiar in our high-power systems, and in which, therefore, the means are different from those we are familiar with.

Prof. Pupin: I wish to add one sentence to Mr. Steinmetz's very interesting and instructive remarks, and that is, that you can express what he said in the following words: The distinction between ordinary power transmission and telephone transmission is this: With the ordinary power transmission we want to have as large a power factor as possible, and in telephone transmission we want to have as small a power transmission as possible. I used this same comparison several years ago before the Institute.

J. J. Carty: Mr. Lockwood asked a question about the two-number and particular-party business. That is an expression well known among telephonists, but I thought when I used the term in the paper it might not be understood by those in other branches. I thought I would do as they do sometimes—run in some new terms, as they do, and leave us to find out the best way we can. What was meant by that term might be better expressed by calling it number calls instead of two-number calls. For instance, the suburban business is handled on the number basis; for the subscriber in Newark just the same as for the subscriber in New York, although the method of handling the call may be different. In many stations for suburban business the plan is to call by name for the particular party at the office called, and if the party is not obtained, then there is no charge, and the idea seems to be in the minds of the people who use that system that they save money by not being charged for that call, but inasmuch as all such calls involve extra labor and really greatly increases the cost of handling the business, it is obvious that the cost of that must fall on telephone users; so we have in this neighborhood as far as possible managed our trunk-line plant and our method of operating so as to require the calling by numbers. That enables the caller to get through more quickly, more reliably and more cheaply.

In regard to what Dr. Pupin had to say about limits, I was very much impressed by the very dramatic situation which existed when he made his celebrated invention. We had struck our limit, the limits of speed of underground cables had been reached, and the limit would have been put on the long-distance business and underground toll-line business, and there was a great question as to what we could do about it. I can only compare it to the incident in the Civil War between the Merrimac and Monitor. The Merrimac was running amuck among our ships, and we all thought the limit had been reached, when the Monitor appeared on the scene and changed the course of affairs; and enlarging on this comparison, I think I can make it clear that the arrival of Dr. Pupin with his load invention is justly compared with the arrival of the Monitor of Ericson.

Frivolous Use of the Telephone in Washington, D.C.

A quiet investigation has been under way in Washington, D. C., for about two months, from which, according to a newspaper dispatch from that city, it has been learned that of the telephone calls by government employes during office hours about 23 per cent. were for the government service and 77 per cent. were personal calls. The newspapers publish the following interesting record for the Treasury Department: Government business, 23 per cent.; dinner engagements, 12 per cent.; theater, 28 per cent.; poker engagements, seven per cent.; bucket-shops, eight per cent.; loan companies, four per cent.; social, 12 per cent.; miscellaneous, six per cent. Fifty-three per cent. of the calls were made by male employes and 47 per cent. by females.

Shopping by Telephone.

In the Sixth Avenue store in New York city of Siegel, Cooper & Co. a telephone system was installed recently which is said to be the largest ever put in a commercial establishment. Knowing that a great majority of New Yorkers use the telephone the management has had the store equipped with a system bringing a telephone within the reach of practically every clerk in the establishment. The telephones, which are at all counters and selling points, are connected with a large switchboard on the third floor. The operators are trained carefully and a person calling the store is connected immediately with the department or salesman desired. The operators transfer the telephone shopper from counter to counter, or department to department, as desired. The idea of shopping by telephone has met with success in Chicago.

The Farmers' and Merchants Mutual Telephone Company has been incorporated at Richmond, Okla., with a capital of $10,000.

Ohio Telephone Notes.

Owing to the campaign for business, the percentage of the gross receipts of the Cuyahoga Telephone Company for maintenance is larger than it otherwise would have been. The company has had a great growth, and it has cost something to get it. Competition between the Cuyahoga and Bell companies in Cleveland has been sharp, and both furnish a good service. For either to make a substantial progress, then, requires hard work and push. Both are putting this forth with the result that both have shown excellent gains in the number of telephones added within the last year.

The new exchange of the Gallipolis Telephone Company of Gallipolis has been completed and is ready for work. It is modern in every particular and has a capacity of 2,400 telephones. Much improvement has been made in the outside work also, new wire being put in and many new posts set. A. B. Kratz has had charge of the work since last October and he has given it close attention. He has arranged so that the exchange is able to call all the members of the fire department simultaneously and make other innovations that are pleasing to the people.

The cost of the new conduits and the cable required to equip them, as authorized by the executive committee of the Cincinnati and Suburban Bell Telephone Company a few days ago, will be $165,000. Bids for the work will be called for at once.

The Warrensville Telephone Company of Warrensville has sold its plant to the Cleveland Telephone Company. Many improvements will be made on the plant at once.

The earnings of the Lima Telephone and Telegraph Company of Lima have been sufficient the last year to pay the regular dividends on the prefered stock and four per cent. on common stock, leaving a surplus of $5,000. The company has outstanding $150,000 common stock, $100,000 six per cent. cumulative preferred stock and $128,000 five-per cent. bonds. A syndicate purchased the property from the Federal Telephone Company about a year ago.

Representatives of the Independent companies and the farmers' companies met at Clyde a few days ago and made arrangements to care for each other's business and work in closer harmony.

The Eaton Telephone Company of Eaton has increased its capital stock from $60,000 to $100,000.

The Tedrow Telephone Company of Tedrow has been incorporated by S. M. Stevens and others, to be operated on the mutual plan. C.

Telephone News from the Northwest.

The Fairview Telephone Company has been organized and will build a rural line into Spring Valley, Minn. H. Brandt is secretary.

The Lowry (Minn.) Telephone Company has been incorporated with a capital stock of $5,000.

The Empire (Wis.) Telephone Company has filed articles of incorporation. William C. Ray heads the list of stockholders.

The Citizens' Telephone Company of Fargo, N. D., has filed articles of incorporation with a capital stock of $50,000.

The United States Circuit Court has entered an order denying the motion of the Northwestern Telephone Exchange Company for a provisional injunction to restrain the city of St. Charles, Minn., from interfering with its construction of a local telephone exchange. The council there refused to grant a franchise except with a regulation of rates, which the company refuses to consider.

The Hermosa Telephone Company, Hermosa, S. D., has been incorporated with a capital stock of $10,000.

The Northwestern Telephone Exchange Company has taken out building permits for the construction of an addition to its main exchange in Minneapolis, to cost $10,000, and also for the new sub-exchange in North Minneapolis, to cost $15,000.

The Mesaba Telephone Company has been granted a franchise at Deer River, Minn.

D. F. Siegfried has sold the Sanborn (N. D.) telephone exchange to Earl Shannon.

Thomas A. Way of Mason City, Iowa, has sold his holdings in the Western Electric Telephone Company and has gone to Watertown, S. D. A Mr. Gardner of Osage, Iowa, bought the controlling interest.

The Mutual Telephone Company of Williams, Iowa, has filed articles of incorporation with a capital of $15,000. E. R. Johnson is president and R. P. Johnson secretary.

The Supreme Court of North Dakota has decided that a land owner is entitled to compensation when a telephone line is built on the highway on which his property abuts; holding that it is a new servitude upon the fee of the abutting owner and not a highway use within the purpose of the original dedication.

The Sheep Canyon Telephone Company of Hot Springs, S. D., has been incorporated with a capital stock of $5,000. W. F. Wyatt is president.

The Pioneer Telephone Company of Hitchcock, S. D., has been formed with a capital of $5,000. Charles Phillips is president.

The Highland Telephone Company, Oak Gulch, Day County, South Dakota, has been incorporated with $20,000 capital stock. John D. Hutchinson, John Owen, John Heydlauff and Alfred A. Taylor, all of Oak Gulch, are the incorporators.

The Lake George Telephone Company has been organized at Woden, Iowa. Thomas Quinn is president and A. Orthel secretary. R.

Indiana Telephone Items.

The Charlottesville Northern Telephone Company of Charlottesville has been incorporated. Dr. W. R. Johnson is among the incorporators.

C. E. Stevens, connected with the Princeton Independent Telephone Company at Princeton ever since its organization, has disposed of his interest in the company at Princeton and Hazelton. Mr. Stevens will put in an extensive system through this county, with headquarters and central exchange at Oakland City to connect with the new Independent system proposed for Evansville.

The Richmond Home Telephone Company is reported to have absorbed and taken over the New Paris Telephone Company. The two plants will be operated from Richmond.

The Independent Telephone Company of Owensville is in the market for a new switchboard. A number of telephone lines entering Judson, Ind., have agreed to co-operate and have organized the Judson Switchboard Association. A new contract with the Park County Telephone Company on the same basis with the local company's contracts now in force with other co-operative companies provides that the patrons of the Park County Telephone Company shall pay a line charge of five cents per call for the use of the Judson line.

Railroad officials of Indiana are interested in a safety device which has just been patented, by which, it is said, a train dispatcher has control of trains on his division over every mile of track. It consists of a series of semaphores placed at frequent intervals along the track, which can be raised and lowered by the dispatcher without leaving his desk. It is proposed to use telephones in connection with this device, so the conductor of a stopped train can communicate at once with the train dispatcher and receive new orders.

The City Council of Kokomo has disposed of the long-pending telephone controversy by passing an ordinance granting to the Citizens' Telephone Company the right to form connections with the Central Union Telephone Company for long-distance service to points not reached by the New Long-distance Telephone Company, and this without prejudice or forfeiture of the Citizens' company's franchise.

The Arlington Banking Company is adding a second story to its building to be occupied by the Arlington Telephone Company's exchange. A new and modern switchboard may be installed.

The Central Union Telephone Company has just completed two additional copper metallic circuit toll lines between Indianapolis and Columbus. This is preliminary work to the new exchange the company will build in Columbus this spring. S.

TELEPHONE MEN.

M. R. McClatchey, manager of the Southern Bell Telephone Company at Cartersville, Ga., has resigned his position and is succeeded by Paul Gilreath, mayor of the town.

David Sparks of Jeffersonville, Ky., has been appointed chief electrician for the Lexington district of the Cumberland Telephone Company. His headquarters will be at Lexington.

J. E. Hannon, district contract agent for the Northwestern Telephone Exchange Company at Winona, Minn., has been transferred to Faribault, Minn., where he has been put in charge of the exchange.

Charles H. Coar has resigned his position with the Northwestern Telephone Exchange Company to accept a position with the Twin City Telephone Company of St. Paul in the latter's engineering department. Mr. Coar was recently appointed a member of the Minnesota State Board of Electrical Examiners by Governor Johnson.

NEW COMPANIES.

A new telephone company has been formed in Cortland, Neb., with R. H. Oltman as president.

L. G. Acree is president of the Model Telephone Company of Model, Tenn., recentiy incorporated with a capital of $5,000.

The Courtland and Waverly Telephone Company of Courtland, Va., has been organized with ample capital by J. N. Sebrell, Sr., and others of Courtland.

Articles of incorporation have been filed at Austin, Nev., by the Austin-Manhattan Telephone Company. The company will run a telephone line from Austin to Manhattan by the way of Smoky Valley.

Among the recently incorporated telephone companies are the following-named: Citizens' Economic Telephone Company, Fedora, S. D.; Farmers' Independent Telephone Company, Thurston, Neb.; St. Bernard Telephone Company, St. Bernard, Neb.; Steele City Telephone Company, Steele City, Neb.

Independent Telephony in Western Massachusetts.

A considerable number of interesting points in regard to telephone service and development have recently been brought out in the Massachusetts legislative committee hearings upon the proposed bill to place all companies engaged in the business of transmitting intelligence by electricity under the supervision of the Massachusetts Highway Commission. The proposed bill was drawn up as a result of the suggestion of Governor Guild that some sort of supervision of signaling companies might be desirable; but as far as the hearings have shown, there does not appear to be any very great demand on the part of the public for such action. Representatives of the Bell, Independent, telegraph, cable and wireless organizations have been in constant attendance at the hearings, but perhaps the most interesting points evolved have been the side lights on the Massachusetts situation which have developed from time to time. Most of the companies are opposed to the bill.

Conspicuous among these side lights is the surprising development which has been attained by the Heath Telephone Company, a rural organization operating in the hill towns of the western part of the state. This company had on March 6th 815 subscribers in the region, including and adjacent to the towns of Buckland, Colrain, Ashfield and Charlemont, and pays six per cent. dividends, giving practically an unlimited daytime service throughout the territory, the extreme points covered being Halifax, Vermont and Conway, Mass. The lines are in use between 7 a. m. and 9 p. m. on week days, while on Sundays and holidays the hours of service are between 9 and 10 a. m. and 5 and 6 p. m. The capital stock of the Heath company is worth about $30 per share, aggregating 1,468 shares, held by 317 persons. All but 16 stockholders live in the territory served, which is of a distinctly rural character. The average holdings are less than $150 per stockholder, and almost all the stockholders are subscribers. In this respect the company comes close to public ownership, although it enjoys the full benefits of private initiative.

The rates charged are $12 per year for the service given, which is all metallic-circuit line except one, which serves 42 old subscribers on a grounded circuit with series instruments. These stations pay only $6 per annum apiece, but a toll charge of 10 cents is made for calls on their line to points outside the original territory. There are 11,137 inhabitants in the territory served, which means one telephone to every 13.7 inhabitants, or about one to every 2.5 families. In the rural portion of Buckland the density is one telephone to every 5.1 inhabitants. The rates and the service are determined by the stockholders, and there is now a proposition afoot to give 24-hour service 365 days per year, the cost being $14 per subscriber instead of $12 rental. The service has been found to be of great value in the hill towns, especially in the case of the more remote farms, which are often seven or eight miles from a physician, and in severe winters isolated by huge snowdrifts and heavy gales. Far more than in the city every family has imperative use for the telephone, both in business and social ways, and in several cases instruments taken out on the ground that the subscriber was too poor to pay the necessary $12 per year have been replaced for the reason that no one can really afford to be without an instrument. There is not much doubt that the company has reached the point where any considerale extension through new territory will force it to establish tolls between exchanges. In a recent annual report it was stated that the company probably gives a larger service to subscribers without toll charges than any other company in the United States, and there is no question that the company gives its subscribers an opportunity to transmit messages by wire throughout its territory at a lower rate than the United States mail affords, for an average use of each instrument only twice every working day would amount to less than two cents per message for the year. In the last 2½ years the number of instruments in use has been almost doubled.

Within a few weeks a proposition was made by the New England Telephone and Telegraph Company to the Heath company to the general effect that the latter take over the former's branch lines in the territory, put in Bell receivers and transmitters at an annual rental of $1.25 apiece; refrain from extending its lines into other territory; interchange messages and divide toll business pro rata, according to the distance covered between connec- [illegible]

GENERAL TELEPHONE NEWS

The Home [illegible] of Portland, Ore., [illegible] Helena, Mont.

R. I. Small [illegible] Bell Telephone Company [illegible] to install a new telephone [illegible] in that city.

H. B. Newman [illegible] for the erection of a [illegible] for the Wabash Valley [illegible] $20,000 switchboard will be placed in the new building.

On February 21st the Michigan State [illegible] Company cut in its new system at Saginaw, [illegible] and that city [illegible] service. The switchboard has a capacity of [illegible] telephones.

Peter Mortenson and F. H. Wheeler of Lincoln, Neb., have purchased the Ord, North Loup and Burwell (Neb.) telephone exchanges and lines from Bell & Sorenson. They will install many improvements.

Charles J. Close of Columbus, Ohio, has gone to Havana, Cuba, to arrange plans for a building for the Cuban Telephone and Telegram Company. Frank L. Packard made the preliminary drawings for the building.

The Central New York Telephone and Telegraph Company of Syracuse will expend $60,000 in extending its service in the Thousand Island territory and between St. Lawrence River points in general. W. C. Wolverton is chief engineer.

The Michigan State Telephone Company has completed arrangements with the Hillsdale County Telephone Company, whereby the exchange of toll messages is possible between the two companies. This brings to the use of the Hillsdale exchange about 500 more telephones than heretofore, located in many parts of the county.

The Pittsburg and Allegheny Telephone Company of Pittsburg is making arrangements for extensive improvements and extensions. It has secured franchises in Glassport, Canonsburg, Donora, Waynesburg, Charleroi, and an ordinance is pending in Monessen. At Charleroi the lines of the company will make connection with those of the Tri-State Telephone Company.

The Board of Supervisors of San Francisco has passed to print an ordinance providing for the sale of a franchise for a telephone system to the highest bidder, on the Home Telephone Company's petition. The new company desires to bid for the privilege. Sealed bids will be received up to Monday, April 23d, each to be accompanied by a certified check for the full amount of the bid.

The Ohio and Mississippi Telephone Company of Carbondale, Ill., which was formed recently to take over the telephone companies at Du Quoin, Anna, Marion and Carbondale, Ill., has completed the consolidation of these companies. The new company is capitalized at $100,000 and its first officers are: President, Edward Sampson, Anna; vice-president, H. C. Miller, Du Quoin; secretary, F. W. Willard, Anna; treasurer, D. M. Parkinson, Carbondale; general manager, E. J. Baldridge, Du Quoin. Directors, H. C. Miller and M. C. Brookings, Du Quoin; Joab Goodall and J. M. Mitchell, Marion; J. B. Bundy and D. M. Parkinson, Carbondale; Edward Sampson and A. J. Phillips, Anna.

The Colorado Telephone Company (Bell) has placed an automatic switchboard in the factory of the Holly Sugar Company at Holly, Colo. This is not the first automatic board in Colorado, though it is said to be the only one now in operation and the first to be installed by the Colorado Telephone Company. It was desired to have a system where each department of the factory could communicate with any other department and at the same time have connections with the telephone company's exchange at Holly. It was also desired to have it possible for the telephone operator at Holly to call any one of these departments at the factory, and all this over one circuit running from central to the automatic central at the factory.

MANUFACTURERS AND DEALERS.

No exception is made to the general high quality of the Stromberg-Carlson bulletins by the one which has just been issued. It is devoted to central-energy telephones and is very tasteful in appearance as well as instructive in the reading matter which it contains. One of the interesting things described in the bulletin is a combination telephone receiver and transmitter set for desk use. This set requires no triplet and the switch is operated by merely placing the receiver to the ear. When not in use the instrument may lie upon the top of the desk or be hung up by a ring.

CORRESPONDENCE

Great Britain.

[illegible] culiarities of the service have been adopted, and [illegible] the total number of cars is in use. When they have all been delivered a two-minute service will be inaugurated. At one point the subway is midway between the road level and the deep level twin tunnel of the Great Northern, Piccadilly and Brompton railway, one of the Yerkes group of tube railways.

Further to the west of London the London United Tramway Company has opened some new extensions which include the first cross-the-Thames tramway ever built, viz., Kingston Bridge. This line was only sanctioned by Parliament after severe competition, which, even now, has not altogether disappeared. However, the lines have now received the sanction of the Board of Trade. The extensions in question are mainly on the south side of the River Thames, but they form a through connection, via the bridge in question, with the same company's lines on the northern side. The feature of the new system from the electrical engineering standpoint is that it is supplied with current from the huge generating station at Chelsea, owned by the late Mr. Yerkes' company, the Underground Electric Railways Company of London. The distance between this generating station and the tramway sub-station is 10 miles, and the pressure is 11,000 volts. Another interesting detail, too, is that a new type of double-deck car has been introduced with a larger seating capacity than hitherto.

An event of more than ordinary interest took place at the end of last week at the city telephone exchange of the General Postoffice. As previously reported, the rapid growth of the business has necessitated the erection of a new exchange board, which will have the effect of doubling the present capacity of the system. The new board being of a more modern design than the original, it was decided to transfer to it all the existing subscribers pending the reconstruction of the first board. The change over of some thousands of subscribers' connections was carried out with practically no hitch. Eventually it is the intention, it is generally understood, to retransfer the subscribers on the completion of the reconstruction of the old board.

That the decision of the London, Brighton and South Coast Railway Company to employ the single-phase system of electric traction upon some of its suburban lines has engendered a greater feeling of doubt than ever in the minds of other railway managers has been abundantly manifested recently. The record of lost traffic incurred by some of the steam suburban lines in and about London gets worse year by year, and the companies, being at their wits' end to counteract this, which is directly attributable to electric-tramway and motor-omnibus competition, turn to electric traction. But what do they find? Take, for instance, the East London railway. This runs over both the District railway and the London, Brighton and South Coast railway, the former of which is equipped with direct current, and the latter about to be worked on the single-phase alternating. The North London railway, which has lost over $100,000 per annum for six years on account of lost traffic and is now losing a further $100,000 per annum through

the reduction of its fares, runs over several systems, and it is not unnatural, therefore, that these companies are in a dilemma as to the best course to pursue. There is not much doubt that the running powers exercised over each of the various companies' lines in London will tend to retard the adoption of electric traction for some time yet, unless a standard system can be quickly agreed upon.

The National Telephone Company is issuing $30,000,000 of new stock, which will be offered to the present shareholders. The report of the company shows an agreeable increase in the use of the telephone in England, especially in London, where the company's business has doubled itself during the last three or four years, in spite of the competition of the Postoffice system, which latter now has 40,000 subscribers. The company has 73,000 subscribers in London. G.

New York.

New York city, March 10.—Controller Metz has made a very interesting suggestion to the effect that the city should take over the ferries and operate them without tolls for the vehicular traffic that now crosses Brooklyn Bridge and thus leave the space on the bridge free for additional trolley tracks. The plan, however, is not at all likely to commend itself either to bridge engineers, traction men or to municipal-ownership advocates.

It is stated that the first passenger train on the northernmost section of the subway will positively run on Monday morning. Pending the completion of the equipment of intermediate stations passengers will be conveyed on a shuttle train from One-hundred-and-fifty-seventh Street to the Harlem Ship Canal, with stops at Two-hundred-and-fifteenth and Two-hundred-and-twenty-first streets.

President Orr of the Rapid Transit Commission has stated that he is confident that there will be more than one bidder for any future subway, and some statisticians have figured out that the lowest bidder will be August Belmont, because the existing Interborough power plant is and was originally designed with a view of supplying all the electric power needed to operated three or four subways. The same authorities state that the Brooklyn Rapid Transit Company will not bid for any Brooklyn subways on account of the need that would arise of constructing an entirely new generating station at an estimated cost of $8,000,000.

Progress is reported on the public-utilities bill which is being promoted at Albany by Tammany interests to give the city power to supervise and control traction, lighting and telephone properties.

Senator Cooper of Brooklyn has introduced a bill at Albany embodying Borough President Coler's ideas for a municipally owned and operated traction system for Brooklyn.

The Metropolitan Street Railway Company's surface car barns on Forty-second Street were destroyed by fire on Sunday night, involving a loss of $250,000. The barns will be rebuilt as speedily as possible.

The New York City Street Railways Company will enlarge its power house at One-hundred-and-twenty-ninth Street and Amsterdam Avenue at a cost of $150,000. This building is on the site of the first cable power house erected in the city.

The New York Times says that a number of women living in the Bronx are obtaining verdicts against the Metropolitan Street Railway Company to the amount of $50 damages and $12 costs each for refusal of the company to grant free transfers. It is said that 600 judgments have been granted already and that the company has paid over the money in many cases. On the other side of the river the Brooklyn Heights railroad has issued an order, following adverse legal decisions, to grant transfers in the future at all intersections.

An analysis of the lighting bids submitted on February 1st shows that the city will save $779,797 on its new gas and electric-lighting bills. The details of the electric lighting bids for 1905 and 1906, respectively, are as follows: Manhattan, $491,325.80 and $338,630; Bronx, $293,591 and $227,270; Brooklyn, $591,184.80 and $459,847.50; Queens, $287,363 and $215,522.50; Richmond, $163,835 and $149,075; total, $1,827,299.60 and $1,390,345.

The Williams Printing Company is now using power from the Edison mains to run its machinery. The Broadway Central Hotel has also recently decided to take the Edison service, and contracts are pending for supplying the new department store now building opposite the Waldorf-Astoria Hotel. At Yonkers some new tenement houses are to be equipped with electric lighting.

The Natural Food Company, which uses electrical power in its factories at Buffalo, is at present exhibiting at a Broadway store an electrically operated apparatus showing how it prepares some of its breakfast foods.

The New York Edison Company reports that on February 28th it had pending contracts for 1,657,408 16-candlepower equivalents, a very considerable increase over the corresponding month of 1905. This amount of lighting, it is said, would suffice for 331 hotels of the size of the Waldorf-Astoria.

The proposals to consolidate the power plants at the Brooklyn Navy Yard are viewed with general disfavor by the officials in charge of the existing isolated plants. They aver that it was enormous task to get the existing plants in operation in view of red-tape regulations, and that a consolidation would mean still more tape in giving orders incidental to the efficient operation of the machinery.

Many new electrical attractions are promised for the Coney Island season, which opens on May 12th.

The Jones Electric Manufacturing Company of 33-37 Bethune Street has made an assignment to Daniel W. Sloan. The company has a capital stock of $50,000 and formerly did much telegraph-instrument business. D. W. W.

New England.

Boston, Mass., March 10.—The Boston Elevated Railway Company has ordered its conductors to announce the denomination of any piece of money larger than five cents, when it is handed to him by a passenger. This is to prevent any misunderstanding in regard to making change.

The Montpelier and Barre Traction Company and its employes have signed a wage scale which will be in force for three years. They compromised on one cent per hour increase, the agreement to last three years.

The articles of association of the Augusta, Oakland and Waterville Street Railway Company have been approved by the Maine railroad commissioners. The company has a capital of $75,000 and it proposes to build an electric railway between Augusta and Oakland, Maine, via Sidney, a distance of 18 miles.

C. J. H. Woodbury of the American Telephone and Telegraph Company's engineering staff, addressed the Medford Club of Medford, Mass., on the evening of February 27th, on "The Development of the Telephone Service in the United States."

The Boston and Worcester Street Railway Company reports gross earnings of $28,000 for February, against $21,951 in February, 1905, and $17,226 in February, 1904.

The long-standing suits of the Boston Electric Light Company against the city of Boston and the Old Colony Railroad Company have been settled. The electric-light company sued for damages occasioned by cutting through the site of its old plant caused by the extension of Federal Street in connection with the building of the South Terminal Station in Boston. By the settlement the company received $388,000 from the city and $2,000 from the railroad company.

In the Massachusetts Legislature the committee on street railways has rejected E. Moody Boynton's petition for a revival of the charter and rights of the Boston, Quincy and Fall River Bicycle Railway Company. B.

Southeastern States.

Charlotte, N. C., March 10.—Work has been started on an interurban electric railway from Anderson to Belton, S. C., the survey having been made by J. E. Sirrine of Greenville, S. C.

The Birmingham (Ala.) Railway, Light and Power Company has been granted a permit to make $50,000 improvements to its Powell Avenue power house.

In the Legislature of Maryland bills have been introduced that appear to give the Maryland Electric Railway Company the right to merge several lines and give a system that will embrace about all of the electric lines within 50 miles of Baltimore. The original charter was granted several years ago. It is added that this charter has now fallen into the hands of interests friendly to the United Railways Company, which may mean extensive mergers.

In view of the fact that 200,000 horsepower of electrical energy will be available from this section, it is asserted that both the Westinghouse and the General Electric companies are contemplating opening branch offices at this place. It is even reported that these concerns have secured quarters in one of the chief office buildings here.

The town of Gastonia, N. C., has awarded to the Spencer Mountain Power Company a contract for supplying power at the rate of $20 per horsepower for day use and $14 per horsepower for night use. It is estimated that about $3,000 a year will be saved to the city in lighting.

The Southern Power Company has offered to supply the town of Chester, S. C., with power at the rate of $20 per horsepower for not less than 2,000 horsepower, this being close to half the present price, and it is likely that the town will accept the offer for city lighting.

The city of Winston-Salem, N. C., has authorized the lighting committee to purchase the Winston Gas and Lighting Company at a reasonable figure at a receiver's sale, and if this is not successful the city will undertake the work of establishing a municipal gas or electric plant.

The Albemarle (N. C.) Ice Company has secured rights to add an electric and water plant to its present plant for the purpose of lighting the city with electricity.

A committee of citizens of Reidsville, N. C., is in charge of securing an engineer to estimate the cost of an electric railway from that town to some point in Caswell County to connect with the Norfolk and Western railroad, and it appears that the work will finally be accomplished. L.

Ohio.

Cleveland, March 10.—At a meeting last week in this city an arrangement was completed whereby the Toledo and Western and the Bucklen syndicate will complete the connection between the lines owned by these two interests and make it possible for a through route from Erie, Pa., to Chicago. Each will build about 12 miles of track and meet at a point near Pioneer, Ind. With the lines built under construction and projected this connection will make it possible to travel from Boston to Chicago by trolley.

Assistant General Manager Moon of the Lake Shore railroad has denied that 75 motor cars, similar to the Strang car, are being built at Collinwood for that company. He said that the company is experimenting with a motor car and may put it into use if it gets one that is satisfactory.

The Cleveland Electric Railway Company has asked for a franchise to complete the Superior Street line into East Cleveland.

The Hippodrome Company will install a lighting plant of large proportions in its new building in Euclid Avenue and will furnish light for other buildings in the vicinity. The same may be said of the heating plant. This company is building an immense show house and office building, and the heating and lighting equipment will be of the best. The electric machinery is being made in Switzerland, it is said.

The Cincinnati Light, Heat and Power Company has been incorporated by Guy W. Mallon, H. H. Bechtel, E. R. Stearns and others, with a capital stock of $100,000. The company will apply for a franchise to furnish current for lighting and commercial purposes at eight cents a kilowatt. The present price is 10 cents, although the franchise would allow 11. The franchise ordinance that Mr. Mallon is preparing will require a vote of the people after the City Council has granted it. It is the intention to make the capital stock from $6,000,000 to $8,000,000 if a franchise is granted, and a provision will be made that the plant may be turned over to the city after 25 years should the city desire to purchase.

Earnings of the Columbus, New Albany and Johnstown road are showing a good gain over the first month of last year. The first of the new cars will be delivered in April.

Stockholders of the Canton-Akron Railway Company have decided to increase the capital stock from $2,000,000 to $2,200,000, the additional money to be used in purchasing new equipment for the power plant and new cars.

It is rumored that negotiations are under way for the sale of the Muncie, Hartford and Fort Wayne to the Elkins-Widener-Dolan people. The story has not been confirmed here.

The House of Representatives has voted in favor of the bill providing for a light plant for the State House at Columbus. The bill carries with it an appropriation of $25,000 for that purpose.

The Dayton and Western has discontinued its fast train, the Inter-state limited, between Dayton and Indianapolis, because it is not paying. A buffet service was operated on the cars.

An engineer will be employed to make plans for a municipal light plant for Covington, Ky., according to a resolution adopted by the City Council a few days ago.

Rumors have been going the rounds of late that the Toledo Railway and Light Company will be absorbed by the Detroit United before a great length of time. O. M. C.

Indiana.

Indianapolis, March 10.—The directors of the Winona-Peru electric railway held a meeting this week and completed plans for the immediate construction of a line between Peru and Winona. Among those present were John M. Studebaker of South Bend and S. C. Dickey of Indianapolis.

J. A. Barry, former manager of the Indiana Northern Traction Company, E. M. Fry, railroad expert for the North American Railway Construction Company, and S. P. McGough, engineer for the latter company, were in Indianapolis last week making arrangements for building an electric railway from Wabash to Warsaw by way of Urbana and North Manchester. The Fort Wayne and Wabash Valley Traction Company will furnish power for the line. It is generally thought that the road, when built, will be merged with the Indiana Union Traction Company.

The Terre Haute council has refused to consider the bid of the traction company for lighting the city and has decided to ask for bids for one year only, at which time the city expects to have a municipal plant ready to operate.

The City Council of Linton is about to sell its municipal electric-light plant. The plant has been operated at a loss and inasmuch as a number of companies are ready to bid on it the probability is that it will be sold.

The Louisville and Southern Indiana Traction Company, with headquarters in New Albany, has

completed plans for the erection of a terminal building in Louisville at a cost of $900,000, which it is said, will be the finest structure of the kind south of the Ohio River. The lower floor of the building will serve as a depot for the various contemplated lines of the company entering Louisville and the second and third floors will be leased to manufacturing concerns using electrical power.

The commissioners of Owen County have ordered an election to vote an appropriation of $25,000 in aid of the Indianapolis, Vincennes and Evansville electric railway.

The City Council of Lafayette has granted a franchise to the Warren Traction Company to enter that city. This franchise provides for a road that completes the link between the Widner-Elkins roads and the McKinley lines, giving complete connection from Erie, Pa., to St. Louis, Mo. The work of constructing the line will begin at once.

S. S.

Michigan.

Grand Rapids, March 10. The electric light question is again up for discussion at Linden. Warren S. Rundell of Flint has made a proposition to light the village from the electric plant at Fenton.

The Village Council at Hart will submit the question of bonding the village for $20,000, for the purpose of putting in an electric light plant, to the voters. A proposition from the Pere Marquette company has been under advisement. The latter company purposes securing power from a dam on the Pere Marquette River in Mason County.

The Detroit Trolley Wheel and Equipment Company of Detroit is out after a contract to supply 10,000 trolley wheels for the Japanese government. The Trolley Wheel company is one of the new industries of Detroit. It manufactures brass, bronze and aluminum goods and turns out the Paragon automobile. It started a little over a year ago with two men, and now it employs over 50.

The building of an electric railway from Battle Creek through Burlington and Girard to Coldwater, it is said, is now an assured fact. It is said that this effectually hangs up the proposed line of Battle Creek to Coldwater, via Athens.

The Richland Citizens' Association will attempt to project an electric railway to connect the village with Kalamazoo. The scheme is to either construct a line to tap the Michigan Traction Company's system at Yorkville, or build a line to circle the west shore of Gull Lake and come directly into Kalamazoo.

W. F. Davidson of Port Huron and associates have been granted a franchise in Flint for the Detroit, Flint River and Saginaw Valley Railway Company. The new company promises to go to work as soon as spring opens, their claim being that the right-of-way has been secured from Saginaw to Flint, and that there will be little trouble in getting similar concessions from Flint to Fenton. Eventually, they say, the road will go through to Detroit.

Water has been raised behind the No. 1 dam of the Grand Rapids-Muskegon Water Power Electric Company at Stanwood, and it is expected that power will be delivered soon to consumers at Muskegon. At Grand Rapids the company has taken up new office quarters at 47 Monroe Street, where the company will display various electric appliances.

It is said that the officials of the interurban railway being constructed between Grand Rapids and Ionia have been investigating gasoline cars in the East. While it has not been announced that the company has decided to try the new motive power on the line, it is noticed that the work on the road is largely confined to grading and filling, and nothing definite has as yet been learned concerning the location of the power houses. It was said by one interested in the progress of the road that perhaps power houses would not be needed.

L. W. B.

PERSONAL.

Mr. Charles Wirt of Philadelphia is making a short visit to his old home, and while in Chicago will have an address at 1061 Monadnock Building (telephone, Harrison 4129).

Gen. A. B. R. Sprague, president of the Worcester Electric Light Company of Worcester, Mass., celebrated his seventy-ninth birthday a few days ago. Although well advanced in years, Gen. Sprague is active in caring for his varied business interests.

H. M. Baxter, engaged in the advertising of engineering products and in general engineering publicity, has secured the services of Charles W. Brooke, engineer, and Frank B. McConnell, art director. Both Mr. Brooke and Mr. McConnell have been connected with Westinghouse companies. The office of the concern is in Pittsburg.

C. T. McDonald, electrical engineer, entered the employment of the Chicago Fuse Wire and Manufacturing Company on March 1st. He graduated from Armour Institute in 1904 and since then has been employed by the Underwriters' Laboratories under W. H. Merrill, Jr., and had charge of [illegible]

[illegible] that it would be impossible for him [illegible] elected.

W. H. Hopkins died of apoplexy at his home, 4058 Lake Avenue, Chicago, on March 6th. Mr. Hopkins was well known in the street railway industry through his connection with the [illegible] and financial end of the business. At the time of his death he was president of the Morris [illegible] Electric Railway Company. He was born in [illegible]ville, Ill., in 1855 and came to Chicago eight years ago. Besides his street railway connections, he practiced law. He is survived by a wife and two children.

M. L. Sperry has been appointed superintendent of the local business of the Taylors Fall power development now under way near Minneapolis. Mr. Sperry succeeds N. E. Seavey, who will undertake special work in connection with the development. Mr. Sperry has been connected with Stone & Webster of Boston for several years in the capacity of manager and engineer, having had charge of the Stone & Webster interests at Ponce, Porto Rico, Savannah, Ga., and other points. He is a graduate of the Massachusetts Institute of Technology.

Mr. E. F. C. Young, the highly esteemed president of the Joseph Dixon Crucible Company and the First National Bank of Jersey City, N. J., has just passed his seventy-first birthday. Mr. Young is hale and hearty and one of the busiest and most hard-working men in Jersey City. On his birthday scores of business friends called on him to congratulate him. Many letters and telegrams were also received. To many of the young men who called to congratulate him Mr. Young said: "I never felt in better health in my life, I hope that all you young men will be as hearty as I am when you are 71 years old."

ELECTRIC LIGHTING.

An ordinance is before the council of Marysville, Mo., to provide for an issue of $30,000 municipal lighting bonds.

The Dewey Electric Light and Power Company has been incorporated at Nampa, Idaho, with a capital of $1,000,000.

The state penitentiary board at Jefferson City, Mo., is said to be planning a new power house at a cost of $250,000.

Frank Koenig of Moulton, Texas, has secured a franchise for the establishment of an electric-lighting plant in Moulton.

Grimes & Absher, who were recently granted a franchise at Wagner, S. D., have let the contract for the construction of a $10,000 electric-light plant.

M. Leiby is organizing a stock company for the purpose of building an electric-light plant at Ellendale, N. D. Already $12,000 have been subscribed.

The corporation of Glasgow, Scotland, has received the consent of the secretary of Scotland to borrow £300,000 for additional electric-supply works.

The contract for installing an electric-light plant in the courthouse and county jail at Crookston, Minn., has been let to Fairbanks, Morse & Co. at $2,740.

A. Rubel and M. J. Lamb have organized a company, capitalized at $250,000, to erect an electric-light plant in Corinth, Miss. They recently were granted a franchise.

The City Council of Watonga, Okla., has rejected all bids for erecting an electric-light plant and has decided to build the plant under the direction of the superintendent.

A. O. Archer of Muskogee, I. T., has secured a franchise for an electric-light plant and street-railway system in Colgate, I. T. He will ask for a like franchise at Lehigh and Atoka.

Business men of Triadelphia, Leatherwood, Woodsdale, Edgewater and other towns in Virginia are planning to establish a central electric light plant to furnish light for the National Road.

The Board of Trade of Louisville, Ky., has named F. C. Nunemacher as chairman of its committee which is to co-operate with other commercial bodies in securing more attractive lighting, by means of electric arches, in the business portion [illegible]

[illegible] railway to cost $328,000.

[illegible] franchise rights.

Plans have been perfected and work will soon be begun by the Denver and Rio Grande Railroad completely to standardize its entire system in the way of light. Electricity will displace gas and every other form of light now in use in the engines, in the offices and shops of the company. No more electricity will be bought. Thoroughly modern electric plants are to be erected at the Burnham shops in Denver, in Salt Lake and at several other points along the line. The company will replace the oil lamps of the semaphores and yard switch lights with electric lights.

Henry Richardi of Bellaire, Mich., who has been successfully promoting a project for a lighting and power station, has recently placed the contracts for complete waterpower and electrical equipment necessary for carrying out his plans. The water rights for the operation of the plant having been secured, a dam and power house are in process of construction, from which some 25 miles of three-phase circuits for lighting and power purposes will be fed. The Allis-Chalmers Company will furnish the complete equipment of electrical machinery and the harnessing devices for direct connection from waterwheels to alternators. The outfit includes a 375-kilowatt alternator, exciter, switchboard, transformers, etc.

ELECTRIC RAILWAYS

The city of Parsons, Kan., has granted a 30-year franchise to the Kansas Union Traction Company, which is to build a line from Coffeyville, Kan.

The Oregon Waterpower and Railway Company of Portland, Ore., is a recent purchaser of a 400-kilowatt Allis-Chalmers generator, with 150-horsepower starter and switchboard.

The Lawton, Denton and Dallas Electric Railway Company has been incorporated, with headquarters in Lawton, Okla. It has a capital of $250,000 and will construct an electric railway from Lawton to Dallas and Denton.

The New Jersey Senate a few days ago passed the Wakelee trolley freight bill. The bill merely repeals the act of 1896, which prohibits trolley lines from carrying freight except those that might then be doing that kind of business. The farmers of the state urged the passage of the bill.

The Shenango and Midland Electric Railway Company has secured a franchise at Sharon, Pa. The agreement is that the city shall receive $5,000 for the franchise and a percentage of the earnings. The new road will connect Newcastle and Conneaut Lake and be the connecting link between Erie and Pittsburg.

The Board of Supervisors of San Francisco has readopted plans and specifications for the reconstruction of the Geary Street railway on Geary Street and Point Lobos. On April 9th bids will be received for the contract to do the work. The plans provide for an underground electric conduit railway to cost $328,000.

Under the name of the Inland Empire Railway Company, a merger has been effected of the Coeur d'Alene and Spokane Railway Company, the Spokane Traction Company, the Spokane Terminal Company and the Spokane and Inland Railway Company. The merger companies will have about 200 miles of road. J. P. Graves of Spokane, Wash., said that a majority of the shareholders in the companies interested have agreed to the merger. Shareholders and others interested in the Granby [illegible]

Copper Company will be identified with the new company, behind which are New York and Boston capitalists. It is proposed to build electric roads and develop waterpowers in and around Spokane, Wash.

It is reported that the London, Brighton and South Coast Railroad Company of England had decided to operate part of its lines by the Winter-Eichberg single-phase alternating-current system, the British patents for which are controlled by the General Electric interests. There will be about 75 miles of track electrified at a cost of about $3,000,000.

A Chicago daily-newspaper writer, referring to the condition of affairs in Kenwood, Chicago, in 1857, says: "One suburban train a day went each way on the Illinois Central Railroad, but there were no stops between Hyde Park and the down-town station. There was no apartment house or hotel within miles. Electric lines were practically unheard of then." "Practically" is good.

Men identified with the Heinze copper interest are said to be preparing to build an electric railway between Elmira and Rochester, N. Y. The company will be called the Rochester and Elmira Electric Railway Company, and will be capitalized at $4,000,000. It is asserted that the enterprise is in such shape that work may be started as soon as the formal approval of the state railroad commissioners has been obtained.

A patent for a closed conduit for electric railways (No. 813,101) is owned by Lohmann & Co. of Chattanooga, Tenn. The patent covers a conduit which will open and close automatically as the cars pass. No excavation is needed, as the appliance lies directly on the cross ties between the rails. The trolley wires are dead except directly beneath the car, owing to the short lengths of wire used, one length of the trolley wire only is energized, that at the time under the car.

The Pittsburg Railway Company will install 20 emergency straight air-brake equipments for motor cars with air compressors and 10 emergency straight air-brake equipments for trail cars furnished by the General Electric Company of Schenectady, N. Y. The cars upon which these equipments will be mounted are to be run singly and in two-car trains, consisting of one motor car and one trailer. The type of air-brake equipment above mentioned, sometimes called "semi-automatic," is essentially a straight air-brake system, having in addition an emergency valve on each car, which, in case the train breaks apart, disconnects the brake cylinder from the train line and connects it directly to the main reservoir, thus applying the brakes on all cars just as in the automatic system.

A new belt railway, for both freight and passenger traffic, to encircle Indianapolis at a radius of 14 miles, is projected by B. V. Hubbard of Mooresville, and others. The proposed road would intersect 15 steam and 11 or 12 electric interurban roads and pass through 14 good-sized towns. The promoters say steam will be used for moving freight, and electricity for passenger service. The road will be nearly 100 miles long. There is another belt road being projected by J. N. Crabb and others, who have formed a corporation known as the Circuit Electric Railway Company. The radius of this proposed road is 25 miles, and it would connect about 10 county-seat cities. If these two lines are completed, there will be three belt lines encircling Indianapolis.

POWER TRANSMISSION.

W. G. Schamberger and associates of Gallatin, Tenn., have secured control of the falls of the Cumberland River in Whitley County, Kentucky, and will build a dam and electric power house. A fall of 180 feet is said to be obtainable, and it is believed that 50,000 horsepower can be developed for transmission electrically.

A municipal delegation from Port Arthur, Ont., has waited on the Ontario government and made application for a lease of the Great Dog Falls on the Kaministiquia River. The falls are calculated to be capable of developing from 30,000 to 50,000 horsepower. If the lease is granted the town proposes to make arrangements for the full development of the power.

At the annual meeting of the Washington Water Power Company in Spokane, 11 directors were elected, who chose the following-named officers: President, H. M. Richards; first vice-president, A. B. Campbell; second vice-president and general manager, D. L. Huntington; treasurer, H. E. Perks; secretary, H. L. Bleecker. The company plans several extensions and new lines during the coming year, and will greatly increase its electrical power, developed at Spokane and in Post Falls, Idaho.

The Maritime Coal Company of Cumberland, Nova Scotia, has a project for establishing an electric plant at the mouth of the company's mines from which electric power will be transmitted by wire to many important towns in that province. Senator Mitchell is president of the company. The screenings in most Canadian coal mines go largely to waste, but by converting them into electrical energy the company expects great results both for itself and the country it will supply with power. A pole line has already been purchased to connect the mines with the town of Amherst.

The generating plant of the Truckee River General Electric Company, located near Floriston, Cal., was threatened with partial destruction a few days ago, when several loaded freight cars plunged over an embankment while running at high speed, and rolled across the flume, carrying water to the plant's big turbine wheels. Fortunately the flume did not break or the plant would have been wrecked by the flood of water that would have poured through it until the headgates could have been closed. The plant is the most costly on the Truckee River, and is the pioneer of all the plants owned by the Fleishackers. It furnishes power for the Comstock mines, Virginia City, and Carson.

PUBLICATIONS.

A useful book of instructions on the installation and operation of Bullock direct-current motors and generators has been issued by the Allis-Chalmers Company of Milwaukee. The instructions apply to types N and B. Particularly clear and comprehensive diagrams of connections are a feature of the pamphlet.

Direct-current motors and generators are made the subject of a new bulletin from the National Electric Company of Milwaukee, Wis., the type NL being described. The machines are of a new type, adapted for use as either motors or generators, with slight modification. The company is also sending out another of its artistic mailing cards showing a National 1,000-kilowatt frequency changer—one of a recent order of four.

New and striking designs in advertising literature are characteristic of the Holophane Glass Company, New York. This time it is two handsome little booklets—edition de luxe. They are devoted, respectively, to the lighting of churches, schools, libraries and hospitals and the lighting of theaters and public halls. They are illustrated plentifully with examples of interior illumination, and many useful hints as to this character of lighting are included.

Among the recent bulletins of the General Electric Company are three, devoted, respectively, to "Rotary Converters for Railway Service," "Isolated-plant Switchboard Panels" and "Prepayment Attachment for Thomson Recording Wattmeters and High-torque Induction Wattmeters." There is also a complete index to bulletins, dated January, 1906, included among the material sent out. A number of pamphlets, leaflets, price lists, etc., are also being mailed.

Two bulletins from the Western Electric Company describe, respectively, type I motors (one-twelfth to one horsepower) and hoisting motors, type H. The former are adapted for belted or direct connection to machines requiring one horsepower or under. They are semi-enclosed and neat and simple in design. The type H motors are especially designed for hoists and electric-crane service and are completely encased. The bulletins are plentifully illustrated and describe the apparatus fully.

The Booster, "a periodical of protest, progress and prosperity," has made its appearance. It is published quarterly by the Curtis Advertising Company of Detroit, co-operating with the Co-operative Electrical Development Association of Cleveland, and is intended to help the central-station manager do more business by suggesting improved methods of business getting. There are numerous illustrations and many articles and suggestions of value to the new-business department. The whole is very much up-to-date. Naturally, not a little is said about the Curtis Advertising Company, but as the subscription price is only "your honest opinion," no one should object to that.

SOCIETIES AND SCHOOLS.

The Illuminating Engineering Society, which was recently organized in New York city, has issued in printed form its constitution and by-laws, also a list of members. Neatly printed invitations to become members of the society are being widely distributed.

A quarterly meeting of the Street Railway Association of New York state will be held at Elmira, N. Y., on March 29th. The subjects to be considered are advertising, city schedules, collection and registration of interurban fares, interchangeable mileage books, methods of discipline, and station rules.

The next regular meeting of the American Institute of Electrical Engineers will be held Friday evening, March 23, 1906, at 8:15 p. m., in the assembly room of the New York Edison Company, 44 West Twenty-seventh Street. Papers will be read and discussed as follows: "Some Features Affecting the Parallel Operation of Synchronous Motor-generator Sets," by J. B. Taylor, railway engineering department, General Electric Company, Schenectady; "Notes on the Design of Hydro-electric Power Stations," by D. B. Rushmore of the General Electric Company, Schenectady, N. Y.

The University of Wisconsin has recently purchased from the General Electric Company a 25-kilowatt horizontal-type Curtis steam turbine for the instruction of students and for experimental purposes. Owing to the increasing importance of this type of machine in electrical plants as well as the recent successful application for ship propulsion the college of engineering has found it necessary to make this addition to its laboratory equipment.

The Trunk Line Association and the New England Passenger Association have authorized a rate of a fare and one-third, on the certificate plan, from points in their respective territories to Atlantic City and return, for delegates and their friends attending the twenty-ninth convention of the National Electric Light Association, to be held at Atlantic City, N. J., June 5th to 8th, inclusive. Negotiations are under way with the other passenger-traffic associations, and it is hoped that the same rate will be obtained from them.

Purdue University at Lafayette, Ind., has begun the erection of an important addition to the electrical building in a structure to be equipped with a pit, traveling crane and a unique classroom equipment for conducting tests upon interurban cars. These improvements will amount to an entirely new dynamo laboratory 68 by 90 feet, with a basement equally as large. Interurban cars will enter at the east end of the building and be placed over the pit to admit of inspection and experimentation in connection with the car equipment. The building will be completed by July 1st.

AUTOMOBILES.

The San Francisco Gas and Electric Company of San Francisco, Cal., which is now controlled by the Pacific Gas and Electric Company, has made a new departure by purchasing six automobiles of the runabout type for the use of the outside superintendents.

Local capitalists of Chester, Pa., have formed the Philadelphia and Chester Coach Company, and will apply for a charter to establish a line of automobile stages between the two cities. The incorporators are J. Frank Black, George C. Hetzel and George W. Atherholt. The new enterprise is the outcome of the recent proceedings to have the Chester and Darby Pike condemned. The coaches will be operated by gasoline or electric power and will run parallel with the trolley lines of the Chester Traction Company.

MISCELLANEOUS.

Judge Hickman Moore of Seattle, Wash., has been elected mayor of that city on a municipal-ownership ticket by the small majority of 15 votes.

Secretary Shaw has submitted to Congress an estimate of $927,000 for the construction of a cable from Key West, Fla., to Guantanamo, Cuba, and thence to the Panama Canal Zone.

The Eastern States Telephone and Telegraph Company has been organized at Jersey City, N. J., to construct telegraph, telephone and electric cable lines. Henry A. Bingham, Cornelius A. Cale and others are the incorporators.

The Watt Memorial Fund committee of Greenock, Scotland, inaugurated two years ago by Mr. Carnegie, has resolved to proceed with the erection of a building upon the site of James Watt's birthplace at the corner of William Street and Dalrymple Street, Greenock.

The People's Gas Light and Coke Company of Chicago, it is announced, is having plans prepared for a large new gas manufacturing plant. Possibly $5,000,000 will be expended at the outset. The company has a 300-acre tract of land in the southwestern part of the city, near the Drainage Canal and several railroads, where the plant will be built.

The Civil Service Commission announces an examination for the position of chief harbor engineer for the city of Chicago, the position to pay $5,000 per annum. The candidates must be familiar with bridge work, the electrical operation of bridges, hydrographic and city surveying, building foundations, concrete work, etc. The examination will be held March 19th. Application blanks may be secured from William E. Rafferty, secretary of the Civil Service Commission, city of Chicago.

Recently in Stroudsburg, Pa., a duck came in contact with a broken telephone wire charged with electricity and was killed. Lee Tyerman and B. H. Hursh subsequently discovered that the duck's feathers were loosened by the shock. Now they have constructed a device by which ducks ready

for plucking are subjected to an electric current. The scheme renders "dry plucking" easy and the meat is not injured. Dry-plucked ducks bring three cents a pound more, it is said, than those treated by the scalding process.

The Senate at Albany, N. Y., has passed Assemblyman Agnew's New York city 80-cent gas bill. The measure is a city bill, and now goes to Mayor McClellan for his approval before it can be sent to the executive chamber for the governor's approval. In several wards in Queens, Brooklyn and Richmond boroughs the rate is fixed at $1.

At Salamanca, N. Y., the Village Board recently passed an ordinance providing that all electric wires and cables in the town must be raised so that they will be at least 29 feet above the street. The action of the board came about through the moving of a house, the progress of which was stopped for a week because the building could not pass under a cable.

In England a country-house electrician has varied duties apparently. This is an "ad" in the Birmingham Daily Post of February 14th: "Electrician wanted, beginning of March. Must be used to oil engine, repairs, pumps, etc., and a good plain carpenter; fill in odd time indoors or out; married, no family; light employment for wife; comfortable home. Salary £40 a year to start with. H. C. Potts, Llanyre Hall, Llandrindod Wells."

By the terms of an agreement which has been entered into between the Water Commission of the city of Pendleton, Ore., and the Northwestern Gas and Electric Company, the city pumping plant is henceforth to be operated by electricity. The contract proposed is for 10 years, and for pumping the water the electric company will be paid $4,000 the first year and $3,500 annually for each succeeding year. The Water Commission must still employ its own men to care for and operate the pumping station, though the company guarantees to keep the plant in repair and retains the ownership of the motor and pump.

A flywheel on one of the big engines in the southwestern power house of the Chester (Pa.) Traction Company, located at Penrose Ferry bridge, broke a few days ago, and one of the pieces, weighing 300 pounds, was driven through an 18-inch stone wall, traveled a distance of 1,000 feet and landed on a coal barge in the Schuylkill River, nearly wrecking the boat. The flywheel in its flight tore the entire roof off the building, knocked one side of the building to the ground and almost completely demolished the opposite side. The dynamo was [illegible] was badly damaged, but the [illegible] stood in the midst of the wreckage [illegible] Alexander Milroy of Philadelphia, [illegible] who was in charge of the power house at the time of the accident, is said to [illegible] result of the [illegible] loss, it is said, is about $25,000. Superintendent C. V. Mills has arranged to get power from other sources until repairs can be made.

Suit has been brought under the Sherman anti-trust law by the direction of Attorney-general Moody against 27 elevator manufacturing companies included in what is known as the Otis elevator combine. The operations specifically complained of have been carried on west of the Rocky Mountains, where, it is alleged, an illegal combination and agreement exist to control the trade and commerce in elevators. There are said to be only three elevator companies not in the combination carrying on business west of the Rockies. An attorney for the company said that even if the company can be styled a monopoly, it is because of the control of the business through patents.

TRADE NEWS

The time of opening proposals for conduit and electric wiring system for the postoffice and United States courthouse at Ogden, Utah, is extended from March 14 to March 27, 1906.

The National Office Appliances Show at the Coliseum in Chicago will open on March 17th. Among the exhibitors are the Stromberg-Carlson Telephone Manufacturing Company and the Electric Appliance Company.

The Robb-Mumford Boiler Company announces that it has moved from its old shop at Cambridge, Mass., to its new shop at South Framingham, Mass., and asks its customers to note the change of address. The new shop is equipped in the most up-to-date manner and the company is in a much better position than before to give quick delivery and favorable prices on all lines of boiler work.

The Westinghouse Machine Company of Pittsburg, Pa., states that on March 9th it filed a second bill of complaint against the Allis-Chalmers Company of Milwaukee, Wis., in the United States Circuit Court for the District of New Jersey, in which the latter concern is charged with the infringement of a certain patent relating to the manufacture of the Parsons steam turbine. The present suit alleges infringement of patent No. [illegible]

[illegible]

BUSINESS

The [illegible] Company, of Milwaukee, Wis., [illegible] Edison Illuminating Company of Detroit, Mich., [illegible]

In rebuilding the [illegible] Company, Mansfield, Ohio, [illegible] destroyed by fire last year, the order for roofing was placed with the H. W. Johns-Manville Company of New York [illegible] The roofing to be used is the well-known J-M asbestos roofing. The [illegible] order, which amounted to [illegible] squares, [illegible] competition with all the roofing [illegible] and it was placed with the H. W. Johns-Manville Company only after a thorough investigation.

The Oswego (N. Y.) Boiler and Engine Company now [illegible] tank and plate line. This plant, formerly known as the Oswego Boiler Works, is one of the largest and best-equipped plants in the East. The management is under the charge of Mr. I. L. [illegible] M. E., recently mechanical engineer of the Lehigh Valley Railroad, who has had a wide experience in engineering and steel construction. The boiler shop will be in charge of Mr. C. W. Crozier, a first-class shop man, with large experience in all classes of boiler and plate work.

The George A. Fuller Company, contractor for the building of the New Plaza Hotel, New York city, has recently let contracts for the engines to be installed in the building power plant. Four Allis-Chalmers heavy-duty cross-compound Corliss engines will be installed, two 18 by 42 inches and the others 22 by 42 and 25 by 47 inches, respectively. The Carnegie Steel Company has also recently purchased two Reynolds heavy-duty cross-compound rolling-mill engines, 50 and 78 by 60 inches, for the Homestead Steel Works, Munhall, Pa., to be furnished by the Allis-Chalmers Company of Milwaukee.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 6, 1906.

814,012. Automatic Railway Safety Gate. Henry E. Bartlett, Chicago, Ill. Application filed April 4, 1905.

The gate is operated by fluid pressure, the valve admitting the fluid to the system being operated electrically.

814,021. Railway Traffic-controlling Apparatus. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company. Application filed April 13, 1905.

An electrically controlled valve mechanism is adapted to arrest or permit the flow of the actuating fluid to the system.

814,050. Electrical Smelting Process. Woolsey M. Johnson, Iola, Kan. Application filed May 24, 1904.

An electrical smelting process consists in interposing between a low-resistance charge containing low-grade ore and a furnace wall, a high-resistance charge containing high-grade ore, thereby protecting the wall from the action of the low-grade ore, and transmitting an electric current through the charge.

814,064. Storage Battery. Francois Mouterde, Lyon, France. Application filed July 24, 1905.

A storage battery comprising a lead vessel having columns integral with its bottom is provided with flanges and a number of open-ended electrodes supported by the flanges, other electrodes disposed in the vessel and a spider supporting the electrodes and terminating in a central pole. The electrodes and the vessel are provided with Y-shaped projections adapted to receive lead fibers deposited therein.

814,065. Portable Electric Lamp. Joseph L. Mulry, Pawtucket, R. I., assignor of one-half to William K. Toole, Pawtucket, R. I. Application filed April 4, 1905.

A base and upright standard supports the lamp. There is a handle on the standard by which the lamp may be carried. A rotatable spring-actuated reel or drum is provided on which the surplus conductor wire is wound, the drum being arranged to rotate about the axis of the standard. Means are supported from the standard for automatically gripping or binding the wire to control the amount to be wound on the drum.

814,083. Generator of Intermittent Electric Currents. Malcolm P. Ryder, White Plains, N. Y. Application filed August 12, 1904.

A generating coil or conductor is associated with a reciprocatory armature, means being provided for reciprocating it to and from position where it will close the magnetic circuit of a magnetic flux in whose field the coil or conductor lies. Means simultaneously open or close a magnetic shunt for the source of magnetic flux external to the coil or conductor.

814,118. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 15, 1903.

A line signal-controlling magnet has its actuating winding included in one of the line conductors and a connection terminal having a line contact connected permanently with the line conductor. A plug is adapted to be inserted in the connection terminal and has a contact co-operating with the contact of the terminal that is connected with the line conductor, and a source of current included between the line conductor and the plug contact, whereby upon the insertion of the plug a path for current is completed through the line-signaling magnet and its working condition thereby determined.

814,123. Automatic Fire Alarm. Napoleon H. Ferland, Manchester, N. H., assignor of one-third to Joseph A. Choquette, Manchester, N. H. Application filed June 3, 1905.

A strip of inflammable material upon burning releases a metallic arm, which closes an electric circuit, operating the fire alarm.

814,146. Panel Board. Ernest R. Le Manquais, New York, N. Y. Application filed June 9, 1904.

The panel board comprises a number of sections, independent bus-bar sections mounted respectively on the panel-board sections and lying contiguous when the sections are assembled, and bridge pieces extended between and attached to the contiguous ends of the bus-bar sections to effect mechanical connections between the panel-board sections and electrical connections between the bus-bar sections.

814,162. Electric Incandescent Lamp. William J. Phelps, Detroit, Mich. Application filed December 22, 1902.

An electric incandescent lamp consists of a single vacuum bulb, a stem projecting within the bulb and having a flattened end and two incandescent filaments, the ends of which are attached to the stem in substantially the same plane. The filaments comprise leg portions which diverge from the stem and central portions arranged one above the other and at an angle to each other in different planes.

814,217. Conduit or Casing for Electrical Conductors. Richard H. W. Knight and Ludwig Nagel, London, England. Application filed March 1, 1904.

A tube consisting of two parts of elastic material of channel form of more than semicircular cross-section, one part fitting in the other, comprises the conduit.

814,219. Automatic Telephonic Installation. Bernhard Kugelmann, Bad Küssingen, Germany. Application filed September 15, 1903.

Several switch apparatuses include one common speaking way and a series of relay devices. One of the devices in each series is attached to each subscriber's line for control by the subscriber, each relay device being adapted to join the corresponding line of the subscriber to the common speaking way. Each apparatus, when occupied, brings the next un-occupied switch apparatus into the sphere of control of the subscriber.

814,259. Reciprocating Electric Machine. Truman H. Aldrich, Birmingham, Ala. Application filed April 5, 1905.

Combined with a field having outer and inner pole pieces of opposite polarity disposed parallel to each other is an armature reciprocable longitudinally in the space between the pole pieces and comprising a body of magnetic material and a coil of conductor distinct from but associated with the body.

814,276. Attachment for Telephone Toll Boxes. Rogers M. Combs, Chicago, Ill. Application filed December 12, 1904.

In combination with a telephone toll box are a chute communicating at one end with the coin slot, a vertically disposed tube for coins and a revoluble ejector adapted to engage the lowermost coin and feed it into the chute.

814,277. Switch Key. Edward B. Craft, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed December 7, 1904.

Switch springs and insulating strips are mounted upon the two arms of a U-shaped metal strap. A plunger operating the springs is mounted to reciprocate in bearings formed in the upper frame plate and the base of the strap.

814,302. Electrical Signal System. Fred Lacroix, San Antonio, Texas, assignor of one-half to Otto Koehler, San Antonio, Texas. Application filed August 29, 1904. Renewed July 31, 1905.

In an electrical signal system are a railway track, a source of electricity, a circuit connected with the source and extending along the track, bridging coils interposed at intervals in the circuit to divide it into blocks of different electrical resistances, means movable along the track and operating to close the circuit through the blocks and resistance indicating mechanism energized by a current passing through the circuit. (See cut on next page.)

814,305. Boiler Feeder. Frederick Leadbeater, Detroit, Mich. Application filed April 24, 1905.

The electrical feature of the device is an alarm circuit indicating the condition within the boiler.

814,322. Reversing Switch for Electrical Circuits. Thomas S. Perkins, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 6, 1904.

Combined with two sets of stationary contact terminals, each of which comprises two pairs, are a longitudinally movable block having two sets of contact

strips that engage the corresponding stationary contact terminals to connect them in different relations and means for actuating the block.

814,323. System of Remote Control for Electric Motors. Thomas S. Perkins and Ray P. Jackson, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 6, 1904.

Combined with electric motors and unit switches in the circuits thereof are controllers for the unit switches and means for automatically actuating the switch controllers comprising an actuating magnet, a retaining magnet, time-controller magnets for alternately opening and closing the circuit of the actuating magnet winding, and a switch operated by the actuating magnet for alternately opening and closing the circuits of the time-controller magnet windings.

814,324. Controller Switch. Thomas S. Perkins and Ray P. Jackson, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 6, 1904.

A controller switch comprises a shaft, drum segments mounted thereon, pole pieces carried by the shaft, a blow-out coil and stationary pole pieces that co-operate with the shaft and its pole pieces to provide a magnetic circuit for the coil.

814,325. Controller Operating Means. Thomas S. Perkins and Ray P. Jackson, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 6, 1904.

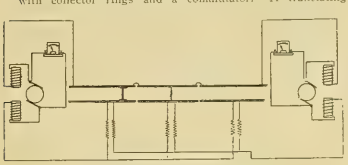
Associated with a drum are a magnet for imparting rotative impulses thereto and two other magnets which are alternately energized through the operation of the first-named magnet and which thereby alternately make and break the circuit through the winding of the first named magnet.

814,364. Lamp Regulator. Alphonsus L. Drum, Lake Forest, Ill. Application filed March 28, 1905.

In a regulator for electric lamps on street cars are a circuit comprising current-utilizing devices, a lamp circuit, a shunt circuit, a rheostat in the clamp circuit, a second lamp circuit and means located in the shunt circuit for maintaining a constant current in either lamp circuit during the opening and closing of the circuit comprising the current-utilizing devices. (See cut.)

814,380. System for Variable-speed Operation of Alternating-current Motors. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 8, 1904.

A machine for changing the frequency of current alternations comprises a rotary converter having no magnetizing field coils and an armature, which is provided with collector rings and a commutator. A translating



NO. 814,302.—ELECTRIC SIGNAL SYSTEM.

device is supplied from the commutator of the machine, and there are also means for varying the voltage supplied to the collector rings of the machine and means for varying the speed of rotation of the armature of the frequency-changing machine.

814,386. Telephone Exchange. William M. Marean, Belvidere, Ill. Application filed June 6, 1904.

In a telephone exchange a numbering machine is described, comprising character-bearing movable members located at the central exchange. Independent electro-responsive devices and circuits actuate the members respectively, a main signal switch connecting the main signal circuit with any one of the first circuits. Other features are a switch circuit, means for closing the switch circuit, means acting simultaneously with the means for sending a various number of impulses over the signal circuit and means under the control of the subscriber for varying the number of the impulses at will.

814,411. Telephonic Relay. John Trowbridge, Cambridge, Mass. Application filed July 14, 1905.

In a telephone relay are a receiver, its diaphragm, a vibrator opposed to the receiver diaphragm, an air layer between the vibrator and diaphragm, in free communication with the circumambient atmosphere, a transmitter in connection with the vibrator and continuous solid sound-transmitting connections between the vibrator and the diaphragm.

814,417. Dynamo-electric Machine. William L. Waters, Milwaukee, Wis. Application filed June 3, 1904.

In a single-phase alternating-current motor are a field frame having salient poles, energizing windings for the poles, an armature associated with the field frame, a commutated winding on the armature, a commutator for the winding, brushes engaging the commutator, a circuit including the brushes and a ring of magnetic material at each side of the field frame, the rings engaging the sides of the poles near the faces and encircling the armature.

814,461. Electric Door-releasing Device. Libermond A. Léon, Montreal, Canada. Application filed May 8, 1905.

A locking bar of the mechanism is adapted to rest normally in contact with a hammer, while an electrically operated means rocks the locking bar from engagement with the hammer.

814,478. Telephone or Telegraph System. Georg Ritter, Stuttgart, Germany. Application filed June 16, 1904.

Combined with a main-line circuit and a number of sub-station instruments connected to the main-line circuit are a controlling device at each sub-station operating directly to render its sub-station instrument inoperative, an electric circuit including the controlling devices, mechanism at each sub-station arranged to regulate the admission of electric current to the circuit connecting the electric devices, and to render its own disconnecting device inoperative, and means at each substation arranged to prevent the operation of its own controlling device.

814,482. Lightning Arrester. Frank K. Singer, Wheeling, W. Va. Application filed April 17, 1905.

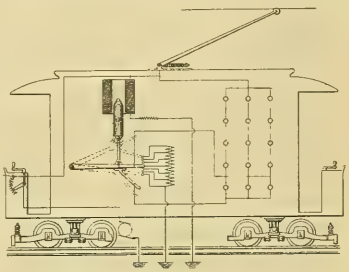
A lightning arrester comprises an insulating tube, a choke coil on the outer side of the tube, a fuse within the tube, terminals with which the coil and fuse are electrically connected and a spark gap and ground plate independent of the fuse and choke coil. (See cut.)

814,498. Car-handling Apparatus. Frank E. Woodford, Chicago, Ill., assignor to the Hauser Company, Chicago, Ill. Application filed May 2, 1905.

Combined with a motor-driven car having electrical brake are a distant switch controlling station and independent feed conductors therefrom to the motor and brake. A single switch is adapted to alternately energize the motor and brake conductors and means are attached to them to vary the current in each of the conductors.

814,501. Relay. James Allen, United States Army. Application filed July 31, 1905.

A coil is mounted for deflective movement between the poles of a magnet, a contact tongue being mounted for movement by the coil. Contact stops for the tongue, an armature mounted for movement by the coil but independent of its magnetization, and a pair of auxiliary adjustable pole pieces, between which the armature is arranged to oscillate, complete the apparatus.



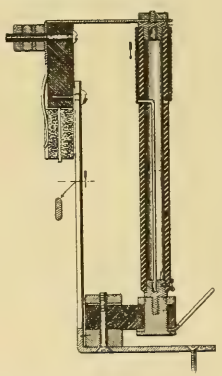
NO. 814,364.—LAMP REGULATOR FOR ELECTRIC CARS.

814,503. Receptacle. Momme Andresen, Otto Magerstedt and Gerhard Ollendorf, Berlin, Germany, assignors to Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany. Application filed July 11, 1905.

Details are described.

814,535. Electric Signal Apparatus. Lawrence Griffith, Yonkers, N. Y. Application filed October 28, 1904.

An electric signal apparatus for railways includes an electric indicator and an electric motor or unit for moving the signal and electric means separate from the indicator for preventing the action of the indicator while there is electric energy supplied to the motor.



NO. 814,482.—LIGHTNING ARRESTER.

814,537. Safety Device for Railway Switch and Signal Apparatus. Lawrence Griffith, Yonkers, N. Y. Application filed September 20, 1905.

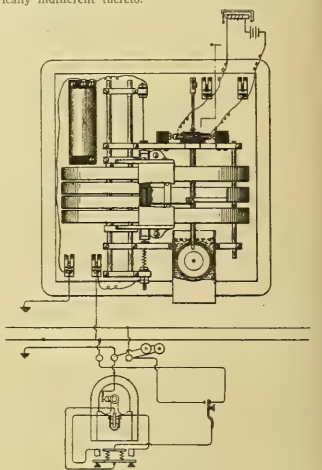
Apparatus for operating switches, signals and the like comprises an electric indicator and an electrically operated motion plate or device to be moved. Means prevent the action of the indicator, while there is electric energy supplied to the operative means of the motion plate, which consists of a mechanical lock for the indicator, operated by electric means separate from the indicator.

814,571. Telephone System. Elmer A. Terpening, Geneseo, Ill. Application filed September 6, 1904.

A party line circuit connects several subscribers' stations connecting with a central station. At each subscriber's station are means for producing alternating and direct current in the lines, and a signaling device is responsive to alternating current only. At the central station a relay comprises a coil supported for oscillation in a magnetic field, and means for retarding the oscillation of the coil. (See cut.)

814,632. Support for Osmium Filaments. Carl A. von Welsbach, Vienna, Austria-Hungary. Application filed May 31, 1901. Renewed July 31, 1905.

An osmium filament is provided with a support composed of a sintered or fritted mixture of refractory oxids, non-adherent to incandescent osmium and chemically indifferent thereto.



NO. 814,571.—TELEPHONE SYSTEM.

814,643. Plural-speed Electrical Controller. George N. Eastman, Chicago, Ill., assignor to the Minerallac Company, Chicago, Ill. Application filed May 5, 1904.

Combined with an overload-current relay provided with a pair of circuit-closing devices are a controlling device included in a circuit including contacts adapted to co-operate with one of the circuit-closing devices, a mechanical device requiring a time interval for its operation and an electromagnetic device controlling the mechanical device and included in a second circuit, which includes contacts arranged to co-operate with the other circuit-closing device of the overload relay. Means are supplied whereby the operation of the mechanical device causes the closure of the first-mentioned circuit, including the controlling device.

814,658. Safety Device for Railway Switch and Signal Apparatus. Lawrence Griffith, Yonkers, N. Y. Application filed November 5, 1904.

Apparatus for operating switches includes an electric indicator and an electrically controlled pneumatic motor for the motion plate or device to be moved, and means for preventing the action of the indicator while there is air under pressure supplied to the pneumatic motor of the motion plate.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on March 12, 1906:

399,236. Electric Railway. J. B. Blair, Chicago, Ill.
399,274. Secondary-battery Electrode. A. V. Meserole, New York, N. Y.
399,291. Hydraulic Press for Covering Electrical Conductors with Soft Metal. W. Siemens, Berlin, Germany.
399,292. Electrical Measuring and Controlling Apparatus. W. Siemens, Berlin, Germany.
399,314. Telegraph System. W. Burnley, North East, Pa.
399,320. Dynamo Machine. G. L. Dy Laney, New York, N. Y.
399,326. Coupling for Electric Circuits. A. C. Griggs, Wilmington, Del.
399,328. Dynamo Armature. J. A. Hayes, San Francisco, Cal.
399,329. Commutator for Dynamo-electric Machines and Electric Motors. B. Heywood, New York, N. Y.
399,331. Electric Railway Switch and Alarm. W. S. Hull, Sheffield, Ala., and J. C. Anderson, Charleston, N. C.
399,336. Electric Meter. E. F. H. H. Lauckert, Charlton, County of Kent, England.
399,341. Electrical Appliance for Stopping and Starting Elevators. R. F. McFeely and H. V. Potter, Pittsburg, Pa.
399,372. Electric-railway System. C. S. Bradley, Yonkers, N. Y.
399,377. Electric Circuit. J. J. Carty, New York, N. Y.
399,390. Electric Circuit Protector. W. B. Harvey, Memphis, Tenn.
399,401. Prevention of Sparking in Dynamo-electric Machines and Electric Motors. D. Higham, Philadelphia, Pa.
399,402. Prevention of Sparking in Electric Generators and Motors. D. Higham, Philadelphia, Pa.
399,403. Dynamo-electric Machine. D. Higham, Philadelphia, Pa.
399,404. Dynamo-electric Machine. D. Higham, Philadelphia, Pa.
399,409. Conductor for Electric Railways. R. M. Hunter, Philadelphia, Pa.
399,416. Electric Gas Lighter. E. Kronenberg, Philadelphia, Pa.
399,497. Combined Gas and Electric-light Fixture. J. C. Cassidy, East Orange, N. J.
399,507. Switch for Electric Motors. A. H. Eddy, Hartford, Conn.
399,514. System of Electrical Distribution and Conversion. T. H. Hicks, Detroit, Mich.
399,535. Secondary Battery. J. L. Huber. Hamburg, Germany.
399,550. Electric Switch. H. T. Paiste, West Chester, Pa.
399,556. Electric Railway Signal. T. A. B. Putnam, New York, N. Y.
399,569. Regulator for Electrical Machinery. G. H. Condict, Philadelphia, Pa.
399,639. System of Electrical Distribution. G. Westinghouse, Jr., Pittsburg, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Electric Railroading under Difficulties.

By Dr. Alfred Gradenwitz.

The electric railway connecting the city of Chieti, Italy, and a nearby steam-railroad station is one of the most recent and most interesting Italian electric-railway plants. The Chieti station of the Rome-Castellammare-Adriatic railway is situated at a level about 300 meters lower than the city of the same name, which latter is built on the top

Fig. 1. View of Line Entering Chieti, Italy.
Fig. 2. Station in Lower Chieti.
Fig. 3. Turnout at Tricalle Station.
Fig. 4. Overhead Work on Steep Curve of Chieti Line.

ELECTRIC RAILROADING UNDER DIFFICULTIES.

of a hill whose slopes are 800 meters distant from the station. Under these conditions the use of electrical traction for the transport of goods and passengers, while being desirable on account of the greater speed and higher efficiency, encountered very serious difficulties owing to the high grades and considerable curves obtaining on the line, thus necessitating a special investigation both of the electrical equipment and rolling stock intended for the railway.

Italian engineering circles find this system of special importance from the fact that this is the first electric-railway plant exclusively installed with co-operation of Italian firms. Messrs. G. Terrei Mincani di Chieti have undertaken the construction and management of the railway. While reserving for themselves the construction of the roadbed and masonry structures, they entrusted the design and construction of the whole electrical plant to the Società Nazionale delle Officine di Savigliano. Messrs. Langen & Wolf of Milan were finally given the order for the gas engines to be installed in the power station. The line, 8.7 kilometers in length, runs nearly throughout on a special roadbed, with numerous curves and changing with an average speed of 20 kilometers an hour are run, had accordingly to be adapted to the mountain-railway type.

The gauge of one meter was adopted, steel rails of the Vignole type of the weight of 21 kilograms a running meter being used, which were placed on hardwood sleepers, with anchorage plates and hooks covered with ballast up to the level of the rail base. The electrical joints between the various sections of the rails are effected by means of copper wire connections having iron plugs. Counter-rails were used in the curves, the outer rail being placed on a higher level and the track being broadened. On the section traversing the city, ordinary Phœnix rails are used. The curved sections of the rails are, for safety's sake, bent in the cold state with special machines.

Four stations are included in the line, viz., the two terminal and two intermediate stations intended for the local traffic.

The station of Lower Chieti, being situated close to the state railway station, is provided with a turntable for the transfer of goods to the ordinary railway cars.

The station of Tricalle, lying close to the electrical different materials, and the dwelling rooms and offices of the chief officials.

Figs. 1, 2, 3 and 4 are some interesting views of the line and its equipment.

Central Station.

The central power station generating the electrical energy required for feeding the motor cars has been installed in the neighborhood of Tricalle Station at about the middle of the line in an advantageous position for the distribution of current. Fig. 6 is a plan of the station.

Possibility of distributing three-phase current and using this for feeding the motor cars was deemed quite out of the question, owing to the complicated construction of a double-wire aerial line with special insulation as well as to the tortuous profile of the railway, which makes it impossible to use constant-speed motors, and the speed having to be varied in the urban and suburban sections, respectively. The advantage of supplying the trolley with high-tension current was on the other hand of no importance on account of the shortness of the line.

Though the Società Nazionale delle Officine of Savigliano has made a special point of the construc-

tion of compensated single-phase motors, the use of this system was not thought advisable on so short a line, a medium tension as best suited to the special conditions of the line being most easily obtained by the use of continuous current supplemented by batteries.

While two generating sets of 150-170 horsepower each (of which one was to serve as a reserve) were provided for in the first design of a plant, the construction firm found it convenient in course of construction to purchase electrical energy derived from a high-tension three-phase line belonging to the Pescara plant, adding to the generating sets just referred to a motor-generator set of a

FIG. 5. SKETCH MAP SHOWING TORTUOUS ELECTRIC LINE FROM CHIETI, ITALY, TO RAILROAD STATION.

capacity of 170 horsepower intended to convert the alternating current into continuous current at 750 volts, and having as reserve one of the above self-contained generating sets, while the other set was arranged for generating three-phase alternating current for the illumination of Chieti city.

The power station of Tricalle accordingly comprises two different plants, one being intended for the railway service and including a converter set, accumulator and reserve generator, while the other plant serving for the illumination of the city of Chieti consists of a self-contained electrical generator. The converter is installed in a transformer station, where it receives the three-phase current at 13,500 volts and 45 periods. The three-phase transformer of 160 kilovolt amperes capacity is, according to modern practice, made up of three single-phase transformers, on account of the special advantages as to the economy and safety thus insured. The transformers are of the normal-ventilation type, with vertical cores and concentric windings.

The transformers are connected to the distribution switchboard of the motor-generator set by means of a conductor carrying the secondary current at 500 volts.

The motor-generator set comprises standard series machines of the Società Nazionale delle Officine di Savigliano. The three-phase motor has an entirely laminated magnetic circuit with stationary inductor and rotating armature, rod windings with contact rings, devices for short-circuiting and lifting the brushes with single control to avoid any mistake in handling.

Tudor repulsion cells are used for the battery, there being 375, all having 110 ampere-hours capacity, with a normal discharging current of 90 amperes and a maximum instantaneous value of 180 amperes. This battery is intended to deal with the surplus load during the starting of the trains and on the steepest inclines, while being able to insure the regular service of the motor cars during the time required to start the gas-engine plant. The battery, owing to the high-working tension, had to be insulated with especial care, to effect which the lead plates are arranged in glass vessels mounted on a triple series of glass and porcelain insulators. Each of the generators working in the power station is able to charge the battery by the aid of a buffer dynamo, the charge being driven up to 1,000 volts. The buffer battery made up of series machines of the standard type, consists of a 750-volt continuous-current motor and of a generator of variable tension.

Two generator sets above mentioned, which worked in the first stage of the plant when the converter set receiving the energy from the Pescara plant was being installed, at present serve as a reserve. They each consist of a gas engine and a belt-driven generator of an output of about 170 horsepower. Gas engines, apart from their technical and economical advantages, were adopted mainly on account of the lack of water.

Service, which is carried out with only two trains (one rising and one descending), submits the generators to sudden variations in load, passing from zero to exceedingly high maximum during the starting. The gas engines had accordingly to be especially regulated in order to maintain their speed constant under variable loads, and the suction type was therefore adopted. This system, in which the production of gas is independent of the load of the motor, places at the disposal of the service a good reserve of gas capable of eliminating any excessive variations in speed in the case of momentary variations in the load.

The gas engines are of the Otto horizontal two-cylinder type, with regulator valves and flywheel 3.4 meters in diameter. The degree of regulation is 1 : 150. The speed of rotation is 180 revolutions per minute. An ample reserve has further been provided for in the gas generators.

For the controlling of the ventilators of the water-circulating pump and the motor-starting compressor there are used two electric motors of 12 horsepower each, one of which serves as a reserve to the other. The dynamos coupled to these motors are of the same type as those of the converter sets, but for the fact that the considerable peripheral speed of the flywheels and high power to be transmitted requires a third support to the foundation between which the flywheel is inserted.

The distribution and regulation switchboard of the power station is mounted on white marble plates supported by metal frames and is divided into four panels. The two central panels are reserved for the generators while the two lateral ones contain the regulation and measuring instruments of the buffer dynamo and accumulator battery and the other the ampere meters and interrupters of the feeders. In view of the high tension of the direct current produced special care was bestowed upon all the particulars of this switchboard. All the interrupters and accumulators have their contacts on the back of the board and are provided with arc-breaking devices and with insulated sleeves for handling on the front panel of the switchboard. The automatic current-reversing interrupters intended to protect the dynamo against any discharges of the battery, and the automatic maximum-current interrupters, are provided with especial signaling devices indicating the position of their contacts, which are likewise placed on the back of the switchboard. A registering ammeter records the daily variations in load.

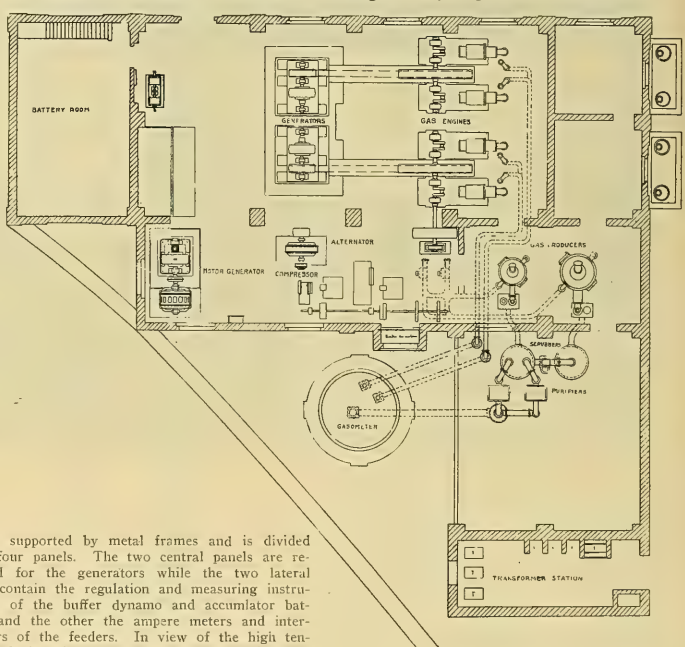

FIG. 6. PLAN OF CENTRAL STATION FOR CHIETI ELECTRIC RAILWAY.

Feeders and Aerial Line.

Electrical current destined to feed the trolley line is carried by three feeders connected to the latter at 11 conveniently chosen points. Two of the feeders are connected to the line in the neighborhood of the terminal station and use the poles supporting the trolley line wherever they run along the railway track, while being otherwise carried by special poles. The rails connected to the distribution switchboard by means of insulated cables (which is protected with a lead sleeve) serve as current return. On account of the numerous curves and considerable gradients of the track bow trolleys were found to be the most suitable means of collecting the current, allowing the number of supports forming a polygon on curved tracks to be reduced and diminishing the risk of derailment. The insulators of the supports could be placed at distances of as much as 60 centimeters from the central line of the track, the sliding portions of the aluminum trolley bows being 1.3 meters in length.

Trolley wire is of electrolytic copper 9.9 millimeter in diameter and is supported at the height of 5.5 meters above the level of the rails. The suspension from the poles and from the walls of the houses situated on the track is effected by means of steel ropes, including a double series of insulators. On the rectilinear portions of the track the distance between the supports is about 75 meters while being variable in curves.

Poles installed alongside the track are of wood with steel-tube arms. The line is divided into 7 sections (see Fig. 5), the terminal points of which correspond to the feeding points and which sections may be rendered independent and self-contained by means of section interrupters which are installed in boxes fixed to the poles. The feeders themselves are provided with interrupters.

The maximum drop in tension observed on the contact wire during the running of two trains (one ascending and the other descending) amounts to eight per cent., and the mean fall for the entire length to six per cent. The rails give rise to minimum drops in tension so as to render any resulting electrolytic phenomena immaterial. The joints between the rails were provided with connections consisting of hardened copper wire kept in position by riveting to the rail. At each 100 meters length of the rails there are provided transverse connections to insure a junction as satisfactory as possible between the two rails.

Rolling Stock.

Rolling stock comprises both motor cars and trailers for passenger service and motor cars and trailers for the conveyance of goods. In normal working order each train is made up of a motor car and a trailer. The general conditions taken as a basis in the design of the motor cars, and which caused serious difficulties, were the high adhering weight necessary, the adhesion having to

be so great as to have the empty motor car at each point of the track to be able to draw a loaded trailer, while the gauge of one meter had to be maintained and the distance between the axles of each car had to be reduced to a minimum.

Motor cars comprise two compartments of the first and second class, respectively, and a central compartment used as luggage van. The motor cars are made up of a truck of laminated iron with two axles and two motors. The motors are placed between the axles so as to increase the stability and to improve the equilibrium of the car.

The 750 volt continuous-current motors (see Fig. 7) of 30-horse-power normal output work at a speed of 1,000 revolutions per minute. They are of the hermetically enclosed traction type with four-pole inductor, steel magnetic circuit and laminated pole pieces. The inductor coils are care-

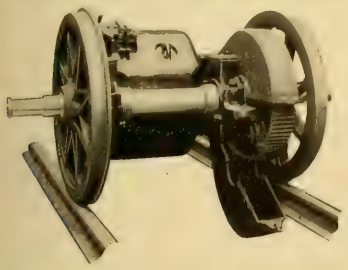

FIG. 7. NARROW-GAUGE TRUCK AND MOTOR OF CHIETI EQUIPMENT.

fully insulated in each of the elements as well as in their whole by means of cotton layers impregnated with special insulating varnishes. The insulation of the mass is effected by means of several layers of presspan and linen.

The armature is of the traction collector type, with many laminæ and several elements united in each armature slot. The collector has been carefully designed as to its insulation and commutation, the brush-holders (with carbon brushes) being susceptible of inspection from above, while each of the brushes is insulated and the windings protected against sparking by pieces of insulating material. The lubrication of the bearings is automatic, a box with melting fat being provided to serve as a reserve in case of heating due to any insufficient oiling.

The motor frames are divided in a horizontal plane to allow of inspection and repair work. The suspension of the motor is effected by double springs, the motor axles being controlled by means of a convenient gear, enclosed in a lubrication casing. In the course of tests made of these motors, the maximum temperature, after two hours of working at full load and normal speed and tension, was found not to exceed by more than 50° C. the surrounding temperature, while the commutation at variable loads and speeds and in both directions of traveling was found to be excellent. The motors may be connected both in series and in parallel to the controllers installed on the platform and which also affect the insertion of the starting and stopping resistances as well as the handling of the short-circuit brakes and of the Westinghouse electromagnetic brake. The crank of the controller may take four different positions to regulate the speed of the motors, both in the series and parallel arrangement. The controllers are provided with spring contacts, a magnetic blowout and convenient block arrangements, to avoid any mistake in control. The resistances arranged beneath the car body, are made up of insulated iron laminæ that are compressed against each other.

Both hand and electromagnetic brakes are arranged on the car, the former being actuated by means of chain and hand wheel, while the Westinghouse electromagnetic brake is worked by the short-circuit current of the motor, acting on another system of jaws arranged inside the car, while the jaws cling to the rails.

Each of the motor cars is provided with a wooden fender, two pedal-operated sanders, two alarm bells, one electrical bell outfit and other auxiliary devices. Both the motor cars and trailers are lighted by electricity by means of two sets of five incandescent lamps. A high-intensity lantern and the signaling lamps are installed on the roof of the motor cars. A flexible cable serves to connect the motor car to the trailer. The latter is of a much lighter construction and contains a single second-class compartment with longitudinal

[illegible] cost. The luggage and [illegible] in their [illegible] are [illegible] passenger car [illegible] are of the open-seat type [illegible] was [illegible] including a [illegible] also include [illegible] well as a [illegible] car.

The railway plant [illegible] full operation for a [illegible] satisfaction.

Mine Operation from Central Power Stations.

In a number of mining districts in Europe and also in the United States, central power stations have been installed in which electric current is generated and supplied by overhead power transmission lines to various shafts of mines for operating electric mining machinery. Heavy, lead-covered cables are provided in the various shafts and throughout the mine, supplying current to electrically driven hoists, electrically operated pumps and electric ventilating machinery, as well as excavating apparatus in the way of electric drills and electric coal cutters.

While direct-current machinery has been largely used in these mining generating stations, since the advent of the three-phase alternating system this class of apparatus has been more extensively employed, particularly in German and other continental mines.

While mining central power stations are mostly operated by steam engines of the reciprocating type, recently, owing to the great development of the high-power gas engine and the steam turbine, these forms of motive power are now being utilized in mining power plants to a considerable extent.

The accompanying illustration shows a new steam-turbine mining power plant recently installed at the Zeche Neuessen mine in Germany by the Siemens & Halske Company. The picture shows a high-speed steam-turbine unit of 320 kilowatts capacity, the alternator being direct connected, and mounted on the same base as the steam turbine. The exciter is mounted outside of the main alternator bearing, on the extended shaft of the steam turbine and electrical generator. This turbo-generator unit supplies a current of 2,200 volts, and operates at a speed of 3,000 revolutions a minute. It is maintained that the steam turbine and electrical generator are particularly well adapted for mining central-station work, and have given excellent satisfaction in this class of service.

The current is conducted at high pressure to various sub-stations at the different mining shafts, where it is reduced in pressure and carried to various parts of the mine by lead-covered cables.

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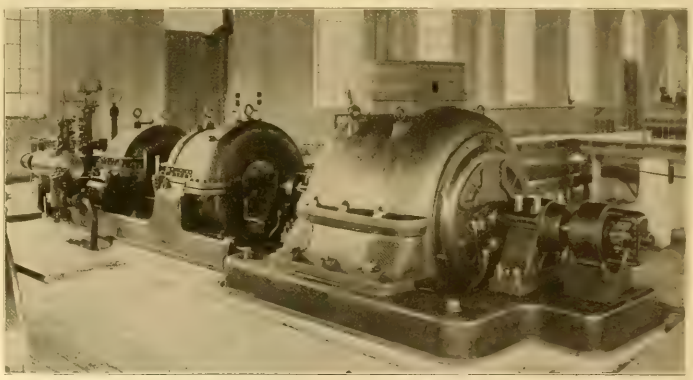


STEAM-TURBINE POWER PLANT FOR ZECHE NEUESSEN MINE.

Entertainment of Visiting Engineers in Great Britain.

Writing under date of March 7th, the London correspondent of the Western Electrician says: "A provisional programme relating to the visit of foreign institutions to Great Britain this summer has now been issued. The invitations were sent by the Institution of Electrical Engineers, and so far acceptances have been received from Canada, France, Germany, Italy, Switzerland and the United States, seven institutions altogether having expressed their intention of coming over. A large general committee and an organizing committee have

Buffalo Citizens Discuss Municipal Lighting Proposition.

[illegible] amount [illegible] [illegible] to de[illegible] [illegible] [illegible] [illegible] [illegible] nicipal light plant.

Frank M [illegible] attitude to the [illegible] $8.00 watts [illegible] cent on 70,000 [illegible] owner [illegible] W. J. [illegible] [illegible] Business Men's [illegible] contributes to every [illegible] was opposed to the [illegible] bonds and obligations.

Frank C. Perkins and [illegible] the bill. Mr. Perkins thought [illegible] erate electricity by burning [illegible] duce it with little cost of [illegible] pal electric plant would not cost [illegible] $800,000 and would soon save that much money to the city.

Attorney Martin Carey for the electric company said his company would meet the city and agree to any fair and reasonable changes. He thought it strange that if the city has been [illegible] some would make it appear that the city had never exercised its rights to complain against the company to the state commission on gas and electricity.

A Vivid Short-circuit in San Francisco.

The largest and brightest exhibition of fireworks ever seen in the West, writes a correspondent of the Western Electrician, occurred on the night of Sunday, March 4th, in the southern part of San Francisco, when two high-tension wires of the California Gas and Electric Corporation were accidentally crossed by a sagging wire driven by the wind. About five minutes elapsed before the current was cut off, and during that period the display of blue light was something unread of. The entire city was illuminated, the intense blaze of the arc being reflected from the clouds. Some of the dwellers in the Patrero District thought the Last Day had arrived when the unwonted display enlightened the usual gloom of their surroundings. The fuses of the big motor-generators at Station C were blown, and for an hour nearly all of the downtown district that suffered from the effects of the fire of February 22d was again in darkness. Several of the theaters had to resort to candles temporarily and later to gas to complete their performances. The Daily Examiner, fortunately, was able to start up its own isolated plant after a short time. No serious damage resulted at any of the lighting company's stations from the cross.

Preparations for the National Electric Light Convention.

Active preparations for the coming convention of the National Electric Light Association, to be held in Atlantic City, N. J., June 5th to 8th, are under way. The convention committee consists of the following-named gentlemen: Arthur Williams (chairman), New York; W. C. L. Eglin, Philadelphia; John Martin, San Francisco; Henry L. Doherty, Denver; L. A. Ferguson, Chicago; Alex Dow, Detroit; Samuel Scovil, Cleveland; Sydney Hosmer, Boston; Dudley Farrand, Newark, N. J.; H. T. Hartman, Philadelphia; Leon H. Scherck, Birmingham, Ala.

Under the rules of the Atlantic City Hotel Men's Association, no single hotel can be considered as the association's headquarters. This will make little difference, however, as the association has contracted for the use of Young's Pier during convention week. The secretary's headquarters for the registration of members, securing badges, and general information, will be at the front of the pier, adjacent to the entrance. The meetings will be held in the small auditorium, at about the middle of the pier. The front, with the exception of the spaces occupied by the exhibits of the associate members, can be used as a music hall and sun parlor by the ladies of the association. Arrangements have been made for a thousand rocking chairs and for morning, afternoon and evening concerts. It is expected that this, with other features, will make the convention unusually attractive.

Special prices have been obtained from 35 of the largest hotels, of which 13 are on the ocean front. The inclusive rates for one person, on the American plan, vary from $2 to $4 daily without bath, and from $3 to $6 with bath; for two persons, from $4 to $8 without bath, and from $6 to $10—in some instances slightly higher—with bath.

Master of Transportation George F. Porter is now arranging for special railroad rates from various sections of the country. It is hoped to have very large delegations even from the extreme West. If a sufficient number can be obtained, say, at San Francisco, Mr. Porter could arrange for a special car from that point to Denver or Chicago, from which it might be possible to run a special train. These matters will be the subject of a special circular. Already the Southeastern and Western Passenger associations have authorized a rate of a fare and one-third, on the certificate plan, from points in their respective territories.

A special exhibit will be made of various means of advertising employed by many of the member companies. Inaugurated at Denver last year, this feature will be continued this year on a much larger scale, and in a position which will give members an opportunity to study the exhibit at leisure and in detail.

The large room at the end of Young's Pier, adjoining the Board Walk, has been leased as an exhibition hall for associate members. There will be between 10,000 and 12,000 square feet of space available for this purpose. This auditorium will be open to the public upon the payment of 10 cents—convention members, wearing their badges, entering free—a feature, it is thought, which will add greatly to the value of the exhibition. The accompanying plan shows the relative location of the Board Walk and exhibition hall and the various exhibit spaces.

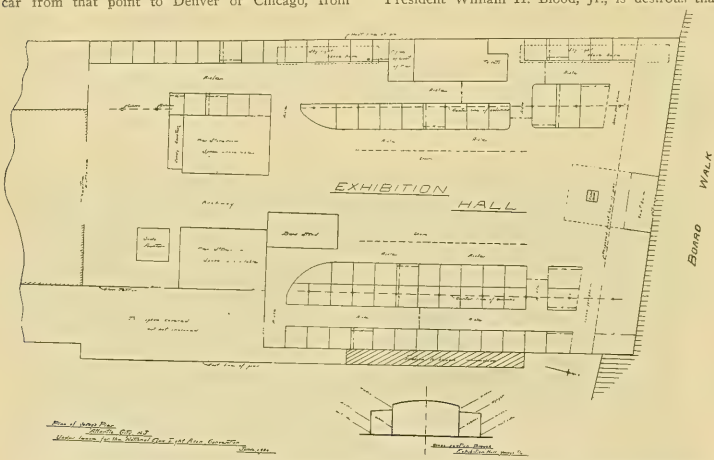
Heretofore, associate members have found it necessary to rent private rooms in the headquarters hotel, in which they have found it impossible to make an adequate display. Often these rooms were difficult of access, and could hardly be found unless each member were piloted to them. This year, in the exhibition hall, a charge not exceeding 20 cents a square foot for the entire week will be made. This price includes everything with the exception of the erection of the individual booths and any special lighting which the exhibitors may require. It is, of course, understood that the work will be done subject to the approval of the pier management. Those so desiring may make reservations with the committee at once, stating the kind of exhibition to be made, whether additional service will be required and the approximate number of square feet.

The general illumination of the pier is included within the rental arrangement. Additional current, however, will doubtless be required by the exhibiting members. Through the courtesy of Mr. H. T. Hartman, the local company will make a special convention rate of four cents a kilowatt-hour.

It is expected that the rental derived from the exhibits of associate membership will be sufficient to cover the cost of the pier. This rental, as stated, will not exceed 20 cents a square foot, as it is the desire of the committee that this exhibition shall be a success artistically, technically and commercially, rather than financially. It has been customary for the company entertaining the convention to assume all financial obligations. This has not seemed entirely fair to the executive committee, which has therefore decided to ask that the convention expenses be met by individual company subscriptions. These may be sent to W. C. L. Eglin of Philadelphia, who has kindly consented to serve as treasurer of the convention committee. All funds received for the convention will be expended only for that purpose, and subject to the action of the executive session, any surplus will be returned pro rata to the subscribers.

President William H. Blood, Jr., is desirous that this shall be a "working convention." The papers presented will be of a high order, on timely topics, written by those most eminent in their respective fields. In the exhibit of the associate members it is expected to have the tantalum incandescent lamps, the Nernst lamps, the new flaming and magnetite arc lamps and examples of the Moore vacuum and Hewitt tube lighting. Already space has been taken for electric signs, heating appliances, fan and other motors. It is expected that, in their aggregate, these will make a convention of surpassing importance from a technical, executive, managerial and operating standpoint.

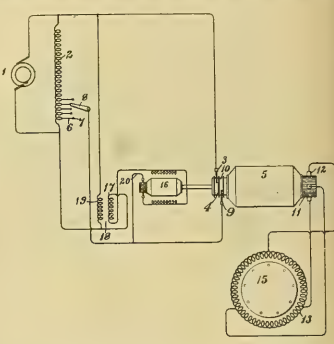
Entertainment features, however, will not be absent. Atlantic City is known for the variety of its entertainments. The programme will include the opening of the exhibition on Monday night, a large reception at the New Marlborough-Blenheim on Tuesday night, and a convention banquet will probably follow later in the week. The governor of the state, and many others prominently identified with the industry, are expected at some of these functions. The ladies will be taken to Philadelphia for a day, going and returning by special train, and lunching at the new Bellevue-Stratford. The General Electric Company is now electrifying the railroad between Philadelphia and Atlantic City. Efforts will be made to have at least part of the road in operation to show the delegates.



PLAN AND SECTION OF YOUNG'S PIER, ATLANTIC CITY, LEASED FOR NATIONAL ELECTRIC LIGHT CONVENTION.

Variable-speed Operation of Induction Motors.

The induction motor fills the requirements for variable-speed operation under certain conditions. To bring about the necessary variation the frequency and voltage may both be varied. A method of speed variation for induction motors is suggested by Mr. B. G. Lamme of Pittsburg, Pa., in a recent patent which embodies these two elements. As the best method of varying the frequency he recommends one previously patented by him (No. 682,943). This method consists in supplying alternating currents of a given frequency through brushes and collector rings to the armature winding of a rotary converter, the field magnet of which is unprovided with magnetizing coils, and driving the armature at such speed between zero and synchronism as will insure the supply of currents of the desired frequency to the commutator leads. Since the frequency-changing apparatus may be of such construction as will permit of its being operated at relatively high speeds, it need not be large or costly as compared with the motor which it is intended to control, and consequently its use permits of economical speed control of the simplest form of driving motor.



VARIABLE SPEED OPERATION OF INDUCTION MOTORS.

In ordinary operation if the voltage supplied to a motor is not varied approximately in proportion to the variations in the frequency of alternations of the current the magnetic-flux density in the stator or field magnet of the motor will rise as the frequency of alternations is decreased. This is a condition tending toward very large torques at low speeds, but represents also a condition of high wattless-current input to the motor at the lower speeds, and therefore low power factors. Such a frequency-changing device as is described in patent No. 682,943 has the characteristic of changing the frequency of alternations of the current without changing the voltage ratio—that is, with a given voltage applied at the collector-ring end of the machine the voltage delivered at the commutator end will be practically constant, and therefore independent of the frequency of alternations of the current.

According to Mr. Lamme's present invention a means for varying the voltage—such, for example, as a transformer with variable-voltage ratio, or a regulator having relatively adjustable primary and secondary members, is employed between the main supply circuit and the frequency changer or between the frequency changer and the induction motor.

As illustrated in the accompanying diagram, alternating-current energy is supplied from a suitable source to an auto-transformer (2), one terminal of which is connected to a brush (3), bearing upon a collector ring at one end of a frequency changer (5).

The auto-transformer winding is suitably subdivided by means of leads, which are respectively connected to contact terminals (7), with which a pivoted arm is adapted to engage, the arm being connected to a brush (9), which bears upon a second collector ring of the frequency changer. Bearing upon the commutator cylinder (11) at the other end of the armature of the frequency changer are three brushes, which are connected to the proper

points in the primary winding (13) of an induction motor.

The auto-transformer winding may be replaced by a two-winding transformer, one of the windings of which is suitably subdivided by means of leads in a manner similar to that here shown in connection with the auto-transformer winding, or it may be replaced by a regulator having primary and secondary windings, the inductive relations of which, with respect to each other, are adjustable. Evidently, any other suitable voltage-varying device may be employed.

If the voltage regulator is used in connection with a frequency changer, as just described, then the variations in voltage accomplished by the voltage regulator may be made to automatically vary the frequency delivered by the frequency changer. To this end is shown the frequency changer as driven by an alternating-current variable-speed motor, the speed of which varies in proportion to the voltage derived from the auto-transformer. The motor is connected in series with the secondary winding (17) of a transformer (18), the primary winding of which is connected between the terminals of the auto-transformer winding (2). One terminal of the secondary winding (17) is connected to one terminal of the primary winding (19), and the free armature terminal (20) of the motor (16) is connected to the pivoted arm (8). By means of this arrangement of connections a reduction in the voltage delivered by the regulator increases the voltage supplied to the driving motor, and a reduction in voltage supplied to the frequency changer causes its speed to increase, and thus the frequency of alternations of the current is reduced. Hence the frequency of alternations of the current delivered to the induction motor is made to vary approximately as the voltage is varied.

One of the principal advantages of the invention lies in the fact that the frequency changer may be a polyphase machine having a rotating magnetic field, and consequently its least losses and easiest conditions as regards commutation, occur at or near synchronous speed when it is delivering its lowest frequency. Such a machine can therefore carry very heavy loads when delivering currents of low frequency, as the machine has the least losses and is running at the highest speed.

As the speed of the frequency changer is decreased until it approaches zero speed, the frequency of the current delivered rises, and consequently the motor that is operated by the energy received from it approaches its highest speed and lowest torque. Therefore, as the frequency changer approaches a condition of poorest ventilation and highest losses its load is diminished, thus tending to compensate for the poorest conditions of operation.

Notes of California Power Development.

The Northern California Power Company will complete the extension of its 20,000-volt transmission line to a connection with the California Gas and Electric Corporation's power lines at Chico soon. The new 66,000-volt line will be connected to the same system. The Gas and Electric Corporation, now controlled by the new Pacific Gas and Electric Company, has contracted to take the surplus electric power of the Northern California plants in Shasta County. A recent decision against the government will permit the Mountain Copper Company to reopen its smelter and take power under its contract with the Northern California Power Company.

The Big Creek Power Company, which transmits power about 12 miles to Watsonville, Cal., from its hydro-electric plant on Big Creek, has sold its power plant and transmission lines to representatives of the Nartin-De Sabla interests. This means that the plant will be controlled by the Pacific Gas and Electric Company. The Coast Counties Power Company was recently incorporated by the same interests for the purpose of taking over the Big Creek Power Company, the Santa Cruz Electric-light and Power Company, the Co-operative Light and Power Company of Santa Cruz, and any other company which may be acquired in the counties south of San Francisco. The Monterey County Gas and Electric Company has elected a new set of directors, which may indicate that it will fall into the same hands. A lighting and electric-railway plant is operated at Monterey.

Arrangements are being made to establish two additional generators of 8,000-horsepower capacity each in Butte County by the California Gas and Electric Corporation, one being at Centerville and one at De Sabla. Several engines of 5,000 horsepower will be installed by the California Gas and Electric Corporation in the large cities to drive generators that will be installed in reserve plants and be used for emergencies.

Artistic Lighting Fixtures in Chicago Federal Building.

Viewed at night [illegible] the interior of the great [illegible] Building in Chicago [illegible] remembered. The [illegible] the [illegible] the first floor to the [illegible] the interior of the [illegible] design in [illegible] the [illegible] the [illegible] above the other to the point where [illegible]

FIG. 1. 750-POUND ELECTROLIERS AT EIGHTH FLOOR IN DOME OF FEDERAL BUILDING.

spring from the perpendicular portions of the interior. Around the dome at each landing are rows of incandescent lamps, set back in the recesses formed in the architectural design, which, seen from below, give the appearance of continuous chains of light. To enhance the beauty of the picture an elaborate color scheme in red, white and blue has been attempted and carried out with entire success.

But the crowning feature of the whole lighting scheme is the installation of two rows of massive electroliers, one at the second floor and one at the eighth floor. While a photograph will not do justice to the artistic appearance of these electroliers when the lights are burning and their harmony with the rest of the lighting can be seen, the accompanying illustrations serve to give an idea of the beauty of their outward appearance and the pleasing manner with which they fit in with the architectural features of the dome itself.

Fig. 2 shows, at the right, one of the electroliers and its sustaining bracket which hangs out from the second floor. In all there are eight of these fixtures on this level. These fixtures were put up

FIG. 2. ONE OF THE LOWER ELECTROLIERS IN DOME OF FEDERAL BUILDING.

new and tastefully executed feature in the scheme of illumination.

In Fig. 1 are seen two of the eight electroliers which encircle the dome at the eight floor, over 100 feet from the main floor. These electroliers are designed along much the same lines as those below, but are larger and heavier and have each a row of lights around the outside. They each weigh 750 pounds and cost $500 apiece. They are of cast brass, and their great weight made their installation no small task. In the interior of each globe (which is of leaded glass) are 12 eight-candlepower incandescent lamps with red globes, which, when lighted, give the large globes a rich red color which contrasts in a striking manner with the blue and white lights around the dome. The row of lamps on the outside of the electrolier is composed of eight-candlepower lamps with white frosted globes. This picture also gives a good view of the elaborate ornamentation of the interior of the dome. The circular openings, guarded by low railings, form a connection for light, air and vision between the corridors and the central portion of the building.

Exports of Coal from the United States in 1905.

Statistics compiled by the Department of Commerce and Labor show that the exports of coal and coke from the United States during the calendar year 1905 aggregated over $31,000,000 in value as against $11,00,000 in 1895, a decade earlier. Although the United States now holds first rank as a producer of coal, it holds only third place as an exporter of this commodity. The coal exported from this country goes chiefly to nearby countries, but it is beginning to find its way to other parts of the world. Of the $18,000,000 worth of bituminous coal exported last year, $11,500,000 worth went to British North America, and to that place went also nearly all of the $11,000,000 worth of anthracite coal exported. Mexico was the next largest customer.

The coal production in the principal coal-producing countries of the world was, in 1904, the date of the latest available figures, as follows: United States, 314,563,000 tons; the United Kingdom, 232,428,000 tons; Germany, 118,907,000 tons; France, 33,303,000 tons; Belgium, 23,135,000 tons; and Japan, 9,701,682 tons, the quantities in each case being long tons of 2,240 pounds each.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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CONTENTS OF THIS NUMBER.

Electric Railroading under Difficulties. By Dr. Alfred Gradenwitz. Illustrated 231, 232, 233
Mine Operation from Central Power Station. Illustrated 233
Entertainment of Visiting Engineers in Great Britain 233
Buffalo Citizens Discuss Municipal Lighting Proposition 233
A Vivid Short-circuit in San Francisco 233
Preparations for the National Electric Light Convention. Illustrated 234
Variable-speed Operation of Induction Motors. Illustrated. 234, 235
Notes of California Power Development 235
Artistic Lighting Fixtures in Chicago Federal Building. Illustrated 235
Exports of Coal from the United States in 1905 235
Editorial 236
Electric Lighting in New York State 237
Canadian Electric-railway Statistics 237
Proportion of Electrical Facilities to Population 237
Submarine Telegraphs of the World 237
Proposed Reduction of Electric-light Rates in Chicago 238
A Peculiar Lighting Controversy 238
Alternating-current Traction in Heavy Railroading (New York Railroad Club) 238, 239
A New Single-phase Motor. Illustrated 239
Gaso-electric Project for Indiana 239
Chicago Meeting of the Railway Signal Association 240
Traction Company to Give Lectures on Electric Cooking 240
Single-phase Equipment for Central Illinois Railways 240
Rates for Commercial Space-telegraph Messages 240
Book Table 241
New Star Electric Fans. Illustrated 241, 242
The Gas Engine as a Prime Mover 242
Salesmen's Meetings to Be Held in Chicago 242
Chicago Street-railway Situation 242
National Civic Federation Inspects Lighting Plants 242
Western Society of Engineers 243
Telegraph Ciphers by the Billion 243
Chicago Meeting of the Institute 243
Interurban Competition in Iowa 243
Telephone Engineering as a Profession 243
Indiana Telephone Items 243
Southeastern Telephone Developments 243, 244
Ohio Telephone Notes 244
Telephone News from the Northwest 244
Michigan Telephone Matters 244
Iowa Telephone Association 244
Illinois District Telephone Meeting 244
West Virginia Independent Telephone Association 244
New Companies 244
Chicago Telephone-rate Inquiry 244
National-Interstate Telephone Convention to Be Held in Chicago 244
Campaign for Cheap Telephones in England 244
General Telephone News 245
Special Roads for Automobiles 245

DEPARTMENTS.

Correspondence 245, 246, 247
Great Britain 245
Dominion of Canada 245
New England 245, 246
New York 246
Southeastern States 246
Ohio 246
Indiana 246, 247
Michigan 247
Northwestern States 247
Pacific Slope 247
Personal 247
Electric Lighting 247
Electric Railways 247, 248
Societies and Schools 248
Automobiles 248
Miscellaneous 248
Trade News 248, 249
Business 249
Illustrated Electrical Patent Record 249, 250

DATES AHEAD.

Street Railway Association of the State of New York (next meeting), Elmira, N. Y., March 29th.

Ohio Independent Telephone Association (annual meeting), Columbus, Ohio, March 30th.

Iowa Electrical Association (annual convention), Kirkwood Hotel, Des Moines, April 18th and 19th.

Iowa Street and Interurban Railway Association (annual convention), Kirkwood Hotel, Des Moines, April 19th and 20th.

American Electrochemical Society (general meeting), Ithaca Hotel, Ithaca, N. Y., May 1st to 3d.

Indiana Independent Telephone Association (annual meeting), Indianapolis, Ind., May 17th.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.

THE CENTENARY of the electric light may very appropriately be celebrated in two or three years. There have not been so many centennial celebrations in electrical development that this one should be suffered to pass unnoticed. Although his experiments with electricity extended over a period ranging from 1802 to 1821, it was in 1809 and 1810 that Sir Humphry Davy, using current from a voltaic battery of 2,000 pairs of plates, produced a continuous and brilliant electric light, practically identical in principle with the arc light of today. "This great experiment," says Crocker, "is unquestionably the foundation of the present methods of electric lighting." The one-hundredth anniversary of such an important event should be appropriately celebrated, and the great electrical societies of the world may well take measures to that end.

IT IS rather amusing, when the cold, hard facts in the case are considered, to observe the pomp and circumstance with which an eastern electrical contemporary, in its issue of March 10, 1906, heralds "the birth of a new electrical art." The "art" to which reference is made is the Cahill electrical music system. But it is rather late to "announce the birth," for an article describing the system in general terms was published in the Western Electrician of February 25, 1905, over a year ago. At that time it was thought that the invention would be demonstrated at the Portland Exposition, and the article in question, written by Mr. W. E. Brindley, was entitled "Electrical Music for the Portland Exposition." Like the subsequent writer in the eastern journal, Mr. Brindley noted the fulfillment of one of Edward Bellamy's dreams in "Looking Backward;" he then proceeded to outline the principles and applications of Dr. Cahill's invention. This article attracted considerable attention in the daily and literary press. The Chicago Daily Tribune went so far as to say that "the Western Electrician and other papers devoted to electrical interests speak of the invention with such an air of certainty that little doubt remains of the practicability of the new music-making machine." In an editorial published in the Western Electrician of May 13, 1905, we disclaimed any certainty in relation to the system, although we took occasion to say that "we see no theoretical reason why electrical impulses, to be translated into musical sounds, could not be transmitted in the manner outlined."

Thus it will be observed that the "art" had excited considerable discussion before our contemporary announced its birth.

MOTORS are offered for hire by the municipal electrical departments of several English cities, and the idea will probably be given a trial in Birmingham. The plan is exciting considerable interest among the small power users of that city who are contemplating the use of electric current to drive the machinery in their establishments. The City Council of Birmingham will be asked by the electric supply committee for permission to supply motors and starting switches on terms ranging from $12.15 per annum for a half-horsepower motor up to $126.36 per annum for a 50-horsepower motor. Small charges will be imposed for conveying and fixing, but the wiring work will be allowed to go to the private electric-wiring contractors of the city. Special facilities will be afforded to manufacturers who desire to become purchasers of the motors which they may at first only hire. A sum of $40,000 or $50,000 will, it is estimated, be required for the working of the scheme for the first two years, after which it is believed the service would become self-supporting. As we understand it, the rent of the motor is distinct from the revenue derived from the current supplied to it to operate it. The idea seems to be to encourage the use of electric power among the smaller manufacturers by providing a method whereby the motors need not be bought outright, rather than to make much profit on the renting of the motors.

In the United States the renting of electric motors to customers by central-station companies is not practiced to any great extent, we believe, if at all. Easy terms of payment are arranged, if desired, and sometimes the electric drive is put in on a month's trial to demonstrate the advantages claimed for it. But the customer is expected to buy the motors just as he would any other machinery used in his plant, and just as he undoubtedly did in the case of the steam engines, shafting or belting which the motors replace. Electric signs are put in without purchase, on a service-basis contract, and lamp renewals are given free, but motors are not considered analogous. One reason is that, especially in the case of direct-current motors, the machine may be injured by incompetent attendance, which is not the case with a sign. Then, too, by actually owning the motors it may be supposed that the customer will be more steadfast in his allegiance to electricity than in the case of a temporary arrangement. But possibly the subject of putting out electric motors for hire, as a systematic policy, is worthy of more attention than it has received in this country. We shall be pleased to hear from managers and new-business promoters on this subject.

BRITISH manufacturers are asked to take notice by Dr. C. V. Drysdale, the British juror for electricity at the St. Louis Exposition of 1904, that they may learn something from the Americans in the matter of standardization of electrical machinery. In his report the commissioner recalls that British manufacturers were not ready to supply plant for traction work when the alteration of the laws rendered such work possible. Just in the same way, he says that America has now probably solved the problem of single-phase traction, which will most likely enable the main railways to be successfully electrified in future. He tells the British public that this has only been done by the expenditure of such amounts in experiments as would frighten British manufacturers, and that, "unless we are alive to the question, we may possibly in a few years be seeing all our large railways being equipped with American plant, just as we saw our tramways some few years back." Dr. Drysdale thinks, further, that the elimination of extreme and ruinous competition is one element of strength in the American electrical situation, preventing waste of talent and multiplicity of types of machinery. It would appear, he concludes, that the British electrical industry would gain by the co-operation, and even the amalgamation, of several of the now competing firms, and, above all, if the short-sighted policy of trade jealousy and secrecy were discarded.

It is to be observed that competition in the electrical business in the United States is more keen and active than some foreigners seem disposed to think. If Dr. Drysdale came to the United States and publicly announced that he was about to purchase apparatus for, say, an electric railway, with an open mind as to the best type of machinery and appliances to install, he would soon find evidence of real competition in the zeal and character of the arguments that the engineering salesmen would present to him. But it is undoubtedly true, speaking in general terms, that the competition in the electrical business in the United States does not go to the desperate extremes sometimes witnessed in other countries. There is also to be considered the latter-day "get-together" movement, although this is quite new, and its ultimate extent and importance, from an economic point of view, are uncertain.

But in whatever direction the various currents and cross-currents of electrical business-getting may set in the United States, one must always admire the original research and experimental work constantly under way by the great electrical manufacturing companies of the country. It is work of this kind that is bringing forth the single-phase railway, amid controversy and eager discussion. How healthful are these animated—perhaps even heated—debates! They make for the progress of the art, and, it may be said, of humanity also. We can exult in the knowledge that there is no stagnation in the electrical business. Ever learning, ever pursuing a higher good, a more efficient machine or method, the electrical engineers are in the van of progress. And in this development work the great electrical manufacturing companies take a very prominent and honorable part. They are actuated by selfish motives, no doubt, but enlightened, future-gazing, upward-tending selfishness of this sort is worthy of cordial praise.

Electric Lighting in New York State.

The first annual report of the New York State Commission of Gas and Electricity has been put into type. The commission was appointed in July, 1905, for the purpose of investigating the affairs of lighting corporations, recommending any necessary modifications of the law regarding them, inquiring into methods of operation of plants, and to make any suggestions for the protection of the public interests. In the advance proofs of the report furnished to the Western Electrician it is stated that the commission found it necessary to institute a thorough canvass among 1,500 village, city and town clerks for information of the names of corporations, municipalities and persons subject to the supervision of the commission. A blank was prepared requesting information as to the incorporation territory supplied, capital stock, bonded indebtedness, capacity and price charged for product of all gas and electric companies. In the case of persons and municipal corporations, particulars relating to the cost of plant were obtained, and from municipal plants only the cost of lighting supplied by them. The response of the companies was prompt, 475 reports having been received, of which 399 are from operative companies. The results obtained may be classified as follows:

CAPITALIZATION OF LIGHTING AND POWER COMPANIES

Classification.	Number.	Preferred Stock. Authorized	Preferred Stock. Issued.	Common Stock. Authorized	Common Stock. Issued.	Bonded Indebtedness. Authorized	Bonded Indebtedness. Issued.	Dividend Paying.	Amount Invested in Plant
Electric	156	$ 7,501,000	$ 6,563,500	$100,276,979.23	$ 86,274,070.23	$106,047,383.80	$ 92,530,068.80	34	
Electric individual	32	....	....	....	....	....	....	....	$194,[illegible]
Electric, municipal	30	....	....	....	....	566,778.00	563,978.00	....	860,167.23
Gas and electric	50	6,100,000	5,903,300	29,007,000.00	27,489,111.30	41,394,000.00	40,402,000.00	14	....
Coal and water gas	51	19,804,000	17,812,700	173,496,750.00	147,518,100.00	103,348,000.00	99,574,100.00	8	....
Acetylene	10	....	....	63,400.00	61,300.00	....	....	....	....
Acetylene, individual	12	....	....	....	....	....	....	....	15,000.00
Oil gas	14	....	....	55,450.00	42,850.00	2,500.00	2,500.00	7	....
Oil gas, individual	3	....	....	....	....	....	....	....	16,768 00
Municipal gas	3	....	....	....	....	8,800.00	8,800.00	....	14,000 00
Natural gas	36	1,098,000	381,650	5,967,700.00	4,893,500.00	1,902,000.00	1,230,000.00	8	....
Natural gas, individual	2	....	....	....	....	....	....	....	200 00
Total	399	$ 34,503,000	$ 30,661,150	$308,867,279.23	$266,278,931.53	$253,260,461.80	$234,311,386.80	71	$1,101,348 92

ELECTRIC COMPANIES (LAMPS SUPPLIED.)

Classification.	Public Arc Lamps. Open.	Public Arc Lamps. Enclosed.	Commercial Arc Lamps.	Incandescent Lamps. Public.	Incandescent Lamps. Commercial.	Incandescent Lamps. Public Buildings.
Electric	5,295	14,435	40,446	88,671	3,413,423	530
Individual	107	134	15	969	24,519	....
Municipal	971	825	153	1,927	67,770	475
Gas and electric	3,896	8,657	6,698	4,420	643,430	2,757
	10,269	24,051	47,312	95,987	4,149,142	3,762

From the foregoing it appears that of the 399 operative companies reporting, only 71 are dividend paying. Of the 156 electric companies, 34 only pay dividends, and of 50 gas and electric companies, only 14 pay dividends. The coal and water-gas companies make even less favorable showing in this respect, for of the 51 reporting only eight are producing returns to stockholders.

The total bonds and stock issued by all lighting and power companies of the state amount to $531,251,468.33, equal to about $75 per inhabitant of the state. The individual and municipal plants represent an investment of $1,101,348.92. The amount of gas of all kinds sold annually to consumers is 36,397,747,816 cubic feet, and the amount sold for public lighting is 1,569,446,124 cubic feet. The enclosed arc lamps for public-lighting purposes in use in the state are more than double the number of open arc lamps, which only number 10,269.

While no satisfactory statement of comparative growth will be afforded until subsequent annual reports are compiled by the commission, the figures of the United States census as of 1900 form an interesting basis of study:

ELECTRIC COMPANIES COMPARED WITH THE FIGURES OF THE CENSUS OF 1900.

	Census.	Reports to Commission.
Number companies	186	206
Preferred stock, authorized	$ 9,377,000	$ 13,601,000
Preferred stock, issued	8,914 500	12,466,800
Common stock, authorized	102,793,500	129,283,979
Common stock, issued	95,330,975	113,763,181
Bonds authorized	101,549,374	147,441,383
Bonds issued	86,054,674	132,932,008
Public arc, open	19,888	9,298
Public arc, enclosed	10,720	23,226
Commercial arcs	26,697	47,159
Commercial incandescent	3,506,803	4,071,372
Public incandescent	139,290	94,060

The use of enclosed arc lamps for public lighting has more than doubled, and now reaches 23,226, as against 10,720 in 1900, and the use of public open arc lamps has fallen off in the same proportion, or from 19,888 to 9,298. Municipal lighting industries in the state show a comparatively small increase in number as well as in amounts invested.

The preponderance of the lighting interests, gas and electric, of the city of New York is illustrated in tables showing the [illegible] amount of gas sold by all the [illegible] New York as compared with the [illegible] the state. While the average capital [illegible] panies furnishing gas [illegible] the entire state is $5,194,213, the average capital [illegible] cluding the city of New York, is only $[illegible]. New York city alone furnishes 78 per cent of the total capitalization of bonds and [illegible] throughout the whole state by companies furnishing gas only (coal and water), and 9[illegible] per cent of the total sales to consumers by such companies. The figures for companies operating both gas and electric plants are quite the reverse, the amount being much larger and in a smaller proportion in favor of the state, outside of New York city. Of the electric companies outside of New York city furnishing no gas, the average capitalization is $361,188, as against $1,188,251 for the entire state. Of the purely electric companies, New York city furnishes 71 per cent of the capitalization and 77 per cent of the number of commercial incandescent lamps used in the entire state and supplied by such companies. New York city companies report nearly one half of the public enclosed arc lamps in use in the entire state for street lighting and 3,250 open arc lamps, as against 2,045 in the rest of the state.

The recent growth of the electrical power and transmission companies is shown by the fact that they have developed, from waterpower sources, upward of 125,000 horsepower, with the full capacity of their plants not yet reached. These companies (seven in number) have issued capital stock to the amount of $17,180,700 and bonds to the amount of $7,860,000. Two other plants, in process of installation, are designed to supply an additional 100,000 horsepower.

Questions of importance have presented themselves to the commission which suggest modifications of general laws, and of the law creating the commission. A bill embodying the amendments proposed will be submitted at an early day. It is a noteworthy fact, and one which argues strongly for the need of supervision, that during the two months preceding the enactment of the law, 74 gas, electric-light and power companies were incorporated, with a total nominal capital stock of $42,192,000. Of these, only six are reported as operative. Attention is also called to the fact that under the law as it exists in New York state, it is allowable for corporations whose stock is valued at much above par to issue convertible bonds or permit its stockholders to subscribe at part for stock, and thus largely increase the charge on the earnings.

D. W. W.

Canadian Electric-railway Statistics.

According to the report of the department of railways, just brought down in the Canadian Parliament, at the close of the last fiscal year there were 793 miles of electric railway completed in the Dominion, the paid-up capital of which amounted to $61,033,321. The gross earnings aggregated $9,357,125, an increase of $903,516, and the working expenses $5,918,194, an increase of $591,677, leaving the net earnings $3,438,931. The number of passengers carried was 203,467,317, an increase of 22,777,319. The accident returns show a total of 53 persons killed during the year, 30 being passengers, three employes and 20 others.

Proportion of Electrical Facilities to Population.

[illegible] plants, 397 [illegible] and New York [illegible] each [illegible]. The total number [illegible] United States [illegible].

Of all central, southern and [illegible] fornia [illegible] population where central [illegible] able to total population [illegible] This high standing [illegible] electrical development in [illegible] the table shows that there [illegible] territory as yet untouched by [illegible] tricity. Following is the table:

TABLE, BY STATES, SHOWING PROPORTION OF POPULATION HAVING ELECTRIC SERVICE TO TOTAL POPULATION.

States and Territories	Number of Cities and Towns	Population of Cities and Towns where Electric Service is Available	Number of Electric Light, Heat and Power Plants	Total Population Census of 1900	Percentage of Total Population where Electric Service is Available
Alabama	[illegible]	246,7[illegible]	[illegible]	[illegible]	[illegible]
Arizona	16	[illegible]	14	122,[illegible]	[illegible]
Arkansas	62	[illegible]	[illegible]	[illegible]	[illegible]
California	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Colorado	[illegible]	309,447	[illegible]	[illegible]	[illegible]
Connecticut	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Delaware	11	[illegible]	[illegible]	[illegible]	[illegible]
District of Columbia	1	[illegible]	1	[illegible]	[illegible]
Florida	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Georgia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Idaho	[illegible]	42,20[illegible]	34	161,772	[illegible]
Illinois	[illegible]	[illegible]	[illegible]	4,821,5[illegible]	[illegible]
Indiana	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Indian Territory	[illegible]	42,[illegible]	[illegible]	[illegible]	[illegible]
Iowa	201	[illegible]	[illegible]	2,231,853	[illegible]
Kansas	[illegible]	404,2[illegible]	[illegible]	[illegible]	[illegible]
Kentucky	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Louisana	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Maine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Maryland	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Massachusetts	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Michigan	[illegible]	[illegible]	[illegible]	[illegible]	48.22
Minnesota	159	[illegible]	[illegible]	[illegible]	[illegible]
Mississippi	68	[illegible]	66	[illegible]	[illegible]
Missouri	145	[illegible]	[illegible]	3,106,665	22.6[illegible]
Montana	24	[illegible]	[illegible]	[illegible]	[illegible]
Nebraska	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nevada	10	[illegible]	[illegible]	42,[illegible]	[illegible]
New Hampshire	68	[illegible]	[illegible]	[illegible]	[illegible]
New Jersey	154	[illegible]	[illegible]	[illegible]	[illegible]
New Mexico	[illegible]	34,251	[illegible]	[illegible]	[illegible]
New York	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
North Carolina	62	[illegible]	[illegible]	[illegible]	[illegible]
North Dakota	25	[illegible]	26	[illegible]	[illegible]
Ohio	268	[illegible]	[illegible]	[illegible]	[illegible]
Oklahoma	22	[illegible]	21	[illegible]	[illegible]
Oregon	56	168,[illegible]	[illegible]	[illegible]	40.56
Pennsylvania	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rhode Island	20	351,66[illegible]	[illegible]	[illegible]	[illegible]
South Carolina	48	[illegible]	46	[illegible]	[illegible]
South Dakota	[illegible]	64,8[illegible]	[illegible]	[illegible]	[illegible]
Tennessee	[illegible]	85,[illegible]	[illegible]	[illegible]	[illegible]
Texas	151	662,[illegible]	162	[illegible]	[illegible]
Utah	[illegible]	102,524	20	[illegible]	[illegible]
Vermont	61	[illegible]	[illegible]	[illegible]	[illegible]
Virginia	55	[illegible]	53	[illegible]	[illegible]
Washington	61	26[illegible],216	[illegible]	[illegible]	[illegible]
West Virginia	[illegible]	[illegible]	52	[illegible]	[illegible]
Wisconsin	151	[illegible]	[illegible]	[illegible]	45.8[illegible]
Wyoming	18	40,2[illegible]	18	[illegible]	[illegible]
Total	4,828	[illegible]	[illegible]	[illegible]	[illegible]

Submarine Telegraphs of the World.

In a lecture recently delivered at Chatham, England, under the auspices of the Royal Engineers, Mr. Charles Bright had for his subject "Submarine Telegraphy." The speaker presented some interesting statistics showing that there are some 225,000 miles of cable in all at the bottom of the sea, representing $250,000,000, each line costing about $1,000 a mile to make and lay. The average useful life of a cable nowadays he put at anything between 30 and 40 years, according to circumstances. About 6,000,000 messages are conveyed by the world's cables throughout the year, or 15,000 a day, the working speed for any one cable being up to 100 words a minute under present conditions. About 90 per cent. of these are sent in code or cipher for business and official purposes.

Proposed Reduction of Electric-light Rates in Chicago.

Bion J. Arnold, consulting engineer, and William Carroll, city electrician, presented, as requested, a joint report on the rates of the Chicago Edison and Commonwealth electric companies to the committee on gas, oil and electric light of the Chicago City Council on March 17th. The report does not cover power rates for motors, sign business, arc lighting or electric-railway business. It is based on information furnished by the companies as to their business. The service is commended for its quality and reliability. The report says, as to the method of charging:

"In Chicago the use of the Wright demand system of metering and charging for electric lighting furnished by the Edison and Commonwealth companies is almost universal. With this system two meters are connected for each customer, one (the watt-meter) to show the kilowatt-hours of electrical energy actually supplied during any month or other period, and the other (the maximum meter) to show the greatest demand made at any one time. The time of maximum demand is 30 hours.

"The working out of the Wright demand system to its logical conclusion would mean that each customer would stand on his own feet and pay for the actual and equitable cost of his service plus a profit, and if this could be done the supply companies would be doing no part of their business at a loss, but this cannot be accomplished if a limit is put on the maximum charge.

"On the other hand, if the maximum charge is reduced the lighting companies will be forced to do a certain amount of their business at a loss, that is, the 'short-hour' consumers—who are the ones most affected by the maximum rate—will be getting their current at less than actual cost, and the loss must be made up by a reduction in income or by making higher than would otherwise be necessary the rate to the 'long-hour' consumer.

"Theoretically each customer should pay for his own service, and as the Wright demand system aims to accomplish this result, it is theoretically a step in the right direction. On the same theory, however, every merchant should charge proportionately more for the delivery of small purchases than for larger ones—that is, if a pound of coffee or a yard of silk is delivered by itself a higher charge per pound or yard should be made than would be the case if this small purchase were to be delivered with a larger bill of goods. This policy would not be considered good business. As other merchants consider it to their interest to do a certain amount of their small business at a loss, it is not surprising to find that public sentiment is in favor of reducing the maximum rate for lighting, even if the supply company must make up this loss by a slightly larger charge than would otherwise be made upon their larger sales.

"The problem, therefore, resolves itself into the establishing of a fair balance. The desire of the lighting companies is to make each customer pay his own bills, and, therefore, they wish to maintain a schedule with a high maximum and a low minimum. The sentiment of the public is apparently to reduce the maximum so as to give the greatest number of customers the benefit of a comparatively lower rate, even if this benefit is to be secured at a loss to the companies, or at the expense of the wholesale customers. The question, therefore, involves the rights of the 'short-hour' customer, of the 'long-hour' customer, of the wholesale customer, and of the producer, and should not be settled entirely in favor of any one and at the expense of the others."

The present net maximum rate is 16 cents per kilowatt-hour. It may be reduced by changing to a lower figure that may be agreed upon or by changing the time during which the demand registered by the maximum meter must be used before the customer gets the benefit of the secondary or lower rate. If the 30 hours' maximum use were reduced to 20, 15 or 10, the result would be to reduce the customer's bill.

The engineers are satisfied that quite a number, perhaps 25 per cent., of the companies' customers are not producing a profit. But "although the numbers of customers getting served at a loss may appear large, the total amount of actual loss to the companies, when measured in dollars, compared to the total income from all lighting customers, is small, for it is only those using a small amount of current that are supplied at a loss."

Passing now to more tangible considerations, the following quoted portions are selected from the report to give a general idea of it:

"There are a large number of combinations of the maximum and minimum rates which can be made. As we understand the proposal of the companies, it seems that they are willing to agree, under certain named conditions, to reduce their present rates of 16 cents and 10 cents to a maximum of 14 cents and a secondary of nine cents for the next two years, with a further reduction to 12 cents for the maximum rate and eight cents for the secondary for the last three years of the next five-year period."

"The reduction of rates for the first two years to 14 cents and nine cents, as suggested by the companies, means a further reduction of seven per cent. from their original income, or a total reduction of 14.2 per cent. The reduction to 12 cents and eight cents, as suggested by the companies, means a further reduction, amounting to a total of 21.2 per cent. of their income.

"The full valuation of the properties and franchises as fixed by the board of equalization for taxation purposes is $25,707,000.

"Interest at the rate of five per cent. is paid on the bond issue and dividends at the rate of eight per cent. annually are paid on the stock issued. The average annual charge for interest and dividends is 6.5 per cent. on the total par value of the bonds and stock.

"The lighting load is increasing at about the rate of 7,500,000 kilowatt-hours each year.

"Operating costs are decreasing, but income per kilowatt-hour has decreased in about the same proportion. The percentage of current sold compared to the amount generated is decreasing instead of increasing. This is due to an increase in transmission and sub-station losses incidental to serving a larger territory."

The conclusion of this interesting report is as follows:

"After a very careful study of the situation the conclusion reached is that the Edison and Commonwealth companies can afford to reduce their lighting rates.

"If there is no desire on the part of the city to embarrass these companies in their efforts to extend their lines and to render efficient and reliable service, then their offer to reduce their rates to 14 cents for the maximum rate and nine cents for the secondary rate for two years from the present time, and to 12 and eight cents for the next following three years, may be considered reasonable and fair.

"A thorough investigation of the affairs of the companies might show that these companies could afford to reduce their rates to 10 cents and five cents (equivalent to a flat rate of 6⅔ cents), but from all figures which have been submitted this rate at the present time would be a hardship and would probably seriously embarrass the companies, but it is reasonable to expect that the companies can afford to and probably will eventually reach this latter rate.

"The above conclusions have been reached as a result of a 10-day analysis of the figures submitted by the companies. As it would take at least three months thoroughly to investigate the accounts, methods and valuations in order to arrive at a scientific conclusion based upon knowledge which we could prove to be correct, we make no specific recommendations."

At the meeting of the council committee last Saturday drafts of two proposed ordinances were submitted by W. G. Beale for the Edison and Commonwealth companies. One was a general ordinance providing that for five years beginning May 6, 1906, the gross maximum charge for electricity for light, heat or power by any company or individual in Chicago shall be 16 cents a kilowatt-hour. This rate shall be subject to a discount of 12½ per cent. during the first two years of the period and of 25 per cent. during the last three years in all cases where payment of bills shall be made within 10 days from their date, so that the net maximum rate, on prompt payment, shall be 14 cents for each kilowatt-hour for the first two years of the period and 12 cents for each kilowatt-hour for the last three years.

The other ordinance had reference to the Edison and Commonwealth companies only and provided for several amendments in the franchise ordinances of these companies. The changes requested provide for privilege to transfer rights and privileges or to consolidate property, business and franchises of the two companies if desired; also repealing the sections which require underground construction in certain parts of the city, as outlined in the Western Electrician of March 10th.

In considering the Arnold-Carroll report and the ordinances above mentioned the committee requested an opinion from the corporation counsel as to the extent of the city's power to require a company to serve a portion of its customers at less than cost, provided the returns on the total business are reasonably profitable. The corporation counsel requested time to consider the question and further negotiations are awaiting his opinion.

A Peculiar Lighting Controversy.

An interesting condition has presented itself at Columbiana, Ohio, where the village has a municipal electric-light plant. Some time ago a natural-gas company secured a franchise in the village, but it was stipulated that the gas should be used for fuel only, in order not to take business away from the light plant. But a number of citizens piped their houses and business buildings, and began the use of gas for lighting purposes. The Village Council has notified the gas company that if it furnishes gas for lighting its franchise will be revoked at once. The members of the council say that if the people use gas for light the municipal plant will prove a failure. The question being discussed is, Whether the Village Council can compel its citizens to abandon the use of gas and force them to use current from the municipal plant.

Alternating-current Traction in Heavy Railroading.

The New York Railroad Club held an "electrical night" on March 15th at Carnegie Hall, when about 700 members attended to hear a discussion of the advantages and disadvantages of alternating-current traction. President H. H. Vreeland was in the chair, and B. G. Lamme, assistant chief engineer of the Westinghouse Electric and Manufacturing Company, presented a long paper entitled "Alternating-current Electric Systems for Heavy-railway Service." Mr. Lamme did not read his paper, but gave an extemporaneous exposition of its main features. Among other things, he gave some details of the alternating-current equipment of the New York, New Haven and Hartford Railroad.

The main power house will be at Riverside, near Stamford, Conn. The generators in this power house are to be driven by steam turbines of the Westinghouse-Parsons type. These machines have a single-phase rating of 3,750 kilowatts, or about 5,500 kilowatts on three phase, the armature winding being such that three-phase current can be obtained from the same machine. The generators have two poles, turn at 1,500 revolutions per minute, give 3,000 alternations per minute, or 25 cycles per second. Such a generator would have been considered an impossibility only a short time ago, but now the manufacture of these machines appears to be comparatively easy. The machines have an ample margin both electrically and mechanically, and they are particularly well adapted for handling inductive loads. As these machines are to feed directly into the trolley system they are wound for the normal trolley tension of 11,000 volts, and in consequence one terminal for each machine is always grounded when in service.

As the New Haven company contemplates operating certain existing direct-current systems from this power house it was decided to add an additional leg to the armature winding so that three-phase currents could be obtained for feeding into rotary-converter stations for furnishing direct current for some direct-current lines which, at the present time, cannot be conveniently changed to straight alternating current. The New Haven company has also other fields for three-phase power which it proposes to take care of as soon as it is feasible to do so.

The trolley system is to be suspended from steel bridges which span four to six tracks normally, and even a greater number at special points. These bridges are placed at intervals of about 300 feet. At points about two miles apart heavier structures, called anchor bridges, are placed.

The steel cables which support the trolley wire proper are supported by massive insulators on the bridges. Two cables are used for each wire and form a double catenary suspension, carrying the trolley wire by means of triangular supports. The double system of suspension gives increased stiffness to the trolley construction. The triangular supports are placed about 10 feet apart. The steel cables have a total sag of about six feet, while the trolley wire itself is maintained in a practically horizontal position. At the anchor bridges each trolley wire is broken by section insulators and is connected to the other trolley wires and to two feeder wires through automatic circuit-breakers. The trolley wire has a nominal height of 22 feet above the track. This height will vary a few inches up or down with wide variations in temperature. The pantograph type of trolley used on the locomotives has an effective range of about 8½ feet, and therefore a very considerable variation in the height of trolley is permissable. The overhead system is designed to be amply safe under abnormal conditions, such as high wind or heavy coating of ice.

As 11,000 volts is used on the trolley system, no transforming stations are necessary on the part which is now to be installed. The high-voltage trolley system is to extend about 19 miles in one direction from the power house and about three miles in the opposite direction to Stamford. This system could be extended in the latter direction approximately 20 miles farther, if desired, without transforming sub-stations. Therefore, about 40 miles of the trolley system can be supplied directly from the main power house. With a locomotive load representing 4,000 kilowatts about 19 miles from the power house and a corresponding load about 15 miles away, or four miles from the power house, the drop at the end of the line would be about 13 per cent. This drop is on the basis of feeding into the load from one direction only. If there were a transforming sub-station about 40 miles away from the power house, feeding into the same trolley system, then the drop at a point 20 miles away would not be 13 per cent., but would be considerably less, as power would be supplied from both directions. It is apparent, therefore, that with sub-stations along the line feeding into a common trolley system such sub-stations could be possibly 60 miles apart.

The locomotives are to be made by the Westinghouse Electric and Manufacturing Company. The motors are four in number, with a continuous

capacity of over 200 horsepower each, or over 800 horsepower total. The motors are of the gearless type and are wound for a normal full-load speed of 225 revolutions per minute. They are connected permanently in pairs and require about 150 volts at the terminal on alternating current and 550 to 600 volts on direct current. The motors are internally of the same general type which the Westinghouse company has been building for some time for interurban service. However, due to the relatively low speed of the motors, the maximum commutator speed is very low, being less than 3000 feet per minute when the locomotive is making 60 miles an hour. This may be compared with the 5,000 to 7,000 commutator speeds, which are frequently attained in both direct current and alternating current high-speed service with fairly large motors.

Among the interesting features of the locomotive are the greatly enlarged hubs of the wheels, fitted with seven large sockets for the driving quills of the motors. The motors are air cooled, and the air pressure also removes any dust. Motor control is achieved in the usual way when using direct current, but on alternating current the motors are not operated in series-parallel but connected permanently in a given manner, with the supply voltage varied through six definite steps and a number of smaller ones, the latter being used under certain conditions. For the higher speeds the fields are shunted, the motor permitting of almost indefinite shunting before passing into multiple. Direct current is fed direct to the motors, but alternating current is stepped down by two transformers which are arranged at the sides of the frame to balance the weight.

The locomotive is equipped with devices for collecting both alternating current and direct current. For the latter there are eight collection shoes. There are two pairs on each side, one at each end, for the purpose of bridging gaps on a third-rail system. There must be shoes on each side, as the locomotive must be able to make contact when turned. These direct-current contact shoes must also be able to work on two forms of third rail—one in which the shoe runs under the rail and the other where the shoes run over. The locomotive is provided with a pantograph low-tension overhead direct-current trolley to conform with certain New York Central requirements.

For collecting alternating current the locomotive is provided with two pantograph high-tension bow trolleys. Each trolley has a capacity to carry the total line current under average conditions, but two are provided to ensure reserve capacity.

Each of these locomotives is to be able to handle a 200-ton train on local service at 26 miles per hour, with stops two miles apart. In order to make this average the maximum speed will be 45 miles per hour. One locomotive will be able to handle a 250-ton train on through service. For heavier trains it is intended to couple two locomotives together and operate them in multiple. This presents no difficulties, for the locomotives are fitted up for the multiple-unit system of control.

It is evident, concluded Mr. Lamme, that the engineers of the New Haven company have had in view the adoption of an electric system which is particularly well adapted for future extensions. If the electrification were to stop at Stamford, then the full advantage of the alternating-current system would not be obtained. However, the section which will be electrified with alternating current is of sufficient length to enable the New Haven engineers to determine the advantages and possibilities for future extension, and it is safe to predict that such extensions will be made in a comparatively short time.

Mr. Cooper, in showing some pictures, said that the locomotive had been tested at Pittsburg on a total run of 2,000 miles on a one-mile experimental track. A collision test had been made at 10 miles an hour and up to date no defects had developed. Pictures were also shown of similar locomotives geared for a lower speed, and operating from a 3,300-volt trolley wire for use in the Sarnia Tunnel.

DISCUSSION.

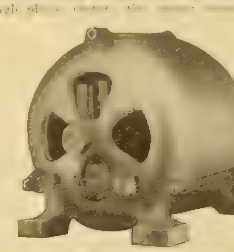
W. J. Wilgus, vice-president of the New York Central railroad, opened the discussion. What motives, he asked, should guide a railroad man in changing from steam to electricity? The first was the desire or necessity to abate the smoke nuisance, such as had been forced upon the New York Central, and the second was to improve the service and attract more passengers. He weighed evenly against each other the danger and disadvantages of steam locomotives and those of high-power conductors. There was a popular impression that the third rail was particularly dangerous and an overhead construction absolutely safe, but this was not so, although conditions would always require either or both methods. The New York Central experiments had proved that with a properly designed third rail all objections on the score of snow or sleet or other dangers were fallacies. Overhead construction was extremely inelastic with regard to additions. On the West Shore railroad the use of the third rail would save them $400,000 on 50 miles of track, and it was not expected to add to it till 1916. In case of derailments there was great danger from high-power overhead conductors, but [illegible] was a great [illegible] current for the [illegible] the third rail [illegible] Central had adopted [illegible] to minimize the [illegible] power and to provide [illegible] or expanding traffic. [illegible] who formerly [illegible] now considered them [illegible] to discuss the general [illegible] for suburban traffic [illegible] more suitable and allowed [illegible] more frequent trains, higher [illegible] attraction to passengers and [illegible]. A railroad system [illegible] all possible safeguards [illegible] quired a system of electrical traction that had passed beyond the experimental stage.

Calvert Townley, electrical engineer of the New York, New Haven and Hartford River railroad, complimented Mr. Lamme on his efforts to develop alternating-current traction. It was necessary for someone to be behind every new development. The New Haven railroad, in adopting electric traction for a part of its New York division, had not considered comparative tests between the performance of steam and electric locomotives or multiple unit systems, for the true comparison lay deeper. A self-contained unit had absolute limitations. Some engineers had so long accepted the limitations of traffic with steam locomotives that they could not realize that electrical traction introduced new conditions both of traffic and equipment. Steam traffic had been conditioned by such things as the size of cylinders, the ability of men to shovel coal and the strength of bridges. Electric traction meant handling traffic according to the needs of the community and all-around improved facilities. Twice the amount of traffic could be handled on the same line. It took a long time with steam traffic to equip additional tracks and frequently they were never installed at all. The question of decreased cost per mile was not the prime objective of the New Haven road. The New Haven had not a single long line, but a network of lines among many manufacturing towns in Southern New England. These conditions meant congested traffic, such as could be straightened out by electrification. Their facilities for tidewater on the coast and for hydraulic power among the New England hills made for the cheap generation of electricity. They looked both to the present and the future, and the mere incident of having to use electric traction in the city of New York was not a question of major importance. If their anticipations were realized they would have long-distance electric traction between New York, New Haven, Hartford, Springfield, Providence and Boston. It was necessary to provide not only for frequent and elastic suburban traffic but also for comparatively long-haul traffic, and for heavy units at comparatively infrequent intervals. Mr. Lamme with his 11,000-volt circuit was doing away, among other things, with high-tension switchboards, static transformers, rotary converters, direct-current switchboards, batteries, third rail, etc. The alternating-current system enabled them not only to deal with the conditions outlined but also to operate their branch lines by means of an inexpensive form of construction, with sub-stations operated from the main feeders, and using either third rail or overhead at any desired voltage. When the time came to equip such branches with alternating current the changes could be made economically.

Frank J. Sprague of the New York Central electrification commission said it was necessary to temper optimism with conservatism and that dollars and dividends were the final arbiters of success. Electricians must prove their facts before the steam locomotive was put on the scrap heap. Mr. Lamme's paper was a plea for the single-phase locomotive. With dense traffic it is possible to accomplish something in the way of economy with a concentrated central station with the additional advantage of having frequently operated units of varying length. It was possible to reduce working expenses with electric traction by reason of the concentration of the prime mover and the possible use of waterpower without changing the conditions of service, but on the other hand any partial change of traction or the moving of freight by steam would leave the question of the efficiency of electrical operation very much in doubt. Density of traffic was fundamental, but short lines would build up territory. The conditions of the New York Central and New Haven railroad systems were different. Their objects were different. He would not discuss these differences except to say that he had no reason to change the conclusions he had formerly come to and which had caused some heartburnings. No one particular system would solve all problems. Difficulties due to electrolysis had been overrated in the case of direct-current circuits. Electrolysis was not due so much to escaping currents as to differences of potential between different parts of the track. These difficulties might arise on an 11,000-volt circuit when a difference of five per cent. of potential would mean 550 volts. He fancied their telegraph and telephone friends would have something to say about a difference of potential of 550 volts in the ground. The higher they went in voltage [illegible]

A New Single-phase Motor.

[illegible]



A NEW SINGLE-PHASE MOTOR.

eliminated, thus to produce a most reliable and serviceable motor, and at the same time secure results possible in other types.

This motor has no phase coils, resistances, clutch pulleys, short-circuit devices, centrifugal devices, etc., or any of the numerous auxiliaries that are usually necessary to start the motor. It belongs to the brush and commutator class. This type of motor had not been developed to such an extent as the rotary-field motor until recently, due to the fact that in the earlier days the destructive sparking at the commutator was supposed to be an insurmountable obstacle. Now commutator alternating-current motors are made for any service, giving practically no more commutator trouble than direct-current motors.

This motor has the characteristics of the shunt direct-current motor in that its speed changes very little from no load to full load. Also, by a suitable resistance in series, the speed may be reduced 50 per cent. below normal. It is capable of starting full load from standstill and has no delicate parts to get out of adjustment or fine wires to become overheated if the starting conditions are especially severe.

The motor is built in the most substantial manner, with large steel shafts, bronze bearings and large, deep commutators. The makers explain that the brushes are short-circuited on each other and have no connection to the supply circuit, thus working the armature "on short" and eliminating armature troubles, which is the chief point of simplicity of induction motors.

The standard windings are for 60 and 133 cycles, 110 volts. Two hundred and twenty volt motors are also furnished.

These motors range in size from one-eighth to one-third horsepower.

Gaso-Electric Project for Indiana.

Announcement has been made in Indianapolis by Senator C. N. Thompson of the organization and incorporation of a company, capitalized at $3,000,000, to construct a railway between Indianapolis and Toledo. W. B. Strang, head of the Strang Construction Company of New York, is said to have the contract to build the road over a right-of-way already secured, work to be begun April 1st. The feature of the new project is that while steam will be used for the movement of freight, gaso-electric cars will be used for passenger service. The road will be known as the Toledo, Fort Wayne and Indianapolis. Mr. Thompson recently traveled from Toledo to Chicago in a gaso-electric car, and is enthusiastic over the prospects of using these cars on steam roads.

Citizens of Holton, Kan., will vote, March 27th, on $75,000 waterworks and electric-light bonds.

Chicago Meeting of the Railway Signal Association.

The regular Chicago meeting of the Railway Signal Association was held in the Great Northern Hotel on March 19th. J. A. Peabody, signal engineer of the Chicago and Northwestern railroad, vice-president of the Western Section, presided. The principal business of the morning's session was a consideration of amendments to the constitution and by-laws, which, if carried out at the annual meeting, will mean practically a new constitution and by-laws. In order to have these proposed changes brought up at the annual meeting it is necessary to have them adopted by both the Eastern and Western sections. Before adoption by either section they must be first presented in written form at a regular meeting and then passed upon at the next regular meeting. At the meeting just held the amendments were duly presented and discussed. At the next regular meeting, which will be held in May, they will be voted upon, and if carried will then be brought up at the annual meeting of the association as a whole, which will be held in October.

The afternoon was taken up with the reading and discussion of three important papers as follows: "Charging of Storage Batteries from Alternating-current Circuits," by F. B. Corey of the General Electric Company; "Substituting Track Circuits for Detector Bars," by W. N. Spangler, supervisor of signals of the West Jersey and Seashore railroad, and "The Power Distant Signal," by W. A. D. Short, signal engineer of the Illinois Central railroad.

Storage-battery Charging.

Mr. Corey in his paper upon the charging of storage batteries described the mercury arc rectifier as manufactured by his company, beginning with a general description of the mercury vapor arc lamp aside from its special application to the rectifier.

In order to show exactly what transpires in the rectifier tube Mr. Corey introduced a series of oscillograph records, which gave accurate measures of the instantaneous values of current and electromotive force in the various circuits. One of these curves showed the variation of current at the two anodes simultaneously. It was interesting to note that the current as shown in the curve was very far from its original sine curve, this distortion being the result of the reactances. The anode curves overlapped by an angle of approximately 20 degrees. Another illustration showed two simultaneous records, the lower curve being the impressed electromotive force and the upper curve the direct current flowing from one cathode shown in its relation to the zero line. In this case the indentation of the current curve was approximately 30 per cent. of its maximum ordinate. If for any reason it is desirable to further reduce the amplitude of these pulsations it may be readily accomplished by means of special reactances and without any great loss in efficiency of the rectifier.

Another curve showed the voltage in charge and discharge of one reactance coil and its relation to the impressed electromotive force, while still another showed the voltage between one anode and the cathode and its relation to the impressed electromotive force. This latter figure also showed the constant voltage drop of 14 volts while the arc is maintained. The length of time that the arc is held after the impressed electromotive force has reached the zero value was also shown by a curve.

The action of the rectifier tube is independent of the frequency of the alternating-current circuit. Standard outfits can be operated on any frequency from 25 to 140 cycles, inclusive, thus covering the whole range of commercial circuits.

One of the questions usually asked is in regard to the life of the rectifier tube. The life of these tubes, according to Mr. Corey, varies in much the same way as the life of incandescent lamps, it being dependent on the maintenance of the vacuum. The life of the tube under normal operating conditions is at least 600 hours. Factory tests during the last year on a large number of tubes show a variation in life from 440 to 3,000 hours, the average being well over 1,000 hours. Standard tubes have operated satisfactorily for over 6,000 hours, while they occasionally fail after a few hours' service, due to damage in shipment or other causes. Two tubes are always shipped with every panel and the cost of the renewal is small.

Use of Track Circuits.

In his paper on the substitution of track circuits for detector bars Mr. Spangler pointed out among other things that where the layout or track will permit the signaling should be such that the point where the circuit begins can be extended two rail lengths in advance of the switch. As it is quite impossible under all conditions that the wheels of a train will form a perfect short-circuit the moment they pass the point of insulation, it is readily understood that while the relay may be working perfectly so far as the shunting point is concerned, it would be slow to open from the gradual reduction of current in its coils, allowing the first part of the train to pass on the switch with the lever unlocked. Where circuits begin too close to the switch points, derailments may also result from the practice of operators and levermen in giving signals and immediately putting them to danger and unlatching the switch lever to change the route, while the enginemen, not noticing the change in signals, has moved just far enough to get on the switch when it is being operated. If the conditions are such that it would not be practicable to extend the circuits or where dwarf signals cannot be placed at suitable distances ahead of the switches, it has been a recent practice to provide a preliminary circuit outside the dwarf which opens the signal indication circuit, only when the signal is clear, providing a means of locking up in good time.

When storage battery or the method of supplying current direct from a generator with a set of battery floating as a reserve is used the condition of the track should be considered and the insulation resistance maintained to such a degree as will permit of a uniform adjustment of battery resistance, making it possible under all conditions to work the relay with a very small margin of current over that required to pick it up. The practice of sanding the rails through interlocking should not be tolerated, and where circuits run through routes that are rarely used they should be adjusted exceptionally close, as an occasional failure on the safe side will be of little consequence compared with the risk to be run in adjusting the circuit to work under all conditions, especially when it is known that additional resistance exists in the shunt formed between the wheels and rails.

Through Altoona yard there are six electro-pneumatic interlockings with a total of 68 working switch levers equipped throughout with electric locking. The results from its use at three of the larger plants and where the movement is heaviest are as follows: At the east end of the yard, a point where all traffic passes and where all west-bound freight, with the exception of high-class trains, is taken into the yard, there are 11 working switch levers. During 1905 there were three failures on the safe side and one on the wrong side. This failure was caused by just enough dead space in a circuit to allow a momentary picking up of the relay while a cabin was being pushed through the circuit by trainmen. As the dead space was just a foot longer than that required for the wheels of a cabin to stand in, we can clearly understand to what degree the electric locking is depended on by the levermen to do the work. At the west end of the yard where all trains are carried through, and where the east-bound passenger tracks cross the west-bound freight, there are 12 working switch levers with a scissors crossing and two double slips. From April 18th, 1905, or when the entire interlocking was electrically locked, to December 31, 1905, there were seven failures on the safe side and none on the other. The situation at the third interlocking, where there are 23 working switch levers, is particularly interesting. The plant was put in operation December 17, 1905, and controls the movement to a receiving yard built from two ladders. At least 30 per cent. of the movements are made by swinging trains, which requires that after the engines have been cut loose and have run far enough to clear the locking circuits, the signals and switches must be changed, the trains allowed to run into the yard, the switches again changed and the cabins allowed to follow the engines. During the 48 days of service no failures of circuits were reported.

Power Distant Signal.

"Five years ago," said Mr. Short in his paper, "the average distance of the distant signal from the home signal at interlocking plants was 1,444.44 feet, and from the interlocking machine it was 1,750 feet. Today the average distance from the home signal to the distant is 3,745.64 feet, and of the distant signal from the interlocking machine 4,025 feet.

"The general practice and the most approved for the installation of the power distant signal is, viz., an electrically operated motor signal with the motor operated by portable storage batteries when local conditions allow of a convenient recharging of the battery, otherwise by one of several type primary potash batteries, preferably the one giving the greatest number of ampere-hours at the least cost. An electric lock is placed on the back latch of the home signal lever to absolutely insure the distant signal being in the caution position before the home signal lever can be unlatched to be placed in normal position.

"Summing up, we can say that the installation of the distant signal has been greatly increased generally within the last few years, and that the power-operated distant signal is being installed altogether at new interlocking plants and is gradually replacing the mechanically operated signal at present plants."

Traction Company to Give Electric-cooking Lectures.

The Kokomo, Marion and Western Traction Company of Kokomo, Ind., has employed Mrs. A. V. Sanborn of St. Louis to deliver a course of lectures on "Cooking by Electricity" and to demonstrate the possibilities of electric cooking. The traction company expects to furnish electricity for cooking to patrons all along the line.

Single-phase Equipment for Central Illinois Electric Railways.

Single-phase equipment is to be installed on new extensions of the Central Illinois Construction Company, consisting of 80 miles of track now being constructed. The portion of track to be so equipped consists of two 40-mile lines, one connecting Bloomington and Peoria, the other lying between Springfield and Lincoln. (See map on page 174, Western Electrician of March 3, 1906.) The present equipment used by the Central Illinois Construction Company is direct current, consisting of heavy suburban-type cars equipped with four General Electric 75-horsepower motors, and the local demand for power is considerable when accelerating or when operating on grade. The cars contemplated for the new extensions are still heavier, and it is evident that the question of secondary distribution is one of great importance, when such large equipments are used over a system so extensive. There is now high-tension distribution from the Riverton station at 13,200 volts, but this line is being changed to 33,000 volts, and the latter staton will be supplemented by a second power house, located in Peoria, with a common 33,000-volt transmission line connecting the two stations.

The new equipment consists of 10 75-horsepower alternating-current compensated motors, made by the General Electric Company, together with necessary sub-stations, overhead-line material, generating-station equipment, etc. Each car equipment consists of four 75-horsepower motors, with the Sprague-General Electric system of multiple-unit control, adapted for use on alternating-current circuits. These are so arranged that they will permit tap control when running on alternating current and series-parallel resistance control when running on direct current. In addition to the motors and control apparatus, complete alternating current-direct current General Electric air compressors and straight air-brake equipments will be installed, as well as arc headlights, adapted for use on 25-cycle alternating current. The trolley will be of the pantograph type, with rolling contact, raised and lowered by compressed air.

The equipment just outlined will take care of the passenger service, but for hauling freight the operating company will employ a single-phase locomotive equipped for service on the same roads as the regular motor cars. This locomotive will be of the eight-wheel type, equipped with four General Electric 125-horsepower compensated alternating-current motors. The total weight of the locomotive complete will be 50 tons, with a drawbar pull of 20,000 pounds. It will haul its train at a speed of 20 miles per hour with the current supply at 3,300 volts and 25 cycles. In common with the motor cars for passenger service, the locomotive will be equipped with multiple-unit control for operation on both direct and alternating currents. It will also be supplied with complete air-brake equipment, comprising an alternating current-direct current motor-driven air compressor, with the straight air-brake apparatus.

To furnish additional power for this new rolling-stock equipment, the present generating station at Riverton will be supplemented by a 2,000-kilowatt Curtis steam turbine, furnishing current at 25 cycles, and the new power house at Peoria will be equipped with two 2,000-kilowatt Curtis turbines. Additional machines will be installed as soon as other lines, now under consideration, are constructed. The generator and high-tension distribution system will be three-phase and will feed the present rotary-converter sub-stations and also the 80-mile section of track operating with alternating current.

The alternating-current trolley (3,300 volts) will be of the now well-known catenary type, suspended from brackets in the interurban sections and cross-suspended through the small towns. Feeding the trolley there will be four alternating-current transformer sub-stations. Each sub-station will contain two 200-kilowatt single-phase transformers, with complete controlling high-tension and low-tension switchboard apparatus. These sub-stations will be placed approximately 20 miles apart, and are so arranged that trouble in any sub-station will automatically cut out that station without affecting operation on the rest of the line. The complete electrical equipment for this line has been ordered from the General Electric Company.

Rates for Commercial Space-telegraph Messages.

The American De Forest Wireless Telegraph Company has opened a Boston office for space-telegraph business in the basement of the Equitable Building. The sending station proper is in M Street, South Boston. The rates are as follows: From Boston to Hartford, New Haven and Bridgeport, Conn., New York and Philadelphia and between those points, 20 and 1; from the Connecticut offices to Atlantic City, N. J., 30 and 3, to Sea Bright, N. J., 25 and 2; from New York and Philadelphia to the New Jersey points, 20 and 2; between any of the above points and Cape Hatteras, N. C., 40 and 3. The company expects to open offices at Portland, Maine, Providence, R. I., and Springfield, Mass., soon.

BOOK TABLE.

STANDARD TELEPHONE WIRING FOR COMMON-BATTERY AND MAGNETO SYSTEMS. By James F. Fairman. New York: McGraw Publishing Company. 1906. Pp. (4¼ by 6¾ inches), 91, with 74 illustrations. Price, $1.

Plain and simple instructions for connecting different types of telephone apparatus in both magneto and common-battery systems, are characteristic of this little book, which is a handy reference guide for telephone wiremen. Not only are there directions for connecting, but considerable descriptive matter concerning the different parts of the apparatus, both at the subscriber's end and at the central station, is also given. The diagrams alone will be found of much practical value. When coupled with the clear and concise directions which accompany them, the combination is one which the wireman will appreciate. The book is of convenient pocket size, with durable leather binding.

THE WIRING HANDBOOK. By Cecil P. Poole. New York: McGraw Publishing Company. 1906. Pp. (4½ by 8 inches), 85, with 61 illustrations. Price, $1.

Wiremen who have occasion to lay out their own work, and engineers and architects who prepare wiring specifications, will find this handbook of service. Laying out wiring work and the calculation of wiring systems for both direct current and alternating current are first given attention, followed by directions for motor wiring and transformer and wattmeter connections. These features form the main part of the book. In addition there are two appendixes, the first containing a digest of the underwriters' rules relating to inside wiring and the second presenting fundamental formulas. One of the most valuable things in the book is a set of 32 tables covering all the data which may be needed in any form of wiring installation bearing upon motor connections, the carrying capacity of wires for different conditions, the calculation of feeders and branches, the sizes of copper wire, constants to be used for certain classes of work, etc. These tables are printed on sheets of tough paper and so bound in the back of the book that they may be readily spread out for consultation.

ELECTRIC-RAILWAY ACCOUNTING. By W. B. Brockway. New York: McGraw Publishing Company. 1906. Pp. (5½ by 8 inches), 84, with six illustrations. Price, $1.25.

Electric-railway accounting, in all its complex phases, has become a problem which requires scientific and thoughtful methods to make it an instrument of real value to the street-railway manager in ascertaining the true condition and earning powers of the system over which he has jurisdiction. This book takes up the subject of electric-railway accounting in a rather more intimate light than does the work which considers the subject from a viewpoint outside of the actual operating conditions. What a report should be, suggested forms of reports, the relations of operating expenses to earnings, what standardization of accounts means, expert examinations, the accounting office, etc., are among the many subjects treated.

Street railways have grown from a very small beginning to a vast and flourishing industry within a comparatively short period of time, and it is only natural that the methods of accounting that they pursue are almost as many in number as are the individual properties themselves. During the last few years strenuous effort has been made, notably by the Street Railway Accountants' Association, to reduce these methods to something like uniformity. But the work has only been begun, and any aid toward bringing about this result, such as the book under consideration, will be appreciated by those who have anything to do with street-railway accounting departments. It is true that the accounting department is not a revenue producer, but it must not be forgotten, on the other hand, that receiverships only too often result from misstatements and misunderstood statements originating in that department, showing that its value, when properly conducted, cannot be overestimated.

ALTERNATING CURRENTS, THEIR THEORY, GENERATION AND TRANSFORMATION. By Alfred Hay. New York: D. Van Nostrand Company. 1906. Pp. (5½ by 8⅜ inches), 291, with 178 illustrations. Price, $2.50.

Upon taking up a book entitled "Alternating Currents" one invariably expects upon opening the covers to be saluted by long and well-marshaled ranks of mathematical formulas, kept in line by stern integral signs, which were the nightmare of classroom days, the monotony being relieved, perhaps, by a few vector diagrams and sine curves. It is with a certain pleasurable sensation, then, that upon opening this book a widely different treatment of the subject is found. Principles and formulas there must always be, but the author has taken care of the most of them quite comfortably in the first three chapters, after which the reader is left to enjoy the concrete but eminently more practical things which are to be studied under the head of alternating currents. Special attention is given to the subject of testing; and the [illegible] rather than [illegible] and historical [illegible] the book [illegible] ought [illegible] knotty problem[s] [illegible] which [illegible] higher [illegible] mark, but thoroughly [illegible]

THE ELECTRICAL TRADES DIRECTORY. [illegible] London: H. Alabaster, Gatehouse & Co. 1906. Pp. (6 by 9 inches) [illegible]. Price [illegible] shillings ($[illegible]).

This directory has again been thoroughly revised and brought up to date as far as possible by the help of correspondents in all parts of the world. It contains the names and addresses of members of the electrical and allied trades and professions throughout the world. For facility of reference it is divided into four sections as follows:

British containing 14,227 names; colonial and general containing 4,335 names; continental containing 7,938 names; United States of America containing 7,020 names. This makes a total of 33,520 names.

Each of these sections is again divided into alphabetical and classified divisions, and in the case of the British a geographical section is also given by which a glance at any town shows all firms of any importance therein. The sections are indicated by a thumb index which renders them easy of access.

A useful feature of the book is the information regarding central stations in Great and Greater Britain. The system of distribution and voltage is given, the engineer's name and capacity of plant, and in the case of alternating current, periodicity and phase are included.

Telegraphic addresses and telephone numbers will be found in the alphabetical sections, and particulars as to capital, etc., of limited companies are given in the British alphabetical section. To meet a growing want the book is now published in two forms, "A" containing the British and Colonial and general sections only, and "B" containing the Continental and United States sections in addition.

MOTIVE POWER AND GEARING FOR ELECTRICAL MACHINERY. By E. Tremlett Carter, C. E. New York: The D. Van Nostrand Company (London: The Electrician Printing and Publishing Company). 1906. Pp. (5½ by 8¼ inches), 672, with 199 illustrations. Price, $5.

This is a comprehensive treatise upon the practice relating to the mechanical equipment of electric power stations, both for electric-light and traction systems. Some attention is given in the leading chapter to the fundamental principles relating to motive power as applied to plants of this nature, the necessary formulas relating to the measurement of power being given. Following this comes the statement of the general problem, "What are the best provisions which may be made for utilizing the available energy for the performance of useful work and the production of paying revenues?" This problem is answered as well as may be in the following chapters, taking up first the all-important factor, fuels. Since steam is the agent by which power is developed in most power plants at the present time, this is the subject given most attention in the book. The properties of steam are gone into thoroughly and the means by which it is produced—furnaces and boilers. Then naturally follows the application of the energy of the steam in the various types of steam engines, including the reciprocating engine and the steam turbine. All the accessories and detail parts of these machines receive comprehensive treatment. The two other sources of motive power, namely, waterpower and the gas engine, come in for their due share, and are described in a manner as thorough as is the steam engine. There is also some data on the laying out of plants. Throughout the work the subject is illustrated by reference to actual practice obtaining in England and other countries, and numerous tables have been prepared giving exact and up-to-date data on the operation of electric power stations.

MODERN MACHINE SHOP CONSTRUCTION, EQUIPMENT AND MANAGEMENT. By Oscar E. Perrigo, M. E. New York: The Norman W. Henley Publishing Company. 1906. Pp. (7⅜ by 10¼ inches), 343, with 208 illustrations. Price, $5.

This work describes the modern machine shop or manufacturing plant from the time the grass is growing on the proposed site to the time the finished product is ready for shipment. Part I. takes up the subject of the construction of the plant, giving advice as to the selection of the site, the method of dealing with the different soils encountered, different kinds of foundations, methods of building construction and the materials used, including the power house, chimney, lighting and ventilation systems, etc. Part II. deals with the equipment of the plant, taking up all the different departments, such as the offices, stock and store rooms, tool room, drafting room, pattern shop, foundry, carpenter and machine shop and the many others which go to make up the modern factory plant. Part III. pertains to the management of the plant, describing the routine [illegible]

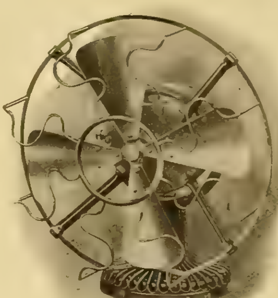
[illegible] methods for [illegible] retical action of the [illegible] the gas engine [illegible] indicator, and [illegible] gines is thoroughly described [illegible] simple arithmetic [illegible] book useful to practical men.

BOOK RECEIVED.

"Electricity Meters." By [illegible]. Published by Charles Griffin & Co., London; J. B. Lippincott Company, Philadelphia.

New Star Electric Fans.

The Star Electric Company of Niles, Ohio, entered the fan motor field January 1st, and it shows an attractive line of direct current fans. The Star line embraces three types—the swivel, type A; swivel and trunnion, type B, and the oscillating type C. The Star fan is the standard [illegible] type of extra strong mechanical construction. Bases of fans are heavily enameled in black, hand polished, and striped with gold. All brass parts are



NEW STAR ELECTRIC FAN.

highly polished and lacquered. The swivel and trunnion fan has an extra connection with which a wall attachment may be made. The oscillating fan is of the well-known single blade construction.

In these fans the armature is built up of sheet-steel laminations, securely fastened to the shaft, and windings thoroughly insulated from contact with all metal surfaces. The commutator consists of sections cut from hard-drawn copper bar. Segments are carefully insulated from each other with the best grade of India mica. Lead wires are fastened securely into slots milled in the end of the commutator segments, and are bound to an asbestos ring, which prevents injury from rough handling or vibration.

Bearings used in all Star fans are of the well-known self-aligning type, made from a superior grade of phosphor bronze. Continued exhaustive tests have demonstrated that the bearings used in these fans have many points of superiority, both in freedom from heating and in wearing qualities.

Bearings are lubricated by means of wick oil cups of extra large size, which hold sufficient oil to last an entire season under ordinary conditions. All fans have an oil-catching device. Heavy cylinder oil should be used.

Brushes consist of a special grade of carbon pencil of ample cross-section and extra length. They are controlled by compression springs, which hold them firmly against the commutator with an even pressure, and admit of the brushes being used up to almost their entire length.

Field coils are protected by a heavy layer of insulating material, strongly taped, the result being a compact coil of neat design and exceedingly durable. These are form-wound with the best

quality of cotton or silk-covered wire, according to voltage requirements. The speed-regulating device is made up of german-silver wire, wound on a porcelain spool, the capacity and insulation being sufficient to eliminate any possibility of injurious heating. This device gives the fan three distinct speeds and a cut-out.

The Gas Engine as a Prime Mover.

Bearing upon the problem of the gas engine as a prime mover, two valuable papers were recently read before the Western Society of Engineers. One of these was by C. E. Sargent upon "The Prime Mover of the Future;" and the other was entitled "Available Power and Cost of Operation of a Power Station for Waste Gases from a Blast Furnace Plant," presented by H. Freyn of Cleveland, Ohio. These two papers embody many strong arguments in favor of the use of the gas engine.

As pointed out by Mr. Sargent, the era of the gas engine began when it was found that the by-products of the petroleum refinery, gasoline and distillate, were available for fuel and the fundamental patent had expired. Manufacturers began to build engines of the Otto cycle type, and there are now said to be upward of 500 manufacturers of gas engines in the United States alone.

There are three dispositions of the heat in the fuel which goes into a gas-engine cylinder. Part of it, usually about 25 per cent., goes into work, about 40 per cent. into the water jacket and 35 per cent. into the exhaust, radiation, etc. Now, if the amount which is wasted can be reduced, the percentage turned into work will be increased; the amount going into the water jacket depends, other things being equal, on the amount of surface exposed during inflammation. The higher the compression the less surface surrounding the unit of compressed charge, therefore less heat goes into the work. A Lenoir engine, firing at atmospheric pressure, required nearly 100 cubic feet of gas per brake horsepower-hour, while with a compression of five atmospheres an engine of the same horsepower will do the same work on 20 cubic feet of gas.

As the exhaust stroke of a four-cycle, single-acting engine has no compression to bring to rest the reciprocating parts, and as a triple or quadruple crank is not only expensive to build and maintain in alignment, but as the work on one crank must be transmitted through other cranks, there arose a demand in the minds at least of engineers for a double-acting gas engine, which, if made tandem, even with the four-cycle, would give not only an impulse for every stroke, or twice during a revolution, but the reciprocating parts would be brought to rest by the compression indigenous to each stroke.

The higher the compression within the limits of the pressure necessary for premature ignition the greater the efficiency, but the kind of fuel governs the degree, and the compression necessary to ignite kereosene vapor, while not so volatile as gasoline, will not cause the latter to burn. Natural gas can be compressed to 150 pounds absolute, alcohol vapor to 190 pounds, and blast-furnace gas to 210 pounds, and still require an electric spark to start inflammation.

The other loss of heat in a gas engine besides that which is transmitted to the water jacket is the heat which goes out with the exhaust. When a cylinder full of gas and air is compressed and ignited the chemical action generates an intense heat; the gases expand one-four-hundred-and-ninetieth of their volume for every degree of Fahrenheit, and the chemical action even with a proper mixture is not instantaneous and often there is flame coming out with the exhaust.

If a full cylinder of combustible mixture is compressed from atmospheric pressure and temperature and heated further by chemical action, then when the volume is constant the pressure is increased, and the release of this pressure when the exhaust valve opens causes the familiar "sea-lion bark," always associated with the exhaust of a gas engine. This is the second loss of the internal-combustion engine, and when it is considered that from 35 to 40 per cent. of the heat is wasted in this way, is it any wonder that engineers have tried to minimize this loss?

If steam were a perfect gas, void of cylinder condensation, an early cut-off in a single expansion cylinder would give as many expansions and as good economy as in the compound engine. The working fluid of an internal-combustion engine is practically a perfect gas: therefore the efficiency of this type of prime mover may be increased if the working charge be expanded to a greater volume than is compressed.

The Lackawanna Steel Company of Buffalo has over 40,000 horsepower of gas engines installed in its works, running on a by-product of the blast furnace, "furnace gas," the combustible matter of which is mostly carbon monoxide. This steel plant has the largest gas-engine installation in the United States, and is well worth a personal visit and inspection. The Koerting engine has three cylinders where the four-cycle tandem has but two for the same number of impulses, but it has several advantages as well as disadvantages over engines using the Otto cycle.

Mr. Freyn in his paper worked out an elaborate calculation, assuming a new blast-furnace plant of two 400-ton blast furnaces situated in the immediate vicinity of a large city. His figures for all the different elements were complete, as were those upon losses in the plant-operating cost, etc. In conclusion he made the following remarks:

"From the above computations, it will be seen that a power plant of about 10,500-brake horsepower capacity complete in every detail and installed in connection with a blast-furnace plant, would be capable, when running at full-load capacity, of producing one brake horsepower per year at the low cost of $17.88, no value being placed on the blast-furnace gas.

"The enormous saving as compared with the production of power in a steam-engine plant is still more striking when the cost of generation of electric current is considered. One kilowatt-hour at full-load capacity of the plant could be produced at 2.95 mills, which is away below the best figure ever reached with a steam-engine power plant. Even under worse conditions, that is, when the power plant is running on an average of only 50 per cent. of its total capacity, the cost of generation of one kilowatt-hour is but 5.50 mills.

"It is evident that an eventual increase in the capacity of the power plant would still tend to reduce the cost of the generation of power per unit, as certain expenditures for the power plant of 10,500 brake horsepower would remain unchanged for additional power units.

"Computations of this character are sometimes considered as being 'theoretical,' as they naturally can only be made by making certain assumptions. That such figures have some practical value, inasmuch as they permit the clear understanding of the results of practical experience, accounting for the make-up of these figures, will be appreciated.

"The John Cockerill Company has in operation at present seven blast furnaces of about 1,200 tons daily capacity, and in addition large steel plants, rolling-mill plants, coal and ore mines, coke ovens, boiler shops, machine shops, bridge works, gunnery works, steam-turbine works, locomotive works, etc. The Cockerill company employs about 15,000 workmen, and its plant is considered to be the largest of its kind in Belgium and west of Germany."

"In 1900 the Cockerill company had 86 electric motors in use, while in 1905 the number of motors amounted to 333. The lighting outfit consisted in 1900 of 450 arc and 4,500 incandescent lamps, whereas in 1905 the corresponding figures were 660 arc and 5,600 incandescent lamps. In order to produce the power for the electric service, 1,000 kilowatts in steam engines were installed in 1900. In 1901, the first gas engines, operating direct-current generators of 900 kilowatts total capacity, were installed; in 1903, 900 kilowatts in gas engines were added and the capacity of the steam-engine plant was decreased 200 kilowatts, so that up to 1905 only 800 kilowatts in steam engines were in operation; in 1904, more gas engines were added, bringing the total capacity of the power plant up to 3,700 kilowatts. Inside of five years the capacity of the power plant has been increased 370 per cent.

"In 1900 the total operating cost for 1,000 kilowatts in steam engines amounted to 157,462.88 francs; in 1905, for the total capacity of the power plant of 3,700 kilowatts, the cost of operation amounted to 206,327.91 francs. The increase in the operating cost, therefore, amounted to 31 per cent. only, whereas the capacity of the power plant had been increased 370 per cent.

"Although even in the case that the power plant would have been enlarged by additional steam units, the operating cost would have been reduced in proportion, it is clearly evident that the greatest share of the reduction in the cost of operation is due to the installation of gas engines.

"The output of kilowatt-hours produced per year increased from 1,789,281 in 1900 to 9,999,216 in 1905. The cost per kilowatt-hour fell from 0.088 franc in 1900 to 0.0206 franc in 1905, so that the cost of one kilowatt-hour in 1905 was but 25 per cent. of the corresponding cost in 1900.

"There is no doubt but that the operating cost of the power plant per kilowatt-hour would have been decreased in the interval of five years even in the case of an addition of steam units, as the power factor increased during this time."

Salesmen's Meeting to be Held in Chicago.

The Chicago members of the Electrical Salesmen's Association are contemplating holding a few meetings during the summer, at which subjects of interest will be discussed. It is the intention to invite addresses and papers from men who are versed in salesmanship. The general advancement committee, of which Mr. C. A. S. Howlett is chairman, has already secured numerous requests from members, asking that certain subjects be acted upon. It is hoped that the example of the Chicago members will be followed in other cities.

Another innovation is the holding of informal social assemblages at a designated restaurant in Chicago on Saturday afternoons. An invitation is extended to all members. The first of these Saturday afternoon meetings will be held on March 24th, when Vincent Gray of St. Louis, president of the association, will be present. Further information will be furnished by Secretary George H. Erich, 401 Monadnock Building.

The association has now nearly 300 members, and it aims at 1,000 before the year is out. Its aim is technical, industrial and social advancement in the art of selling electrical goods.

Chicago Street-railway Situation.

If the voters approve the issue of $75,000,000 worth of Mueller-law certificates next month, it will still be necessary to test their validity. Pending the outcome of the necessary litigation, Mayor Dunne suggests that the value of the property of the street-railway companies be appraised; that the companies be consolidated; that the new company provide modern, unified street-railway service, according to the city's specifications; that an exact account of the money spent for improvements be kept and that this amount and the appraised value constitute what the city must pay to acquire the unified system; that the companies operate under this arrangement until the city is ready to purchase, receiving a fixed dividend out of the profits and a further percentage, to be agreed upon, of the remaining profits; that these provisions be incorporated in a contract terminable at short notice.

Such, in brief, appears to be the mayor's outline of the steps to be taken after the adoption of the Mueller-law issue—if the voters do adopt it. It provides for private operation, under municipal control, for an indefinite period. A municipally appointed traction manager at a salary of $15,000 a year is suggested.

Chicago traction stocks have broken badly on the market since the United States Supreme Court decision. R. R. Govin of the financial end of the Union Traction Company is said to regard the fright of the stockholders, as indicated by the wholesale slaughter of the prices of the shares, as not warranted by the developments in the case. Mr. Govin thinks the city has been victorious, but only to the extent that it can now compel the companies to give good service under penalty of removal from the streets.

Now that James Dalrymple's report has been made public, Mayor Dunne feels that he may criticize it at will. The mayor gave out a carefully prepared statement on the Glasgow letter, and his opinion of Mr. Dalrymple may be summed up in the following paragraph: "When discussing questions which fall within the line of his skill and experience as a traction employe and manager he is instructive and intelligent. When he travels outside of that line and deals with questions of public policy as applied to American municipalities Mr. Dalrymple's views are simply of the same value as those of any other stranger who spends a few days in this country."

The first actual step in compliance with the secretary of war's order to remove the Washington and La Salle Street street-railway tunnels under the river has been taken by the city authorities. The public-service corporations were ordered to remove their wires and conduits from the tunnels by April 10th and make other provisions for crossing the river. The companies affected by the order are the Chicago Edison Company, the Western Union Telegraph Company, the Postal Telegraph Company, the Chicago Pneumatic Tube Company and the Chicago Telephone Company.

National Civic Federation Inspects Lighting Plants.

Members of the National Civic Federation who propose visiting public-utility plants and those of private corporations in a number of cities of various sizes in the United States for the purpose of making an exhaustive report to that organization on the subject of municipal ownership have thus far visited Indianapolis and Wheeling, W. Va. After the investigators had been to the latter city a local paper announced that while nothing would be given out by the committee, as to its conclusions thus far, it was intimated by one of the party that there was a pretty strong opinion that those in charge of municipal light plants do not have the same interest in them they would have if the plants were privately owned. The same paper says that conditions in both the gas and electric plants at Wheeling were found to be very bad.

Among those on the committee which has in hand the municipal-ownership investigation are Prof. Frank J. Goodenue of Columbia University, Prof. John H. Gray of Northwestern University, Prof. John R. Cummins of the University of Wisconsin; E. A. Moffett, secretary of the Federation; E. W. Bemis, superintendent of the waterworks of Cleveland; Walter Clark of the United Gas Improvement Company of Philadelphia, W. J. Clark of the General Electric Company of New York; Timothy Healey, president of the National Brotherhood of Stationary Fremen; Walter J. Fisher, secretary of the Municipal Voters' League of Chicago, and Messrs. Alfred E. Forstall of New York and Fred Burnett of Toronto, gas experts. The committee also has the service of an expert accountant.

Western Society of Engineers.

A regular meeting of the Electrical Section of the Western Society of Engineers was held in Chicago on Friday evening, March 16th. The topic for discussion, presented by Prof. P. B. Woodworth, was "Schools, Engineers and Employers." The paper briefly reviewed the claims made by many employers, that the product of the engineering schools does not fit their needs. What these needs are and how to meet them with engineering students of the proper qualifications were talked over freely at the meeting.

The requirements of employers vary widely, as pointed out by Professor Woodworth, who quoted from different men prominent in the manufacturing field. Some of them want the minimum amount of shop work and the maximum amount of theoretical training. Others say, "Give more shop work," and they look for a man who will be immediately available upon graduation as a skilled producer in the shop. The instructor in engineering has, therefore, a hard task before him.

Those taking part in the discussion were Chairman McMeen, C. A. S. Howlett, H. R. King, Francis Raymond, Professor C. E. Freeman and Professor Woodworth. The general conclusion arrived at was that, in the first place, let the student know as much as possible of physics, chemistry, mathematics, mechanics and thermodynamics as it is possible to teach him. Teach him the importance of his relation to his fellow men, in other words, how to "mix." If possible, have him settle in his own mind what line he wishes to pursue, so that the employer may better direct his work in the first year of his "apprenticeship." In brief, the ability to think straight rather than to do things will be of the most benefit to the student in taking up practical work.

Telegraph Ciphers by the Billion.

Ten hundred and twenty million pronounceable words with at least two letters difference between each word are contained in the new work on "Telegraph Ciphers: Artificial Words," compiled by Whitelaw and published here by Longmans, Green & Co. The words have been selected in accordance with the decision of the London Telegraph Conference of June-July, 1903. Besides the 1,020,000,000 pronounceable words in the work, there are also 160,000,000 extra words, all being arranged both in alphabetical and terminational order. So that there are no two words to be found that are alike, nor can any word be altered in transmission exactly into another word in the work. The volume is a quarto in size, printed on hand-made paper to bear handling.—New York Times.

These figures and statements are rather puzzling. Apparently there are 1,180,000,000 distinct words printed in the book. Allowing even 5,000 words to a page—certainly a large estimate—the volume consists of 236,000 pages. This would make a book over 39 feet thick, and its production would surely test the bookbinder's art. Even if letters are counted instead of words (25,000 to a page), the book works out to the respectable thickness of about eight feet.

Chicago Meeting of the Institute.

"Telephone Engineering as a Profession" was the title of an admirable paper presented by Mr. J. L. McQuarrie to the Chicago branch of the Institute on the evening of March 20th. The paper was short, but it was concise and to the point, and offered good opportunity for an interesting discussion. Mr. McQuarrie's popularity and the interesting nature of his subject resulted in one of the best-attended meetings of the season, and the assembly room of the Western Society of Engineers was barely capable of accommodating all. Chairman K. B. Miller introduced the speaker, and after the paper had been read a lively discussion took place, participated in by Messrs. J. G. Wray, C. E. Freeman, G. W. Wilder, Lubberger, S. G. McMeen, Bentley, Le Roy Stanton and Chairman Miller. Just before adjournment the chairman announced that Mr. Bion J. Arnold had promised to give the society the benefit of some of his experiences in connection with the New York Central electrification at the next meeting, the date as yet not being decided upon.

Interurban Competition in Iowa.

The Des Moines (Iowa) Register and Leader of March 10th says: "The Winterset and Indianola branch of the Rock Island railroad, with 48 miles of track, is to be electrified and operated as an interurban road. The operating company will be independent of the Rock Island and will operate the property under a long-time lease. The change is to be made in the immediate future and the electric service will probably be installed within the next six months."

"The move has been taken to protect the Indianola and Winterset property against deterioration threatened by the invasion of its territory by interurbans, and the independent operating company has been resorted to so the line can be taken out of the Rock Island system. This will permit the putting in of the usual interurban rates without making the Rock Island [illegible] Iowa railroad [illegible] been taken."

Telephone Engineering as a Profession.

Mr. J. L. McQ[illegible] Engineering a[illegible] at the meeting of the Ch[illegible] can Institute of E[illegible] gave a brief [illegible] the telephone engineer. Telephone engineering [illegible] a comparatively new prof[illegible] was taken up largely by telegraph men. [illegible] establishment of the telephone [illegible] the problems of telephone [illegible] from those of telegraphy, and a new [illegible] came about.

No real distinction was at first made between the managing and engineering features of the business. As the business expanded, however, and [illegible] companies combined into groups with centralized authority, a specialist with knowledge of the equipment was secured, and he was generally known as the "electrician." With the still greater development which has come about in the last few years the electrician has been called upon to do more and more real engineering work, and he is justly given the title of telephone engineer.

Opportunities for the college man in telephone engineering, as pointed out by Mr. McQuarrie, are abundant, and in spite of the fact that a great many look with disfavor on this line of work, because they cannot design and work with big machines, there is ample field for engineering of the highest order. Technical knowledge is, moreover, required at every turn in modern telephony, and problems are coming up which cannot be dealt with by the men who learned their lessons by hard knocks. Witness the work of Dr. Pupin and others who have so materially contributed to the advancement of the art within recent years by the application of technical knowledge to the problems of the business. They represent merely the beginning of a new line of progress, and the work which they have accomplished indicates that there are unlimited opportunities for the trained physicist in the telephone industry to-day.

The central-office switchboard and substation instrument present problems which are particularly inviting to the engineering mind. It is doubtful if there is another branch of the electrical business which offers more attractions to the inventor and the trained mechanician than are to be found in these two portions of a telephone plant; there are no other electrical machines employing circuits of such complexity and apparatus of such varied character as are contained in a modern telephone switchboard, and the difficulties are more pronounced when it is considered that both direct and alternating currents, of proper quantity and proper quality, are employed in the same circuits.

Completion of the telephone plant does not mean that the telephone engineer is through with it, for he is still a necessary part of the business management. Telephone engineers are found filling responsible positions with the various operating companies.

In concluding his paper, Mr. McQuarrie pointed out that the telephone business is already of considerable magnitude. Taking both the Bell and Independent companies together it is estimated that there are close to 4,500,000 subscribers in the United States to-day. A year from now there will probably be a million or more added to this number, and it is not unreasonable to expect that eventually there will be a telephone in every house in the land. There is an outlook for an ever-increasing number of telephones, accompanied by a desire for a reduction in the cost of the service. It is also demanded that the limit of commercial conversation be continually extended, and it is the function of the engineer to indicate how these results may be secured. There is approximately $550,000,000 invested in the telephone industry in this country at the present time, with millions being added every year to provide for growth. It is the object of the business management to see that this money is wisely expended, and it is to the engineer that it must look for advice. It would appear to be evident from these considerations that there are plenty of opportunities for engineers in the field of telephony, and the speaker thought that the work performed by the engineers engaged in the telephone business in the past compares favorably in its result with that produced by engineers in other branches of the electrical industry.

Discussion.

J. G. Wray, chief engineer of the Chicago Telephone Company, was first called upon to discuss the paper. Mr. Wray took the stand that a course of telephone engineering is not needed so much at college as a broad training in the fundamentals of engineering. When the fundamentals are thoroughly grasped, it is easy to take up the problems of telephone engineering and learn to specialize in that line after leaving college. Mr. McQuarrie, in reply to this, said it had been his experience that the young men coming from schools giving what they term a telephone course fall into line a little quicker than those who are from other courses.

Prof. C. E. Freeman stood up stanchly for a course of telephone engineering for the man who expects to follow telephone engineering. Prof. G. W. Wilder also spoke to the same effect, out[illegible] [illegible] underlie them.

Indiana Telephone Items.

The Owensville Independent Telephone Company has decided to install a new [illegible] switchboard.

The Central Union Telephone Company has announced that it will expend [illegible] in the rebuilding of its plant at Goshen.

Mayor Boehne of Evansville has notified the telephone and electric light companies that they must proceed at once to place their wires underground.

It was thought that the telephone controversy was over in Kokomo, but Mayor Brown announces that he will veto the ordinance granting the Citizens' Telephone Company the right to amend its franchise so as to permit it to make connections with the Bell company for long-distance service to points not reached by the New Long-distance Telephone Company's wires. While the ordinance was passed by unanimous vote of the council, it is said there will be no attempt to pass the measure over the mayor's veto. It is generally believed that the New Long-distance Company would cut the Citizens' company off its lines, and as a choice the people prefer to retain the New long-distance service.

The proposition of the Home Telephone Company of Fort Wayne to take over the National Telephone Company, owning and operating 1,000 miles of toll line and exchanges in Kendallville, Sturgis ad other points, has been accepted by the latter. The price is $60 on a capital stock of $250,000. The National people accept $225,000 in six per cent. preferred stock of the Home company.

The Central Union Telephone Company will rebuild its plant in Linden this spring.

The Central Union Telephone Company has secured a foothold in Plainfield by purchasing the franchise of a co-operative company. The Central Union promises to give patrons service free for the first six months and 50 cents a month for the first year following.

Max Von Hoffman, representing a Milwaukee company, has applied for a franchise for a telephone system in Evansville. His company proposes to install instrument in a house for 50 cents a month, plus two cents for every outgoing call. The cost per month shall not be over $4 a month for business houses and $2 a month for resident instruments. Under the contract party-lines are to be entirely eliminated and a cash bond of $20,000 is offered to show good faith. All instruments are to be free until 3000 subscribers are obtained.

The South Side Telephone Company of Lockman has been incorporated to construct and operate an exchange in Lockman and in Brown and Jackson counties. James C. McKinney, Charles N. Springeon and Daniel B. Eddy are the directors.

S.

Southeastern Telephone Developments.

The Wadesboro (N. C.) Telephone Company (Independent) is making improvements on the outside and also will put in new and enlarged equipment in the office.

Durham, N. C., now reports that it is connected by rural telephone with three counties, the rural service proving a success.

D. L. Wray and others of Spartanburg, S. C., have formed a company to manufacture cross-arms and other equipment for telephone and telegraph poles. The capital is $10,000.

The annual meeting of the Chester (S. C.) Telephone Company (Mutual) was held recently, every

subscriber being a stockholder. The exchange has nearly 300 subscribers.

W. L. Abernathy and associates have organized the Fort Lawn Telephone Company at Fort Lawn, S. C., with $5,000 capital stock.

The People's Telephone Company of Beaufort, N. C., has been chartered with $15,000 capital stock. L.

Ohio Telephone Notes.

James S. Brailey, Jr., of Toledo has denied the story that he and his associates have purchased a controlling interest in the Cuyahoga Telephone Company of Cleveland.

Arrangements have been made for the Lancaster Telephone Company of Lancaster to issue $100,000 new stock, of which half will be common and the remainder six per cent. preferred. The company has authorized $75,000 bonds, of which $50,000 have been issued. It has exchanges at Lancaster, Baltimore, Millersport, New Salem and Thurston and toll exchanges at Carroll, Thornville, Rockbridge, Sugar Grove, Lockville, Hooker and Pleasantville. At the end of the year 1,324 subscribers were on the list. The company has paid one per cent. quarterly on the old stock, amounting to $100,000.

A new directory is being distributed by the Citizens' Telephone Company of Columbus. It shows quite a growth in the subscription list since the last book was issued. The Franklin County Telephone Company's list has been omitted and it will issue a directory of its own.

A reduction in the rates for telephones in some of the public offices at Cincinnati has been granted. Private exchanges will take the place of separate telephones.

The North Jackson Telephone Company of North Jackson has been incorporated with a capital stock of $10,000 by F. A. Eckis, S. H. Goldner and others.

The Cuyahoga Telephone Company made a handsome gain in February over the corresponding month a year ago, the surplus showing $10,025.72 in comparison with $3,540.06 last year. C.

Telephone News from the Northwest.

A new telephone exchange is being installed at Northfield, Minn., by Charles Church. The new line is connected with the Faribault rural lines and the Tri-State long-distance system.

The Wisconsin Telephone Company estimates the cost of improvements to be made to its system at Racine, Wis., this year at $121,000.

The New Ulm Rural Telephone Company of New Ulm, Minn., will build 50 miles of toll lines out of that city this summer.

William Bailie of Valley City, N. D., has been granted a franchise for a local exchange in Anamoose, N. D.

A convention of the Independent telephone companies of North Dakota is being agitated and a meeting will probably be called in a short time.

G. J. Grimm and others are organizing a local and rural telephone company at Lamberton, Minn.

The Hughes Electric Company is planning to install a telephone exchange at Garrison, N. D.

Negotiations are pending looking to an adjustment of the differences between the City Council at Albert Lea, Minn., and the Albert Lea Telephone Company.

The Great Western Telephone Company has begun work on its new telephone line from Fort Pierre, S. D., to Rapid City.

The Mutual Telephone Company has begun the work of putting wires in East Des Moines, Iowa, underground, and it is expected that the overhead system will be done away with by August 1st.

The City Telephone Company of Tabor, Iowa, has sold its system to J. W. Wayrick of Leavenworth, Kan., at $57,000. R.

Michigan Telephone Matters.

Abe VanAlstine and E. B. Rutledge of Grant are forwarding a scheme to build a new telephone line from Big Rapids to Pogy, a distance of about 15 miles. A sufficient number of subscribers has been secured and a mass meeting held to perfect a stock organization. The farmers are to build the line, and the Bell company will furnish the service.

At the annual meeting of stockholders of the Gladwin County Telephone Company it was decided to elect two directors for each line represented. The directors elected Fred Powell president, H. L. Dow secretary, and H. R. Clarke treasurer.

The Montmorency County Farmers' Telephone Company has been organized with H. Lundeen, president. The company was organized with 45 members.

Representative farmers have organized the Evart Center Line Telephone Company. Peter White was elected president. Stock to the amount of 35 shares was authorized to be issued at $10 a share. The line will run southwest from Evart, and finally be extended to Big Rapids and Chippewa Lake. B.

Iowa Telephone Association.

The Iowa Telephone Association held its annual convention in Des Moines on March 13th, 14th and 15th. The officers elected for the ensuing year are: President, P. C. Holdoegel of Rockwell City; secretary and manager, Charles C. Deering of Boone; first vice-president, E. T. Averill of Cedar Rapids; second vice-president, E. E. England of Mount Pleasant; third vice-president, H. A. Kinne of Woodbine; treasurer, G. W. Graves of Denison; executive committee, J. S. Bellamy of Knoxville, E. H. Martin of Webster City, J. C. Thorne of Fairfield, George N. Bandy of Des Moines. The 1907 meeting will be held in Sioux City.

The organization of a company to have a capital of $250,000, the stock to be held by the Independent telephone companies in the state, was discussed. This company will have as its object the developing of toll-line business, particularly in the direction of assisting small Independent companies in localities where Bell competition is especially strong.

The association formulated a plan to organize a press bureau to gather and disseminate the news of Iowa. The organization will be made up of the larger Independent telephone companies of the state which have extensive toll service. All of the news is to come into the Independent telephone clearing house in Des Moines, where it is to be sent out with respect to the territory which would be particularly interested. The lines to the larger towns of the state may be equipped for telegraph service. The news is to be gathered by the toll operators in the larger toll stations of the state. This arrangement grew out of the demand of the Iowa Evening Press Association, made up of the larger evening daily newspapers of the state, to secure more state news. E. H. Martin of Webster City, president of the Martin Telephone Company, for many years a telegraph operator for the Associated Press, was made chairman of the committee which will manage this service.

Illinois District Telephone Meeting.

Representatives of 16 Independent telephone exchanges in the Seventh District of the Illinois Independent Telephone Association met in Galesburg on March 15th to complete organization. W. J. McQuiston of Monmouth, vice-president of the state association for the Seventh District, was chosen president. C. M. Erwin of Macomb was elected vice-president and R. G. Roadstrum of Galesburg secretary and treasurer. Among the cities represented were Burlington, Galesburg, Canton, Macomb, Kewanee and Monmouth.

Arrangements were made for united effort to contest with the Central Union Telephone Company for long-distance and toll business. To this end it was decided to urge a better toll service, at less cost, establish a clearing house somewhere in the state where business settlements can be effected, make the toll apparatus standard and uniform, and to push the extension of toll lines from this district and co-operate with the district systems of Illinois, Iowa and Indiana.

West Virginia Independent Telephone Association.

The first annual convention of the West Virginia Independent Telephone Association, held recently at Parkersburg, was well attended. Large and small companies of the state are taking an active interest in the association. Good papers were read and discussed. Several committees were appointed to look after such matters as standardization of equipment, uniformity of operation, etc.

The officers elected are as follows: President, W. C. Handlan of Wheeling; vice-presidents, first district, J. H. Wise of Cameron; second district, W. M. Clayton of Parsons; third district, J. W. Downs of Buckhannon; fourth district, Hugh Amos of Burnsville; fifth district, Lon H. Hutchinson of Huntington; secretary, A. C. Davis of Parkersburg; treasurer, Lloyd Beeghley, Weston. Lon H. Hutchinson, W. C. Handlan and A. C. Davis were chosen as the delegates to the national convention in June.

NEW COMPANIES.

The Vandalia Telephone Company of Vandalia, Ill., has been incorporated with a capital of $6,000 to furnish telephone service.

The Skelton Rural Telephone Company of Enid, Okla., has been incorporated by H. A. Thompson, J. J. Field and J. H. Gibson of North Enid and H. E. Whitney of Enid.

The Fifer Telephone Company of Bloomington, Ill., has been incorporated with a capital of $1,800. The incorporators are C. F. Hoobler, Alex Hebling and others.

The Prairie Telephone Company has been incorporated at Jersey City, N. J., with a capital of $200,000. The incorporators are J. A. Platner and C. M. Chase of Kansas City, Mo., and others.

Articles of association have been filed at Grand Rapids, Mich., by the Port Sheldon and Lake Shore Telephone Company, with a capital stock of $2,000. Harry D. Jewell and others are incorporators.

Chicago Telephone-rate Inquiry.

The investigations of the Chicago council committee which has in charge the matter of recommending a revised rate for telephone service have for several days consisted largely in hearing the arguments of subscribers on the merits of the Chicago Telephone Company's service. Some are satisfied with the service and the cost, but the majority has fault of one kind or another to find. One man spoke of a downtown slot telephone which, he alleged, "took in" $1,000 a year in nickels. Opinions from New York city as to the service there on the measured-service basis, have been solicited by the committee, and on this point there are also differences of opinion.

As a result of the recent Illinois Supreme Court decision requiring the Chicago Telephone Company to pay the city compensation on the business done in territory brought within the city limits since it received its franchise, the compay has submitted the following figures of its business, which have been verified by the city auditor:

Earnings of the company from July 1, 1889, to March 1, 1906	$40,346,865.32
Amounts uncollected	359,434.68
Earnings on which compensation must be paid	39,987,430.94
Compensation paid to the city	942,505.06
Compensation due for annexed territories	312,813.68
Part of compensation claimed as due already paid	200,000.00
Amount still due the city	112,813.68

No recommendations have yet been made by the committee. It is probable that the rates will be considerably revised if the company is given a new franchise. The committee has received numerous communications from Independent telephone companies offering to install a competing system. The latest offer reported is said to come from Senator H. A. Evans of Aurora, Ill., for a 21-year franchise. Mr. Evans is known to be associated with the Interstate company, which operates a fine Independent system in North Central Illinois, with outside connections.

National-Interstate Telephone Convention to Be in Chicago.

The next convention of the National-Interstate Telephone Association will be held at the Auditorium Hotel in Chicago on June 26th, 27th and 28th. This will be the second annual convention of the Independent telephone forces since the reorganization and unification a year ago. Previously it had been announced that the convention this year would be held in St. Louis. The change to Chicago has been authorized by the executive committee at the request of many prominent telephone men, in view of the fact that the Kinloch Telephone Company of St. Louis will be cutting over to its new switchboard at the time of the convention, and requests that the association meet in St. Louis next year, when the Kinloch company will be in a position to properly entertain the delegates and guests.

From the general headquarters of the association, 708 Electric Building, Cleveland, good progress is reported in the Independent movement. Three important committees, viz., "Standard Forms of Accounting," "Standardization of Equipment" and "Standard Operating Rules and Regulations," have taken up their work. All practical Independent telephone men are requested to give these committees the benefit of their ideas and experience. Communications should be addressed to the chairmen of the respective committees in care of the Cleveland office.

The association calls attention to the fact that the value of Independent telephone securities is being recognized and large financial institutions of the country are investing heavily in these securities. A larger amount of new money, it is said, will be put into the building of new lines extending and improving existing properties this year than ever before. The association is now working on 14 state maps of Independent telephone lines, the map of Ohio being nearly completed.

Campaign for Cheap Telephones in England.

John Henniker Heaton, M. P., the famous champion of cheap postage in England, expects to conduct a campaign in the House of Commons in London to secure for England a low residence telephone rate. Mr. Heaton thinks that a shilling a week, equal to about 24 cents American money, or, more exactly, $12.24 a year, is all that British householders ought to be asked to pay. He has been in communication with the postmaster-general of Australia, who thinks that the shilling rate for telephones is not unreasonable. The matter is to be called at once to the attention of the British postmaster-general. The latter is at present in partial control of the telephone service, but the department will obtain full control of all telephones in 1911. But before that time Mr. Heaton expects to have low rates prevail throughout the United Kingdom.

GENERAL TELEPHONE NEWS.

The Martin Telephone Company of Llano, Texas, is putting in an exchange at Blanco, Texas, and will build a line to Kendalia.

The Farmers' Independent Telephone Company of Thurston, Neb., has been incorporated with a capital of $7,000. Herman Honeman is interested in the company.

Telephone companies in Kansas continue to increase. Among those recently organized in the state are the Spring Brook Telephone Company of Hoxie, the Burlington Telephone Company of Sabetha, the Farmers' Telephone Company of Hargrove and the Osage Valley Mutual Telephone Company of Fulton.

Among the recently incorporated telephone companies are the following: Sheep Canon Telephone Company, Hot Springs, S. D.; Mallard Mutual Telephone Company, Mallard, Iowa; Fremont County Independent Telephone Company, St. Anthony, Idaho; Pioneer Telephone Company, Hitchcock, S. D.; Hindsville Telephone Company, Hindsville, Ark.

The General Telephone Company, incorporated some time ago with a capital stock of $10,000,000, is arranging to take over the Louisville Independent long-distance lines as well as those of other towns in that portion of Kentucky and Southern Indiana. This company proposes to gather the Independent companies into a group so that their management will be more economical and convenient. Ed L. Barber is the president of the company.

The Interior Department, through the United States Reclamation Service at Salt Lake City, is inviting sealed proposals until May 2d for installing in connection with the Strawberry Valley reclamation project a telephone system having four telephone stations and about 35 miles of pole line. Particulars can be obtained by applying to the chief engineer of the Reclamation Service, Washington, D. C., or to George L. Swendsen, engineer, Salt Lake City.

The stock of the New England Shaver Telephone Company has recently been acquired by persons who propose to change the name to the Home Telephone Company and increase the capital from $275,000 to $2,500,000. The New England Shaver Company was incorporated by Providence (R. I.) capitalists in 1891, and it proposed to build up an opposition to the Providence Telephone Company, but patent litigation ensued, and the charter has lain dormant until now. The new owners expect to establish a strong competitor to the Providence company.

News from Louisville, Ky., is to the effect that the New Central Home Telephone Company is arranging to purchase the Independent telephone plants in Kentucky and Southern Indiana. The long-distance lines will be operated in connection with the Home Telephone Company of Louisville. The number of companies to be taken in will be about 15, and among others are those at Owensboro, Paducah and Maysville, Ky., and Bedford and Bloomington, Ind. It is the intention to take in others later on and make the new company the dominant interest in that section.

The House committee on railroads of the Mississippi Legislature has decided to insert in the Code chapter on "Supervision of Common Carriers" the provisions of the Sturdivant bill, providing a penalty for the failure of telephone companies to promptly transmit messages intrusted to their care and to make prompt connections over long-distance lines when requested by patrons. The effect of the section is to place telephone companies on practically the same footing as telegraph companies for failure to transmit messages promptly, the offended person being allowed a statutory damage of $25 in each instance of neglect.

Special Roads for Automobiles.

The building of a special automobile road between New York city and Philadelphia, and an elevated path for automobiles in New York city, the two to be made self-supporting by tolls, was advocated by John Brisbane Walker, in an interesting address delivered before the members of the Automobile Club of America on February 20th.

Mr. Walker said that drastic legislation was going to make it necessary to have special roads for motor vehicles, and he gave figures to show how these roads could be built and maintained. He said that a road could be built between New York and Philadelphia for $540,000, and the annual charges would not be more than $67,400, which would be met by a toll of 50 cents each on 400 passengers a day. When 10,000 more automobiles appear in the streets of New York—and their arrival is only the matter of a short time—an elevated highway will be a necessity, Mr. Walker said, in order to relieve congested traffic conditions.

J. S. Hill, an electrical engineer in the Department of the Interior, has invented an electrical "unveiling" device which he suggests for use at the dedication of the Benjamin Franklin monument being erected in Paris.

CORRESPONDENCE.

Great Britain.

London, March 7.—After a short respite the [illegible] the power bill, both for London and the provinces, are once again attracting considerable attention. There are about a dozen affecting London and half that number concerning the provinces. [illegible] important stage of second reading in their parliamentary career has now been reached, this being the first occasion upon which a vote of the House of Commons upon it can be exerted, and many of the bills are in danger of being rejected at this stage there is a strong probability, if the more radical members of a very radical Parliament can have their way. But it is quite evident that the government itself is in a dilemma in the matter, for the second reading has already been postponed for a week, which is a sign of hesitancy to let the subject be settled by a direct vote in the House without a full consideration of all the schemes on their merits.

There are three courses, one of which might be followed. First, as just mentioned, a debate might be allowed on second reading, which might have the effect of preventing many of the proposals being considered from their engineering and financial aspects, a procedure which the Cabinet itself is undoubtedly loth to take. Second, the appointment of a royal commission has been suggested, but such tribunals are now becoming historical as instruments of delay, and there seems a good deal of opposition to this. Third, the appointment of a joint committee of both the House of Commons and the House of Lords would have the effect of but one year's delay, as against a possible two or three years, in the case of a royal commission. Which of these courses is likely to be followed it is hard to say. The most commonsense method would be for an arrangement to allow the second reading to be unopposed and to leave the matter to be settled by a private-bill committee, first in the House of Commons and later in the House of Lords, but it is doubtful whether, with the strong contingent of labor members, plus an equal number of London County Council members, this could be amicably arranged. The pressure upon the two sections of Parliament, from their constituencies, to oppose with all their might, will probably prove too strong.

Mention of royal commissions recalls the statement in the House of Commons a few days ago, that it is not the intention of the government, this session, to put into force any of the recommendations of the Royal Commission on London Traffic. This has come as a great surprise to many, for the late government had announced that a traffic board would in all probability be formed, and it was the general expectation that in a non-political matter of this description, a continuity of policy would have been adopted. One fairly comprehensive scheme of tube railways we know was not promoted this session in view of the constitution of the traffic board and its possibly getting to work next year, and if the present intentions of the government are adhered to, these promoters, who, as a matter of fact, at great expense have deposited this scheme every session for three years, will have got a poor reward.

A bill has been introduced into Parliament to extend for a further six years the government control over the space-telegraph industry. It is unopposed and will pass into law this session.

A royal commission has been appointed by the government to inquire into the system of working the canals in this country. This is a matter which has been attracting considerable attention of late, for the fact that a large proportion of the canal mileage is in the hands of the railway companies has rather led to their deterioration as a means of transport. Some interesting evidence is being looked for on the question of electric haulage.

As an echo of the recent fiscal controversy in this country, mention may be made of a report that Messrs. Callender, the large cable makers, intend to set up works in Germany in order to overcome the heavy import duties on such goods entering that country. It is stated, however, that such an action would leave their British works as at present.

Negotiations have been going on between the postmaster-general and the five municipalities owning telephone exchanges, with regard to the government purchase of these systems, but so far a satisfactory arrangement has not been arrived at, and the local authorities in question are conferring on the matter.

The speeds permitted upon the London County Council tramway system, on certain sections, has been increased to 16 miles an hour, with the permission of the Board of Trade. Two tenders, amounting to nearly $2,000,000, have been let for the conversion of two of the main horse routes on the northern tramway system. G.

Dominion of Canada.

Winnipeg, Man., March 17.—A bill has been introduced into the Manitoba Legislature to empower the government to take over all the telephone lines in Manitoba and run them as a municipal concern. The bill would give the government power to expropriate the lines, with a view [illegible] Manitoba [illegible] the government [illegible] telephone system [illegible] either under Manitoba [illegible]

The capital stock of the [illegible] Electric Light Company has been increased to [illegible], which will be spent on enlarging the plant.

The Kerr Vegetable Company [illegible] an electric-light plant at Canning, N. S. [illegible] proposed to transmit power to [illegible] and Kingsport.

A by-law has been passed by the Council of Carberry, Man., authorizing the local Council to raise $15,000 by debentures, for the purpose of establishing a municipal electric-light plant. The council will proceed with the work [illegible] and expects to have the plant in operation by next fall. Tenders will shortly be called for, and the entire plant purchased this spring. R. A. [illegible] is the clerk, and Dr. J. M. Eaton, mayor.

On June 1st all the Ogilvie mills in Winnipeg, the biggest in Canada, will be operated by electric power. R. S. Kelch, consulting engineer of Montreal, will purchase the necessary plant for the mills and warehouses.

A bill giving the council of Portage la Prairie, Man., power to borrow $50,000 to construct an electric-light system has passed the Manitoba Legislature, and the council will at once proceed to install a plant. E. Brown is mayor and F. A. Whittaker town clerk.

The Toronto and Hamilton Railway has given notice that an application will be made to Parliament for an act changing the name of the company to the Toronto, Niagara and Western Railway Company, and authorizing the company to extend its railway from some point on the main line to the international boundary, at or near the city of Windsor. The company will ask permission to increase its capital stock and to enter into arrangements with electric power companies for the transmission of electric power over its right-of-way for the purpose of changing from steam to electric traction.

The Toronto and Niagara Power Company intends to run its power line through the city of Brantford, and has taken up its options on the right-of-way which its engineers surveyed last fall. Arrangements are being made to build a radial road over the same course this spring.

D. O. Cameron, solicitor of Toronto, is making application to the Ontario Legislature for an act to incorporate the East Toronto and Danforth Electric Railway Company.

The Canadian Pacific Railway Company has obtained control of the majority of the shares of the proposed Fraser electric railway, which is to run from Chilliwack to New Westminster, and will build this summer. The company states that it intends to extend the electric line down the Fraser River, past New Westminster, to the delta, and in this way take in the whole of the Fraser River Valley. H.

New England.

Boston, March 17.—The Consolidated Railway Company is making a new survey for the electric railway between Rockville and Stafford, Conn., a part of the proposed road between Hartford, Conn., and Worcester, Mass. This road was contemplated by the Stafford Springs Street Railway Company, control of which was recently acquired by the Consolidated company.

The trustees of the Worcester Railways and Investment Company, which controls the stock of the Worcester Consolidated Street Railway Company, have announced that a New York broker has offered $105 per share for the Railways and Investment Company's stock. It is believed that the broker is acting for the New York, New Haven and Hartford Railroad Company. If the railroad company obtains control of this company, it would own electric railways, present and prospective, connecting Worcester with Springfield, Mass., and Hartford, Conn. The railroad company seems to be forming an electric-railway system as extensive as its steam-railroad system, by which it will become a serious competitor to the Boston and Albany Railroad. The Railways and Investment Company's stock was selling at $80 per share six months ago.

The Atlantic Shoreline Company has bought control of the Portsmouth, Dover and York electric railway, the stockholders of both companies having voted in favor thereof. The Atlantic Shoreline

company will increase its capital from $1,000,000 to $3,000,000.

Charles F. Fielding, aged 18 years, of Newport, R. I., has received an appointment as operator in the United States naval service. The government's attention was called to him through his fitting up a wireless apparatus with which he interfered with the working of the government's wireless instrument at the Newport torpedo station. He enters the United States service as a third-class electrician.

The Pratt & Whitney Company, manufacturer of machinery and small tools, is to build a machine shop 256 feet long, 180 feet wide and 80 feet high, in Hartford, Conn., to be lighted and operated by electricity.

The Wason Car Manufacturing Company of Springfield, Mass., has received an order for five electric passenger cars and six electric mail and baggage cars, costing $75,000, from the Pennsylvania Railroad Company. The cars will be used on the line between Camden and Atlantic City, N. J. This is the second order the Wason company has received from the Pennsylvania company within the last few months.

The Boston Automobile Dealers' Association is holding its annual exhibition of automobiles and power boats in Mechanics' Building, this week, with an overflow exhibit in Symphony Hall. Every well-known make of machine is on exhibition. The following electrical firms have exhibits: American Electric Novelty Manufacturing Company, Hutchinson Electric Horn Company, Electric Storage Battery Company, Connecticut Telephone and Electric Company, Monitor Electric Speed Recorder Company, Babcock Electric Carriage Company, Electric Rubber Manufacturing Company, Dow Portable Electric Company, and Heinze Electric Company. There are also exhibits of Columbus, Baker, Columbia and Constanti electric cars.

The New York, New Haven and Hartford Railroad Company is preparing to build a machine and boiler shop at Readville, Mass., which will be operated by electricity. The building will be 900 feet long, 150 feet wide and 40 feet high from floor to truss. It will be equipped with four electric hoists. B

New York.

New York city, March 17.—The differences of opinion as to methods of electric traction held by the respective engineers of the New York Central and New Haven railroads were expressed at the meeting of the New York Railroad Club on Friday evening, as reported in another column.

The Mohawk Valley company, a Vanderbilt creation, which controls sundry trolley lines up state, has decided to equip a stretch of track between Syracuse and Utica, alongside the tracks of the West Shore Railroad, with a third-rail system of traction. General details have already appeared in the Western Electrician. The line from Rotterdam Junction to Rochester is also to be equipped in the same manner as soon as plans can be perfected.

Bids for the central power plant at the Brooklyn navy yard will be opened on March 31st. At a later date bids will be asked for similar equipments at the Charlestown, New Orleans and Pensacola yards.

The Elsberg rapid-transit bill has been amended in committee to the effect that the city "may," not "must," make separate contracts for the construction and operation of future subways. The Board of Estimate, however, has the first and final word in this matter, and a modified rapid-transit commission attends to the details.

For the fourth year in succession arguments have been heard at Albany for the appointment of a railroad commission to control the railways in New York city, in the same manner as the state commission supervises affairs outside. Another bill asks for public hearings of traction projects, so that citizens' organizations may have an opportunity to examine details and protest against any unjust conditions. Assemblyman Harte is asking for a law compelling all street cars to be equipped with heating apparatus to maintain a constant temperature of 60 degrees.

Chief Engineer George S. Rice of the Rapid Transit Commission reports that he recently employed 40 men to investigate traffic conditions in the subway, and finds that the regular schedules are not observed, and that no attempt is made by the company to care for the normal conditions of of excess traffic at certain times, such as, for instance, the Sunday-morning church going.

A subway express car was derailed on Thursday morning during the rush hour, but the emergency brakes acted as they were intended to act, and no very great harm was done except a delay of traffic for nearly four hours. General Manager Frank Hedley did heroic work in straightening out the tangle.

The lights at many of the subway stations have been out of action since Friday morning, and meanwhile a few lamps at each ticket office are being lit from the third rail. The cause of the failure of the feeder supplying the usual lamp circuits had not been found up to late this evening. The lighting circuits were kept separate purposely, and this is the second time that a fault difficult to locate has developed.

Dr. George A. Soper made an authoritative statement on Thursday before the Academy of Medicine as to the subway air. He said: "I think the subway, as a whole, is sufficiently ventilated, and is free from conditions injurious to health, except as to the presence of metallic dust, lack of sanitary care and conditions inseparable from overcrowding. The lack of sanitary care can and probably will be corrected. I do not know whether it will be necessary to do anything about the dust. If future investigations show that the dust is really dangerous, American ingenuity can certainly find a way to prevent it."

Brooklyn subway men held a celebration last Sunday on the completion of another definite section of the tube construction, extending from the Borough Hall, Brooklyn, to the Battery. It is expected to be able to pass from Brooklyn to New York by next December.

Fire at the Fiftieth Street car barns of the Metropolitan company did $75,000 worth of damage last Sunday. The Forty-second Street barns were destroyed a week previously.

The mayor of Syracuse, N. Y., has filed a complaint with the state lighting commission, alleging poor quality of electric illumination provided by the Syracuse Lighting Company.

The Atlantic City (N. J.) Light and Equipment Company has been incorporated with a capital of $50,000. Another New Jersey incorporation is that of the American Water Power Company, Jersey City, with a capital of $100,000. With a similar capital, the Electric Metal Recovery Company has also been organized.

Fifty tape machines, directly connected with the Boston Stock Exchange, are being put in sundry offices in this city. D. W. W.

Southeastern States.

Charlotte, N. C., March 17.—The sum of $50,000 has been voted for an extension of the Birmingham Railway, Light and Power Company through the suburb, Avondale, the council of the last-named village having given the desired franchise. The company has just installed a 3,000-kilowatt steam turbine. A duplicate of this turbine has been ordered and will be installed during the next two or three months.

The Electric Supply Company has been incorporated at Charleston, S. C., with $10,000 capital.

The Opelika Railway, Light and Power Company of Opelika, Ala., has, after a lapse of some time, again started work on an electric line from Opelika to Auburn, Ala. The franchise includes, besides the street railway, a light and power plant.

The sum of $700,000 has been added to the capital of the Ware Shoals (S. C.) Power Company, making the capital $1,000,000. N. B. Dial, Benjamin Riegel and others are interested.

The annual report of the North Carolina corporation commission, just out, says: "The constant tendency of the larger companies to absorb the smaller ones in the state makes it important that the power to regulate rates and supervise service shall be made full and clear. The present statute on this subject is somewhat meager. L.

Ohio.

Cleveland, March 17.—Articles of incorporation have been issued to the Sandusky, Fremont and Southern Railway Company of Sandusky, with a capital stock of $10,000. T. H. Hogsett, M. G. McAllenan, H. H. Johnson and others are the incorporators.

The Interurban Railway Company of Cincinnati has been incorporated with a capital stock of $5,000 to operate a line from Lebanon to Morrow.

Reports from Elyria are to the effect that the Lake Shore Electric is endeavoring to secure an entrance into the center of the town. It is said that in order to do this the company must build a belt line around the city.

Notice has been given of a change of name of the O'Kane-Hall Company of Columbus to the Roass-Hall Electric Company.

A new 1,000-kilowatt generator has been put in use in the viaduct power house of the Cleveland Electric Railway Company, and the West Side lines will now have plenty of power.

The Sandy Valley Traction Company of Minerva has been incorporated with a capital stock of $10,000 by Willard Pennock, E. S. DeFord and others.

People of Columbus feel certain that they will secure the next annual meeting of the American Street and Interurban Railway Association from what was said by the committee which met there last week. Columbus is well provided with hotels. It is also a central point with splendid railroad facilities, and would be a good place for such a meeting.

Reports from Toledo are to the effect that the Everett-Moore syndicate is negotiating to the end that they may own not only the local railway systems in Toledo and Detroit but connecting lines between these two cities and Toledo and Cleveland. Only the connection between Toledo and Detroit is needed to make their plans complete, so far as connections are concerned. This would give them the union station at Toledo also.

R. B. Repass was in Columbus this week for the purpose of selecting a location for a station for the DeForest system of space telegraphy. He said that the station would be in working order within 90 days and that it would be used as a distributing point for the smaller towns in the central part of the state. This will be the first station for an inland city between the lakes and Atlanta.

S. A. Webb and John J. Chester of Columbus were in Galion a few days ago to discuss plans for building an electric railway from that point to Delaware, paralleling the Big Four.

The West Unity Power and Light Company of West Unity has been incorporated with a capital stock of $15,000 by J. H. Miller and others.

Right-of-way has been secured for an extension of the Fort Wayne, Van Wert and Lima from Lima to Ada, a distance of 23 miles.

Officers of the electric roads running out of Cleveland state that they have had no thought of cutting their fares to meet the two-cent fare on steam roads. They say their fares have always been under two cents a mile and they have so far seen no difference in the amount of travel as a result of the change.

Columbus men have organized the Battle Creek and Southeastern Railway Company to build a line from Battle Creek to Coldwater, Mich., 28 miles. Scott A. Webb is president. The capital stock is $500,000.

The Urbana, Bellefontaine and Northern has met the cut of the steam roads with which it comes into competition.

Bills have been introduced in the Legislature as follows: Allowing electric-railway companies to sell current for light and power to persons along their lines; providing that companies may issue bonds in excess of the par value of the capital stock, with a tax of one-tenth of one per cent. on such excess; providing that franchise ordinances shall be submitted to a referendum vote if 10 per cent. of the voting population of a municipality demand it.

A franchise has been granted to the Dayton Citizens' Electric Company to operate in Dayton.

Plans have been completed, it is said, for the reorganization of the Barney & Smith Car Company. It is proposed to make the capital stock $5,500,000. Bonds aggregating $2,000,000 and bearing five per cent. interest will be issued to provide additional working capital.

The sale of the Springfield and Chillicothe line to a company, of which E. W. Christy of Cleveland is president, has been confirmed by Judge Kunkle. Arrangements have been made to take care of the claims against the old company.

O. M. C.

Indiana.

Indianapolis, March 17.—Prominent citizens from Madison and Liberty visited President C. L. Henry of the Indianapolis and Cincinnati Traction Company at Rushville and asked for an extension of the company's line to their cities. Mr. Henry promised to investigate the scheme.

The Indiana Contracting Company of Indianapolis has filed articles of incorporation capitalized at $50,000, to finance and construct street and interurban railways. William C. Shoemaker, John A. Shoemaker and George P. Lylon are the incorporators.

Ora Blickenstaff has taken service as a conductor on the Indianapolis and Northwestern Traction line. He is desirous of obtaining knowledge of the successful operation of a big electric-railway system. Mr. Blickenstaff is vice-president and superintendent of the Indianapolis and Ohio Valley Traction Company and will soon assume control of the new company.

The mortality rate for Indiana has been materially decreased during the last few years. Among the causes contributing to this, cited by a noted physician, is the numerous interurban railroads which have promoted public health resorts, pleasure parks and outdoor amusements for the people. "To cars running hourly during the hot summer months, carrying passengers from the heat and dust of the city to the cool resorts and pure air of the country, may be contributed no small share of the reduction of mortality rate," said he.

The Indianapolis Traction and Terminal Company will declare its initial semi-annual dividend of one per cent. on April 1st. The company was organized in 1903, capitalized at $5,000,000. The company's stock is now quoted at 92 on the local exchange.

The Delaware Hotel Company of Muncie has decided to install an up-to-date electric-light plant in the new hotel which the company is building.

The City Council of Cannelton has directed the electric-light board to rebuild the electric-light plant recently destroyed by fire. The cost of the new building is estimated at $3,000 and the new machinery necessary will call for a sum much larger.

A new stock company has been organized at Frankfort to construct a new waterworks plant to cost $150,000. The City Council has voted to allow the city to take $25,000 of the stock of the new company, but the right of the city to do so will be contested by the old waterworks company. The old company's franchise expired last January and the council and the company have failed to agree upon the terms of a renewal of the franchise. The

new company is headed by A. A. Laid and J. W. Colter.

The DeFord Automatic Switch Company has filed articles of incorporation. The capital stock is $10,000. The object of the company is to establish a large plant in this city to manufacture automatic switches, a patented device for steam and electric railroads. The directors are Joseph H. DeFord, J. C. Heyworth, W. H. Porter and William S. Pittman. S. S.

Michigan.

Grand Rapids, March 17. Although a report on the financial condition of the Escanaba municipal lighting plant for the period from August 1, 1905, to December 31, 1905, submitted to the council, shows that the net earnings were $8,352.76, the same report shows that the overdraft against the institution was increased from $10,805.05 to $11,430. The report on the condition of the plant is confusing in that while depreciation on the boilers and gas section is provided for, no depreciation is figured for on the electric plant or the plant building. It is also interesting to note that the overdraft against the plant at the present time, as shown by the city treasurer's report, is but $118.08 less than the overdraft on August 1, 1905, and action has been taken by the council to increase the indebtedness. A request from the Board of Public Works asking that it be empowered to purchase a new auxiliary boiler for the plant at a cost of $3,000 was granted, and the overdraft is accordingly destined to take another leap. According to the report the actual earnings of the lighting plant for the period ended December 31, 1905, was $21,831.75. The total operating expense of the plant was $11,903.11.

Chicago capitalists who have been contemplating the construction of power dams along the Flint River are inclined to go ahead with the preliminary work. John Alling of Chicago has taken an option on 150 acres of land belonging to William Dorwood of Montrose and also on property now owned by John M. Soutter. The large acreage flooded on the Dorwood farm will not only be devoted to furnishing power but to establishing a place for pleasure craft as well. Much interest is being taken in the new Genesee dam proposition, and there are said to be indications that the deal will be put through.

The new 3,000-horsepower steam turbine for the public lighting plant at Detroit has been shipped from Pittsburg. Today there are nine reciprocating engines of varying power in use. Running to full capacity, with some overloaded, they are lighting 3,118 arc lamps and supplying the city's incandescent service, which is the equivalent of approximately 700 arcs lamps.

The question of constructing a municipal electric-light plant and issuing bonds to the amount of $150,000 will be submitted to the voters of Flint on April 2d.

The taxpayers of the village of Hanover have voted 83 to 9 in favor of bonding for a lighting plant and 8 to 10 in favor of a waterworks system. The total issue will be $8,250 and the rate of interest five per cent.

The Houghton County Street Railway Company is to have another extension project to consider. Calumet business men want the company to extend its line from Wolverine to Mohawk. The Mohawk location now has some 2,000 inhabitants.

The Kalamazoo, Lake Shore and Chicago Traction Company has the new line between Kalamazoo and Paw Paw in operation. Until the road is completed through to South Haven, which will be about June, a dummy engine and two passenger cars will be used on this section of the road.

L. W. B.

Northwestern States.

Minneapolis, March 17.—The Ames (Iowa) and College Railway Company is preparing to equip its line with a system of gaso-electric motor cars.

The Marconi Wireless Telegraph Company is planning to establish a station at Minneapolis and will eventually place several stations throughout the Northwest.

An agitation has been started to have the city electric-light system at Menasha, Wis., enlarged. The improvements planned would cost about $25,000.

An old project to build an electric railway between Sioux City and Spirit Lake, Iowa, is being revived by Sioux City promoters.

A new 300-kilowatt dynamo has been installed in the electric-light plant at Austin, Minn.

A. G. Lewis, county auditor of Cass County, N. D., will receive bids until April 5th for electric fixtures to be installed in the new courthouse at Fargo. R.

Pacific Slope.

San Francisco, March 16.—The San Francisco Gas and Electric Company has ordered three additional General Electric motor-generator sets of 1,000 kilowatts each, which will be installed in Station C, where the disastrous fire of February 22d destroyed five engines and 11 generators. Under the new arrangement no engine-driven generators will be operated at this station, although one of the boilers will be restored to [illegible] steam to the [illegible] Building [illegible]. The direct current [illegible] tion and [illegible] generators driven by [illegible] at Station A [illegible]. [illegible] generated [illegible] has almost recovered from the effects of [illegible]. However, the new [illegible] plant of the [illegible] Light and Power Company [illegible] current to supplement the Gas and Electric Company's plant.

It is reported that the general contract for a complete steam power electric generating station to be established on the ocean [illegible] of Los Angeles has been awarded to Charles C. Moore & Co. of San Francisco by the Pacific Light and Power Company. Three 5,000-kilowatt generators and auxiliary apparatus are to be installed, together with direct-connected engines, [illegible] condensing plant and salt water pumping station. The new plant will be used to supplement the present steam plant in Los Angeles and will be advantageously located for supplying the electric railways of the Huntington system, extending to the various beaches.

No further details have been given out as to the reported purchase of the Mutual Electric Light Company by the Pacific Gas and Electric Company. It is known that a good deal of the stock changed hands, but no change has taken place at the plant of the Mutual company. It is reported that the Central Light and Power Company's 2,500-horsepower plant is to be taken over at $9.25 per share of stock.

The Central Traction Company has authorized a bond issue of $1,500,000, the proceeds of which will be used in the construction of an 18-mile electric line from Stockton to Lodi, Cal., and for other purposes. The company already has nine miles of track laid in Stockton, Cal., and has plans drawn for extensive work in the San Joaquin and Sacramento valleys.

Fourteen carloads of rails have been received for the rebuilding of the Stockton electric railway system, and 16 new broad-gauge cars are due to reach Stockton before April 1st. The system, which is now narrow-gauge, will be broad-gauged and rebuilt in a thoroughly modern manner.

Allan Pollok, manager of the San Francisco Gas and Electric Company, has resigned his position and will hereafter devote his entire time to the development of an extensive water rights and power rights in Stanislaus County, where Mr. Pollok and associates have extensive claims.

At a meeting held on March 15th the City Council of Portland, Ore., accepted the offer of the United Railways Company of $150,000 for a 25-year franchise for a trunk-line railway to connect the railroad depots in the north end of Portland with those in the south end.

The franchise held by the Spokane Light and Power Company, carrying right and privilege to build and operate a light and power plant in Spokane, has been sold to Jay P. Graves, who has also secured waterpower and privileges at the falls in the Spokane River, known as the Bowl and Pitcher. It is understood that it is the intention to bring the power to Spokane, where a commercial lighting plant will be installed.

Charles A. Hardy and E. A. Hall have purchased for the Willamette Valley Traction Company of Portland, Ore., the entire plant and holdings of the Cottage Grove Electric Company of Cottage Grove, Ore., for $16,000. The purchasing company will furnish light and power to Cottage Grove, and will shortly install new and better machinery.

Ira P. Englehart has filed on 3,000 cubic inches of water per second from the Naches River, near North Yakima, Wash., to be used for power and manufacturing purposes. This is believed to be preliminary to a new lighting and power plant for North Yakima.

It has been announced that the Portland General Electric Company will install an additional hydro-electric generating plant at Oregon City, Ore., at a cost of $2,000,000. The capacity of the new plant will be 40,000 horsepower. The company has purchased the Citizens' Light and Traction Company of Salem and the Union Light and Power Company of Silverton from Barstow & Chambers, and will extend its power lines south, so as to furnish light and power to all towns between Portland and Salem. A.

PERSONAL

B. F. Coe has resigned as president of the Independent Telephone Company of LeClaire, Iowa, and James J. Ryan was elected to fill the vacancy.

E. S. LeClair, manager of the Northwestern Telephone Exchange Company at Faribault, Minn., has been transferred to a position in the Twin Cities.

President C. A. Coffin of the General Electric Company arrived at New York last week, with Mrs. Coffin, from Naples, on the White Star steamship Celtic.

J. T. Rice, local manager of the Southwestern Telegraph and Telephone Company at Austin, Tex., has been appointed manager at Houston, succeeding Fred Linington, who has been promoted to [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

G. A. [illegible] Northwestern [illegible] telephone busi[illegible] there.

ELECTRIC LIGHTING

Mayor Leiby and associates of [illegible], N. D., have formed a company and will install an electric light plant in Ellendale.

Trustees of Susanville, Cal., have granted [illegible] Granham a franchise for 50 years to put up poles and wires for electric light and power purposes in Susanville.

E. T. Herritt of Green River, Utah, proposes to install an electric-light plant there for lighting purposes. He will develop the water of the Green River in Emery County, where he believes 13,000 horsepower can be produced from turbines.

The City Council of Cloverport, Ky., has passed an ordinance granting an electric-light franchise, which has been sold to H. Stewart Miller, who will erect a plant at once. The city will make a contract with the electric-light company to furnish the city with lights.

A bond issue of $200,000 has been recommended by the City Council of Pasadena, Cal., the proposition to be submitted to the voters: Of this amount $125,000 is to be used for the purpose of erecting a municipal electric power house and providing a system of wiring for street illumination and commercial service throughout the city. The balance, $75,000, is for the purpose of improving and enlarging the fire department, according to plans formulated by the city commissioners.

A device for the controlling of electric headlights on street cars has been invented by George B. Gardner and Fred M. Furber of Haverhill, Mass., and the device is already in use on several cars of the New Hampshire electric-railway systems. The new device is an inexpensive one and can be put on any car in 20 minutes without change to either the car or the headlight. It is easily controlled by the foot of the motorman and the full light can be thrown directly upon the track while going around a curve. The device is movable and can be shifted from one end of the car to the other.

ELECTRIC RAILWAYS

The Arlington Heights Traction Company is building a new street-car line in Fort Worth, Tex.

The State Electric Company of Clinton, Iowa, has been succeeded by the Clinton Street Railway Company.

The February gross earnings of the Manila electric railway amounted to $70,000. Operating expenses were $34,845, leaving net earnings of $35,755.

The Memphis Street Railway Company of Memphis, Tenn., has purchased additional property on Broadway, on which it intends to erect a new power house in the near future.

The Elgin and Du Page Electric Railway Company of Bloomingdale, Ill., has been incorporated to build an electric railway from River Forest to Elgin, Ill. The new line will connect with the Chicago and Oak Park Elevated.

The Georgia Railway and Electric Company has under consideration plans for its new building, which will be erected at the corner of Piedmont Avenue and Jenkins Street, Atlanta. It will be not only an office building, but will be in a sense a club house for the motormen and conductors and other employes. Bowling alleys, shower baths,

lockers and reading rooms will be provided in the building for the comfort and pleasure of the men. The structure will be three stories high and will be built of brick, costing $40,000 or $50,000.

The Chicago and Milwaukee Electric Railroad Company reports gross earnings for February amounting to $36,593. This compares with $23,599 for February, 1905. Operating expenses for February, 1906, and February, 1905, were, respectively, $21,050 and $14,888.

The Aurora, DeKalb and Rockford electric railway will be in operation to DeKalb, Ill., by May 1st, if present plans of the owners are carried out. What motive power will be used is not yet decided. A trip over the road has been made for the purpose of discussing this matter and the question of buying power.

Permission to haul freight through the streets has been asked of the City Council of Elgin, Ill., by the Elgin-Belvidere electric railway. The company is negotiating for the Coliseum Building, to be used as a freight station. The new road has decided to build its car barns at Marengo and the main offices will be in Elgin.

The San Diego Beach Railway Company has been incorporated at San Diego, Cal., with a capital stock of $6,000,000 to build an electric railway south from Los Angeles, and as near the beach as possible, to connect with the San Diego, Pacific Beach and La Jolla line at La Jolla. The latter line is now being equipped for electric traction.

Representatives of the Bowman-Peck-Wells dairy interests of Chicago have arranged with the Aurora, Elgin and Chicago electric railway to ship 40,000 pounds of milk daily from the Batavia (Ill.) dairies during the next six months. The combined interests of the farmers and milkmen in this matter were placed in the hands of a number of the most influential farmers in the vicinity of Batavia.

The Rock Island (Ill.) Southern Railway Company has not been able to reach an agreement with the People's Traction Company of Galesburg, Ill., in the matter of purchasing electric power for its line, and has decided to build a power house of its own in Cameron, Ill. It will be a 1,200-horsepower direct-current station. The car barn and repair shops will also be put up at Cameron. It is now the hope to operate the line by May 1st.

After a struggle of two years or more, the Chicago, Milwaukee and St. Paul railroad ordinance has been passed by the Chicago City Council. This ordinance is designed to give the residents north of the Wilson Avenue terminus of the Northwestern Elevated direct transportation downtown and around the loop for a five-cent fare. It conveys power to the Chicago, Milwaukee and St. Paul company to elevate the tracks of its Evanston division and to operate a six-track railroad over them, connecting with the Northwestern at Wilson Avenue. It gives the St. Paul company 18 months in which to make its connection with the elevated tracks by an inclined approach and allows it to operate trains on grade until December 31, 1913. By that date elevation must have been begun and it must be finished by December 31, 1916.

A company to be known as the St. Louis Electric Terminal Company has been incorporated in Missouri, the purpose being to build an electric railway from Bremen Avenue and the Mississippi River front to the heart of the city of St. Louis. This, it is understood, is to afford an entrance into St. Louis for the McKinley electric-railway system of Illinois. The Springfield (Ill.) News says: "The plan on which the McKinley line is working is to cross the river on transfer boats from Venice, Ill., to Bremen Avenue and then on an elevated line west, probably on Salisbury Street, to Ninth, and south on Ninth to Cupples Station, which is the point the new road wishes to reach. As an important feature of the business of the new road will be its coal traffic, the terminal plan under consideration contemplates building large coal yards in the neighborhood of Ninth and Salisbury streets, St. Louis.

What might have been a very serious accident on the North Avenue line of the Chicago Union Traction Company on the evening of March 14th was averted by the narrowest margin. There is a temporary bridge over the North Branch of the Chicago River on this line. The draw in this bridge consists of a swinging portion of the bridge, one end being pivoted and the other resting on an electrically operated scow or pontoon, which carries the end of the bridge around. When the accident occurred the draw was just being opened. A crowded car holding nearly 100 passengers came up almost at full speed, and crashing through the heavy chain stretched across its path, went into the draw, one end falling on to the scow, which kept the car from plunging into 20 feet of water, from which it is inconceivable that any of the passengers could escape drowning. The accident, while primarily due to the motorman's carelessness, was also due to the slippery track, darkness and the absence of any brakes except of the most antiquated style, which rendered it impossible for the motorman to avoid the result of his carelessness.

SOCIETIES AND SCHOOLS.

The International Brotherhood of Electrical Workers, which has chosen Springfield, Ill., for its national headquarters, has secured a suite of five rooms on the third floor of the Pierik Building. The lease was secured by President F. J. McNulty, and final preparations will soon be made for the transfer of the headquarters from Washington, D. C. The transfer will probably be made April 1st.

The next general meeting of the American Electrochemical Society will be held in Ithaca, N. Y., May 1st, 2d and 3d. It is planned to have the headquarters at the Ithaca Hotel. The forenoons will be devoted to the reading and discussion of papers, and the afternoons to inspection trips to the laboratories and shops of Cornell University, to the filtration plant, the hydraulic laboratory, the university power plant, the Ithaca Gun Company's plant, the Remington Salt Company's plant and the Morse Chain Works. Among the papers to be read are the following: "Cadmium Standard Cell," by G. A. Hulett; "The Electric Vacuum Furnace," by W. C. Arsem; "Electrodeposition of Bronze," by B. E. Curry; "Impurities in Electrolytic Copper," by F. F. Colcord; "The Development of the Nickel-plating Industry," by Isaac Adams. The secretary of the society is Mr. S. S. Sadtler of 39 South Tenth Street, Philadelphia.

AUTOMOBILES.

Only two automobile shows will be sanctioned next year by the National Association of Automobile Manufacturers, the annual show in New York and the Chicago show. Besides taking this action the executive committee of the association at its regular meeting placed itself squarely on record as opposed to the tendency to hold a continuous chain of shows, as has been the case this year. In the opinion of the committee the lesser shows, such as at Boston, Cleveland, Detroit and Philadelphia, have not been productive of benefits to the industry commensurate with the time and expense involved. General Manager Samuel A. Miles reported that the net profits of the Chicago show were $25,000, one-half of which will be retained for the work of the association and the other half divided among the exhibitors.

Charles E. S. Burch, who has extensive mining interests in Alaska, has invented a type of ice automobile which he hopes will overcome many of the difficulties of transportation in the cold season of the year. His automobile consists of a heavy box or body part carried at the four corners by four spiral wheels or runners, each driven by a separate engine. These spirals are made of steel and are made with sharp edges and grip the ice. Each being driven by its own engine and operable in either direction, very good control of the movements of the vehicle may be had. The inventor's plan is to use the machine to draw long trains of sleds. The body part is made watertight, so that, if the machine should get into open water, it may be propelled as a boat. The vehicle is steered by means of two semicircular disks at each end of the body, which are operated by compressed air.

MISCELLANEOUS.

The secretary of the Decimal Association of London announces that he has received 53 promises of support for the metric system from new members of Parliament. In the last Parliament there were 330 pledged to support the adoption of the metric system. There are 253 votes now relied upon and the total support is sure to equal that in the last Parliament.

Mayor Dunne of Chicago, with a party of city officials, recently took a trip through a part of the Illinois Tunnel Company's system under the guidance of Chief Engineer and General Manager George W. Jackson. The mayor was much impressed with the scope of the system and was pleased with the trip. He took the trip principally to find out the conditions at the Northwestern and Union depots, at which points the tunnel company is having a dispute with the city authorities regarding rises in the tunnels to make connections.

The merger deal by which the public utilities of Moline and Rock Island, Ill., and Davenport, Iowa, become the property of Tri-city Railway and Light Company has been completed. The companies taking part are the Tri-city Railway Company, People's Power Company, People's Light Company and the Moline, East Moline and Watertown Interurban Company. In this deal $8,115,000 was paid, and for the Walsh street-car and light companies of Davenport an additional $2,000,000 will be paid. J. R. Beetem of Philadelphia is to be president of the new concern.

The city of Sacramento, Cal., proposes to remove all telephone, telegraph, electric-light and trolley poles from the streets in the business section of the city. This includes poles at the edge of the sidewalk which support illuminated signs in front of nearly all the business houses. Electric signs attached to the building will not be removed. The Sacramento Electric, Gas and Railway Company, to avoid the expense of an underground trolley system, is endeavoring to secure permission to attach the span wires for the trolley to building. If this cannot be done the company will present to the trustees of the city a scheme for ornamental iron poles.

TRADE NEWS.

The new telephone number for the New York office of the Western Electrician is 5220 Beekman.

The Electrical Equipment Company of Springfield, Mo., has succeeded to the business of the Electrical Wiring and Equipment Company.

The sales office of the Universal Electric Storage Battery Company, Chicago, has been moved from the Railway Exchange to 1307 Stock Exchange Building.

A fire in Owensboro, Ky., recently is reported to have destroyed the plant of the Kentucky Electrical Company. The loss was $25,000, with $15,000 insurance.

The Sawyer-Man Electric Company is about to begin the erection of an extensive lamp factory at Bloomfield, N. J. The plant will cost about $1,000,000 and will give employment to 1,000 men.

E. C. Sharpe, the new Pacific Coast manager for the Gould Storage Battery Company, has opened offices at 403-405 Crossley Building, San Francisco. The Century Electric Company formerly carried this agency.

The Standard Trust Company of New York has offered creditors of the National Electric Company of Milwaukee 50 per cent. of their claims, and it is said that a large majority of the creditors have accepted the offer. It is announced that a formal sale of the assets of the company will be made on March 26th.

The Navy Department, through the bureau of supplies and accounts, is inviting sealed proposals until March 27th for furnishing a quantity of fuses, electrical wire, cable, annunciator drops and parts for fan motors, embraced in schedule 409, obtainable at the navy pay office in New York or upon application to the bureau.

The Syracuse Supply Company of Syracuse, N. Y., a large dealer in steam fittings, mill supplies, etc., has opened an electrical department and is carrying a full stock. The company has placed its electrical department in charge of Mr. F. S. Baldwin, late of the R. N. Cornwell Company. It is in the market for electrical supplies of all kinds.

Sealed proposals will be opened in Washington, D. C., on April 20th for furnishing the several executive departments with electrical supplies during the next fiscal year. Among the departments requiring such supplies are the Treasury, Postoffice, Agriculture and Interior. Application for specifications and proposal blanks should be made to the chief clerk of each department.

The Railway Department at the East Pittsburg Works of the Westinghouse Electric and Manufacturing Company, has received, within the last few days, some extensive orders for electric railroad machinery. The Metropolitan West Side Elevated Railway Company of Chicago has ordered an equipment of 100 160-horsepower motors and 50 equipments of unit switch control. The Bluffton and Marion Construction Company of Bluffton, Ind., has contracted for a complete installation of electrical apparatus for a power house to operate an entire railroad, along with 32 50-horsepower motors. Many other orders were received, but the largest came from the Public Service Corporation of New Jersey, which amounted to 378 motors, varying in capacity from 40 to 75 horsepower. These will be used to equip a number of new cars on the surface lines outside of Camden. Altogether, there were contracts calling for 702 motors, and with the additional machinery included in these orders, these contracts represent orders amounting to more than $1,000,000.

The Wagner Electric Manufacturing Company, St. Louis, Mo., announces that it has recently completed arrangements by which sales of its apparatus in Texas, Indian Territory and Oklahoma will be taken care of by the Woods Electric Company of Houston, Texas, successor to D. F. Woods & Co. The sales department of this local branch of the Wagner factory will be under the immediate management of Mr. William F. Sullivan. Mr. Sullivan, for a number of years, has been intimately connected with the Crocker-Wheeler Company, and for the last two years has been attending to the interests of that company in its St. Louis office. He will give his special attention to Wagner interests. The Wagner company bespeaks for Mr. Sullivan a continuance of orders for Wagner apparatus, and assures inquirers that any requests for information made to his office will be ably taken care of. The various district offices of the Wagner company, scattered throughout the United States, will heartily co-operate with Mr. Sullivan in his handling of this southwestern territory. The Wagner company also announces that its Atlanta territory, which was formerly handled by Mr. G. C. Henry, who has been devoting only a part of his time to Wagner interests, will be handled exclu-

sively by Mr. Henry hereafter. Mr Henry has arranged his affairs so that all of his time can be given to Wagner interests.

BUSINESS.

The Standard Electrical Construction Company of San Francisco has contracted to do the electric wiring and conduit work on the new wing of the St Francis Hotel for about $20,000. This firm has also been awarded a contract for wiring the new custom house in San Francisco. The contract price was about $15,000.

The Budget estimates of expenditure of Brazil for 1906 make provision for the disbursement of certain sums on building construction, meteorological apparatus, lighthouses, life-saving apparatus, submarine construction, telegraph and telephone lines, surgical instruments, plants, seeds, stock cattle for agriculturists, waterworks and port improvement works. Provision is also made for the free importation of hydro-electric machinery and apparatus.

In considering the application of electric motor drive many power users defer the use of electricity because of the trouble which seems inevitable in changing over to electric-motor drive. Thus many good old machine tools are left to continue on an old plane of inefficiency. Electric-motor drive would afford greatly increased output and improved product. The [illegible] equipment produced by the Northern Electrical Manufacturing Company, Madison, Wis., [illegible] of application and convenience of arrangement, location and operation. For certain classes of work a special type of variable speed motor, described in Bulletin 47, has been developed. [illegible] multi-speed motors, [illegible] especially designed for application [illegible]. The bulletin is sent promptly on request.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals, until April 10th, for furnishing western navy yards with circuit breakers, voltmeters and ammeters, dry battery cells, resistance wire, etc., embraced in schedule 316, obtainable at the navy pay office in San Francisco or upon application to the bureau at Washington. On April 3d the bureau will open bids for furnishing the Charleston (S. C.) navy yard with a quantity of arc lamps, carbons, wire, lightning arresters, poles, pole fixtures, etc., embraced in schedule 320, which can be obtained upon application to the bureau.

In order to keep pace with its rapidly increasing business, The Power and Mining Machinery Company of Milwaukee, Wis., has awarded contracts for the erection of additions to its shops at Cudahy that will, when completed, more than double the present capacity. These improvements will cost upwards of $300,000, and will include a 200-foot exten- [illegible]

During [illegible] kilowatt [illegible] and three 4,500-brake horsepower units [illegible] York and New Haven Railroad. The West Virginia Pulp and Paper Company already [illegible] 1,000-kilowatt units in [illegible] has resulted from the satisfactory [illegible] first installation.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 13, 1906.

814,669. Elevator Brake. John E. Boyce, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed January 11, 1905.

An electromagnet arranged to release the brake is supplied with a resistance. Manually operable means connect the magnet directly to the source of electrical supply or through the resistance. Other means depending upon the speed of the motor automatically short circuit the resistance.

814,671. System of Preventing the Collection of Ice on Rails. Jeremiah D. Burns, Washington, D. C., assignor of twenty-four one-hundredths to Lincoln Guynn, Wabash, Ind., and William J. Sheetz, Washington, D. C. Application filed February 7, 1905.

In combination with electric feed wires and the rails of a railway system are a metallic support carried by the web of the rails and devices for increasing the temperature of the rails to melt or prevent snow or ice from collecting on the rails. The devices are electrically heated and are carried by the supports directly below the tread of the rail, the devices being connected directly to the feed wires.

814,680. Telephone Attachment. Bernhard Ehrlich, Vienna, Austria-Hungary. Application filed May 3, 1905.

A sanitary attachment for the telephone mouthpiece is described.

814,691. Storage Battery. Howard B. Hallock, Germantown, Pa., assignor to Samuel S. Williamson, Philadelphia, Pa. Application filed May 15, 1905.

The lower end of the sides of the battery jar are inclined inward and downward, conductive material lining the inside surfaces of the inclined portions. Ribs of conducting material extend across and are connected to the conductive lining and a lug extends upward from this conductive material.

814,695. Vapor Electric Lamp. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed July 7, 1904.

In a gas or vapor electric apparatus comprising a container, electrodes therein, at least one of which is of a material which is capable of being volatilized and again condensed, is a gas or vapor other than that developed from the electrode, and means for condensing approximately all the vapors developed from the electrode at or near the electrode itself.

814,696. Method of Producing Light. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Original application filed July 7, 1904. Divided and this application filed October 19, 1904.

The new feature consists in starting the apparatus by any approved means and condensing all or a portion of the vapors developed from the electrode at or near the point of development, thereby permitting current to pass mainly through the other gas or vapor and developing its characteristic light.

814,726. Vacuum Electric Furnace. Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Application filed July 23, 1903.

In an electric furnace are a suitable chamber, an independent insulated support for the walls of the chamber, a central metallic terminal and a refractory conducting block within the chamber, covering the metallic terminal and making contact therewith.

814,727. Electric Pressure Furnace. Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Application filed July 23, 1903.

An inner conducting tube of an electric furnace has an outer conducting tube surrounding it, insulating material being interposed between the two tubes. The outer tube is made in two or more parts separated by insulating material, and terminal connections for an external circuit attached to the outer tube are provided. (See cut.)

814,740. Electric Motor. John A. Smith, Dayton, Ky., assignor to the United States Electric Tool Company, Cincinnati, Ohio. Application filed November 28, 1904.

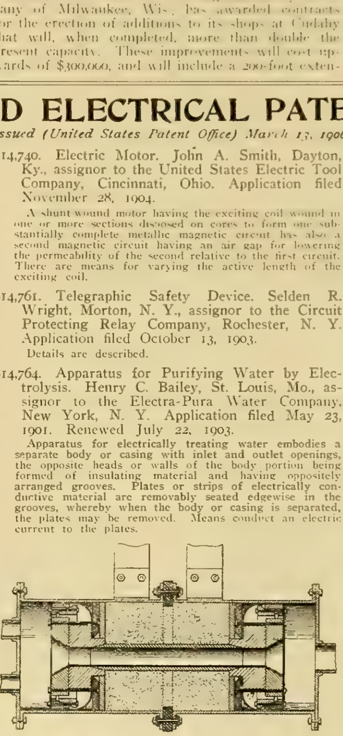
A shunt wound motor having the exciting coil wound in one or more sections disposed on cores to form one substantially complete metallic magnetic circuit has also a second magnetic circuit having an air gap for lowering the permeability of the second relative to the first circuit. There are means for varying the active length of the exciting coil.

814,761. Telegraphic Safety Device. Selden R. Wright, Morton, N. Y., assignor to the Circuit Protecting Relay Company, Rochester, N. Y. Application filed October 13, 1903.

Details are described.

814,764. Apparatus for Purifying Water by Electrolysis. Henry C. Bailey, St. Louis, Mo., assignor to the Electra-Pura Water Company, New York, N. Y. Application filed May 23, 1901. Renewed July 22, 1903.

Apparatus for electrically treating water embodies a separate body or casing with inlet and outlet openings, the opposite heads or walls of the body portion being formed of insulating material and having oppositely arranged grooves. Plates or strips of electrically conductive material are removably seated edgewise in the grooves, whereby when the body or casing is separated, the plates may be removed. Means conduct an electric current to the plates.



NO. 814,727.—ELECTRIC PRESSURE FURNACE.

814,771. Electric Rail Bond and Method of Making Same. Samuel P. Cowardin, Richmond, Va. Application filed March 6, 1903.

An electric rail bond comprises a conductor and a terminal each formed of a metal which will alloy with the metal of the other, the metal of the terminal being in intimate union with the metal of the conductor and alloyed with the metal having a lower fusing point than that of the conductor and terminal.

814,781. Fire-alarm and Sprinkler Attachment. James Hartley, Philadelphia, Pa. Application filed June 9, 1905.

The electrical feature of this device is an electric bell circuit which is closed upon the release of the parts of the device by fusion of one of the members.

814,810. Metallurgical Process. Frederick T. Snyder, Oak Park, Ill. Application filed June 23, 1905.

The process of treating sulfid ore consists of dissolving it in a fused mineral bath, and subjecting the mixture to the action of an electric current in the presence of carbon, at a high temperature, the sulfid being broken down, the metal liberated and carbon bisulfid formed at the same time.

814,825. Battery Zinc. Horatio J. Brewer, New York, N. Y. Application filed August 24, 1905.

An electrode for electrogalvanic batteries consists of a cylindrical rod of zinc formed with an external flat portion between two cylindrical portions of the rod, the flat portion affording a surface for contact with a terminal wire.

814,828. Safety Lowering Device. Victor R. Browning and Earl H. Browning, Nottingham, Ohio. Application filed May 10, 1904.

A motor drives the hoisting member, and gearing connects the motor and member. A safety lowering device in the gearing has a solenoid that [illegible] motor, and means for reversing the direction [illegible] through the solenoid and motor.

814,830. Telephone System. Louis W. Carroll, Anamosa, Iowa, assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed March 24, 1903.

A metallic circuit is normally open at the central station. Telephones are bridged into the circuit, each telephone having an annunciator and a [illegible] generator. A normally open grounded [illegible] signaling generator and an annunciator at the central exchange station located in a grounded connection of one side of the metallic circuit complete the more important parts of the system.

814,838. Stop Mechanism for Steam Engines. Joseph E. J. Goodlett, Memphis, Tenn. Application filed April 27, 1905.

The armature of an electromagnet operates the engine-stop mechanism, the circuit of the magnet being closed by a centrifugal device.

814,852. Electric Sprinkler Apparatus. Joseph W. Larish, Boston, Mass., assignor to the Gas and Electric Protective Company, Boston, Mass. Application filed June 4, 1904.

Combined with a sprinkler head comprising a valve-controlling pivoted lever are fusible means normally holding the latter in valve-closing position, electric contacts closed by the lever in its valve-releasing position and soluble means normally holding the contacts apart.

814,864. Electrolytic Apparatus. Frank McDonald, Roaring Spring, Pa. Application filed April 27, 1905.

A tank is in communication with the anode compartment of the cell, a supply pipe supplying a solution of brine to the anode compartment. A valve in the supply pipe is associated with a ball float in the tank connected by levers to the controlling valve. A resaturating tank, an overflow connection between the first-mentioned tank and the resaturating tank and various other devices for handling the electrolyte are described.

814,878. Electric Musical Instrument. Melvin L. Severy, Arlington Heights, and George B. Sinclair, Winthrop, Mass., assignors to the Choralcelo Manufacturing Company. Application filed November 24, 1900. Renewed August 1, 1905.

In an electrically operated musical instrument are a sonorous body and pulsatory magnets located upon opposing sides of the body and energized alternately.

814,887. Insulator Attachment. Hans Swanson, Warren, Minn. Application filed April 20, 1905.

A wire clamp for insulators comprises an insulator-encircling loop and a cam mounted thereon, the wire-engaging face of the cam being concaved to correspond to the contour of the periphery of the insulator.

814,889. Bubble Fountain. Samuel H. Tacy, San Francisco, Cal. Application filed October 13, 1903.

Electromagnetic means effect the oscillation of the carriage upon which the pump of the device is mounted.

814,906. Box for Electric Moldings. John L. Gleason, Jamaica Plain, Mass. Application filed July 10, 1905.

A junction box for joining at right angles two electric-light-wire moldings is described.

814,907. Junction Box for Electric Wires in Buildings. John L. Gleason, Boston, Mass. Application filed July 12, 1905.

The improved junction box comprises a side wall and a substantially flat top provided with a complete circle of radiating slots.

814,910. Electromagnetic Brake. Erwin Kramer, Berlin, Germany. Application filed August 3, 1904.

An electromagnet for vehicle brakes has a coil, an iron casing inclosing the coil, an iron shoe closing the open end of the casing and a central opening in the shoe coinciding with the hole of the coil. A core is adapted to move axially in the cavity of the coil and shoe, the core

being of such form that the cross section of the path of the lines of force from the shoe to the core is reduced when the core is drawn into the coil.

814,913. Rheostat. Edmund C. Morgan, Chicago, Ill., assignor to the Morgan Electric Machine Company, East Chicago, Ind. Application filed December 5, 1904.

A rheostat element comprises metallic sections piled in cross-wise relation, the one upon the other, to form a space through and between them in combination with terminal plates associated with the pile. Means are provided for clamping the sections and terminal plates together.

814,928. Electrical Door Opener for Elevators. Charles G. Armstrong and Charles A. Dresser, Chicago, Ill., assignors to G. A. Edward Kohler and Franklin W. Kohler, Chicago, Ill. Application filed April 3, 1901.

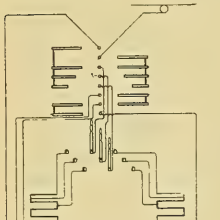
In combination with an elevator car are an electromagnetic device, a door carried upon the car, a door at the landing, means for connecting the electromagnetic device with the door carried upon the car and a part mounted upon the car door for engaging and opening the door at the landing.

814,942. Wireless Telephony. Archie F. Collins, New York, N. Y. Application filed August 21, 1905.

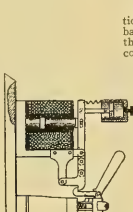
In a wireless telephone or telegraph are a source of electromotive force, an arc light, a circuit with terminals connecting the latter with the earth or other medium and a circuit including the arc light and containing also a sound converter for transmitting or receiving.

814,946. Controlling Device for Motors. Charles A. Dresser, Chicago, Ill., assignor to G. A. Edward Kohler and Franklin W. Kohler, Chicago, Ill. Application filed September 12, 1903.

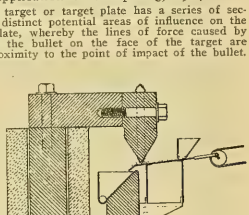
A controlling device for motors comprises a solenoid, a core therefor provided with a contact device, a series



NO. 814,981.—ELECTRIC HEATING SYSTEM FOR CARS.



NO. 815,074.—CIRCUIT-BREAKER.



NO. 815,113.—WET MAGNETIC ORE SEPARATOR.

of contacts along which the core is adapted to move, an intermediate point where the contact device normally stands when the motor is not running and means for returning the contact device to the intermediate point when moved in either direction.

814,981. Electric Heating System for Cars. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed January 5, 1900.

An electric heater for cars comprises separate casings arranged in series and resistance coils of different cross-sectional area and current carrying capacity in each casing, the respective coils of the same size in the different casings being connected together in series, and the several sets of coils also being connected in series. (See cut.)

815,006. Thermal Protector and Alarm. Frank B. Cook, Chicago, Ill. Application filed December 18, 1902.

There is in the device a metallic support, an electro-thermal cut out suitably mounted on the support, the cut out including a line spring and an alarm circuit normally open at a number of points and including the support and line spring.

815,025. Means for Operating the Electric Unloading of Air Compressors. Frederick Van Duzer Longacre, New York, N. Y., assignor to the Ingersoll-Sergeant Drill Company, New York, N. Y. Application filed November 20, 1903.

A discharge valve for an air compressor co-operates with a main regulator valve for controlling the pressure behind the discharge valve. An auxiliary valve controls the movements of the main regulator valve, and an electromagnet operates the auxiliary valve with means for energizing and de-energizing the electromagnet.

815,027. Electroplating Apparatus. Guy L. Meaker, Chicago, Ill. Application filed December 28, 1904.

An electroplate apparatus comprises a tank for containing an electrolyte, a tray for supporting the articles to be plated, the bottom of which is made of conducting material, and means for giving endwise vibratory motion to the tray constructed to advance articles resting on the tray bottom from one end of the tray to the other.

815,042. Telephone Exchange. Benno Salzmann, Berlin, Germany. Application filed November 16, 1905.

Details are described.

815,072. Electric Alarm Clock. Augusta Y. Darche, Chicago, Ill., executrix of George C. Darche, deceased. Application filed June 13, 1904.

The circuit of an alarm bell is closed at a predetermined time by the movement of the clock.

815,074. Circuit-breaking Apparatus. Frederick P. De Wilde, Chicago, Ill. Application filed November 12, 1904.

Combined with a dynamo-electric machine having an element wherein its electromotive force is developed, and the circuit therefor, are a switch included in the circuit, an electroresponsive apparatus for controlling the switch and a potential trap from the winding of the generating element of the dynamo-electric machine subject to less than the entire potential of the element, and including the windings of the electroresponsive apparatus. (See cut.)

815,096. Lamp-socket Lock. Julius C. Kircher, East St. Louis, Ill. Application filed January 6, 1905.

A lamp socket comprises a head having a collar detachably connected thereto, in combination with a lamp having means for connecting it to the head of the socket, and a lock for preventing the removal of the lamp while the collar is in operative position on the head of the socket, the lock comprising two parts, one of which is on the lamp and the other on the collar of the socket.

815,107. Telephone Toll Apparatus. George A. Long, Hartford, Conn., assignor to the Gray Telephone Pay Station Company, Hartford, Conn. Application filed March 11, 1903.

Details of the coin-controlled apparatus of a subscriber's telephone are described.

815,113. Wet Magnetic Ore Separator. Francis J. Odling and William Jamieson, Melbourne, Victoria, Australia. Application filed May 19, 1904.

Combined with a field frame having opposed poles extending horizontally are a table extending between the poles, means for feeding a mixture of water and the material to be separated to the table to flow below the upper pole, a band of non-magnetic material adapted to travel horizontally and adjacent to the face of the upper pole and means for maintaining a water web between the non-magnetic band and the table. (See cut.)

815,117. Self-registering Electrically Operated Sectional Target. George A. Peters, Toronto, Canada. Application filed April 5, 1904.

An integral target or target plate has a series of sections forming distinct potential areas of influence on the back of the plate, whereby the lines of force caused by the impact of the bullet on the face of the target are confined in proximity to the point of impact of the bullet.

815,129. Device for Controlling Generators. Joshua Struthers, Franklin, Pa. Application filed September 12, 1904.

A governor is operatively connected to the shaft of the motor, a rotary shaft being mounted in the controller. A stop is mounted on the controller and adapted to engage the controller handle. Electrical connections are made between the motor and the controller, and mechanism connects the governor and the stop whereby the movement of the governor will operate the stop to limit the movement of the controller.

815,131. Electric-railway Signaling Apparatus. James W. Tatum, Durham, N. C., assignor of one-sixth to B. N. Duke and one-sixth to W. W. Fuller, New York, N. Y., and one-sixth to E. J. Parrish, one-sixth to John W. Smith and one-sixth to Robert B. Boone, Durham, N. C. Application filed June 2, 1905.

In an electric railway signaling system there are combined with suitable circuits a signaling apparatus carried by a vehicle and consisting of a line including a distance-indicating instrument, a telephone and an alarm. A second line includes all of the instruments with the exception of the alarm, and means rendered effective by the operation of the telephone cause the current to flow through the second line whereby all of the instruments are operative but the alarm.

815,163. Apparatus for Laying Electric Conductors. Samuel P. Hatfield, New York, N. Y. Application filed March 18, 1904.

An apparatus for laying and burying electric conductors under ground comprises a plow arranged for forming a self-closing furrow, a gage projecting on opposite sides of the plow beam and extending approximately the length thereof and means on the plow for directing the conductor into the lower portion of the furrow.

815,165. Race-course Machine. Olaf Henrichsen, New York, N. Y. Application filed March 23, 1905.

A toy is described in which dummies simulate race horses, and the speed of which is governed by electric motor.

815,176. Automatic Telephone Connector Switch. Alexander E. Keith, John Erickson and Charles J. Erickson, Chicago, Ill., assignors to the Automatic Electric Company, Chicago, Ill. Application filed April 21, 1905.

A "connector" for automatic telephone systems comprises a electromagnetically actuated switch shaft, switch contacts operated thereby, a locking device for holding the shaft against back movement during its operation, a "release magnet," and a "release armature" adapted when attracted to draw the locking device into position to release the shaft.

815,221. Electric Furnace. Marcus Ruthenburg, Lockport, N. Y. Application filed August 14, 1905.

In an electric furnace are a fused bath a layer of inert material floated on the bath, a layer of comminuted resister floated on the inert layer and an electric circuit having a number of positive and negative terminals disposed in alternate relation in different regions of the resister.

815,245. Shade Holder for Incandescent Electric Lamps. Harry A. Wright, Springfield, Mass., assignor to the Yost Electric Manufacturing Company, Toledo, Ohio. Application filed July 9, 1904.

A small wire arrangement for holding the shade upon the socket is described.

815,283. Trolley. Frank J. Gibbs, Tyrone, Pa. Application filed January 20, 1905.

The pole carries two outstanding bracket arms upon which are mounted two trolley wheels, one behind the other.

815,304. System of Electric Motor Control. Charles A. Mudge, New York, N. Y. Original application filed March 2, 1905. Divided and this application filed June 27, 1905.

In combination with independent inlet and exhaust valves of the fluid control system are independent electromagnet means for operating the valves, whereby the fluid means are operated through successive steps by the continued application of a fluid medium.

815,314. Railway Switch. Guy M. Thompson, Seattle, Wash., assignor of one-fourth to Charles S. Follett, Seattle, Wash. Application filed August 3, 1905.

In a railway switch are two electromagnetic switch-moving mechanisms normally in incomplete circuits and two supplemental electric circuits, a contact maker for each electromagnetic circuit, the contact maker comprised of a bar formed of two pivotally connected parts.

815,315. Railway Electric Signaling Apparatus. Benjamin F. Wooding, Denver, Colo. Application filed November 10, 1904.

In electrical signaling apparatus for railways are the combination of overhead conductors divided into sections or blocks, a local circuit mounted on the train, signaling mechanism included in the circuit, inclined roller contacts mounted on the train and engaging the overhead conductors, and suitable connections between the roller contacts and the local circuit for closing the latter and operating the signaling mechanism.

815,317. Resistance Device for Electric Current Controllers. Lynde Bradley, Milwaukee, Wis., assignor of one-half to Stanton Allen, Milwaukee, Wis. Application filed July 28, 1902.

Combined with a resistance medium of carbonaceous material in the form of plates are a container inclosing the plates, a gas retaining closing means therefor to prevent oxidation of the plates and means for subjecting the plates to pressure to produce variable conductivity of the plates.

815,320. Safeguard for Automatic Railways. Benjamin F. Carpenter, Roselle Park, N. J. Application filed May 12, 1904. Renewed July 7, 1905.

Electric mechanism actuated by each car, as it enters the "danger section" of any station track, locks the switch to such station track and safeguards the car and switch until the car be removed from the "danger section."

815,321. Automatic Telephone Selector Switch. Alexander E. Keith, John Erickson and Charles J. Erickson, Chicago, Ill., assignors to the Automatic Electric Company, Chicago, Ill. Application filed May 2, 1905.

An automatic switching machine for telephone systems comprises banks of contacts, adjustable separating and holding devices between the banks, together with switch arms adapted to co-operate with the contacts in making connections, each bank being held in place and adjustable independently of the others.

815,322. Art of Telephony. Daniel M. Therrell, Charleston, S. C. Original application filed July 23, 1904. Divided and this application filed August 2, 1905.

A step in the art of electrical transmission and reproduction of sound consists in making the terminal transmitter circuit or circuits wholly or partially resonant for the essential frequencies to be transmitted, thereby increasing the efficiency of transformation, and the energy transferred to the secondary circuit.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on March 19, 1906:

399,646. Dynamo-electric Machine. J. W. Balet, New York, N. Y.

399,666. Telephone Transmitter. C. A. Hitchcock, North East, Pa.

399,716. Electrically Controlled Hydraulic Elevator. C. Whittier, Boston, Mass.

399,732. Electric-railway Switch. E. Blake, Boston, Mass.

399,748. Incandescent Electric Lamp Socket. C. E. Egan, Columbus, Ohio.

399,755. Electrical Distribution by Secondary Batteries. F. King, Fulham, County of Middlesex, England.

399,786. Electric-light Support. B. Schardt and G. Jones, Dayton, Ohio.

399,800. Dynamo-electric Machine. E. Thomson, New Britain, Conn.

399,801. Alternate-current Inductor. E. Thomson and M. M. J. Wightman, Lynn, Mass.

399,822. Electric Blast Blower. H. H. Blades, Detroit, Mich.

399,854. Electric Conductor. A. A. Brooks, Cambridge, Mass.

399,876. Circuit-closing Device for Electrical Torpedo Fuses. J. W. Graydon, Washington, D. C.

399,879. Electrical Fuse for Ordnance Shells. J. W. Graydon, Washington, D. C.

399,950. Friction Gear for Electric Motors. C. J. Vandepoele, Lynn, Mass.

399,954. Hinge Joint for Electric Belts. N. Warrell, Farragut, Iowa.

400,028. Electric-alarm Signal for Cables. W. H. Woodring and C. S. Gilbert, Kansas City, Mo.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Department Store Plant Fifty Feet Below Street Level.

Few of the thousands of shoppers who daily visit the large department store of Mandel Bros. in Chicago realize that four stories below them as they enter the new portion of the building facing Wabash Avenue there is an electric-light and power plant from which, as a center, the building is lighted and heated, and from which the 28 hydraulic elevators used in various sections of the store are operated. This interesting plant has an aggregate capacity in electrical units of 1,500 kilowatts, which stand at a level 53 feet below the surface of the street. The floor upon which the boilers are installed is three feet lower than this. The plant is one of the first deep-level plants to be built in Chicago as an outcome of the construction of the subways of the Illinois Tunnel Company. A great amount of excavation was necessary, which, by the way, was nearly all done after the superstructure had been erected, the excavated material being removed through the tunnels. This was costly work, and naturally the space allotted for the plant was restricted to the minimum. How to get so large a plant in such small quarters was no small engineering problem, and at every turn space had to be economized to the last degree. As it now stands, with only a few of the details to be completed, the plant presents many features worthy of attention.

Fig. 1 is a view in the generator room showing prominently one of the large units, of which there are three in the plant. Each of these units comprises a vertical cross-compound Allis-Chalmers engine driving a 400-kilowatt 400-revolution generator of the same make. Besides these three large units there are two smaller units of 200 and 100-kilowatt capacity. The smaller generators are direct-connected to horizontal engines, the 100-kilowatt to a simple engine, and the 200 to a cross-compound. Each develops current at 250 volts. The 400-kilowatt units are located in a row

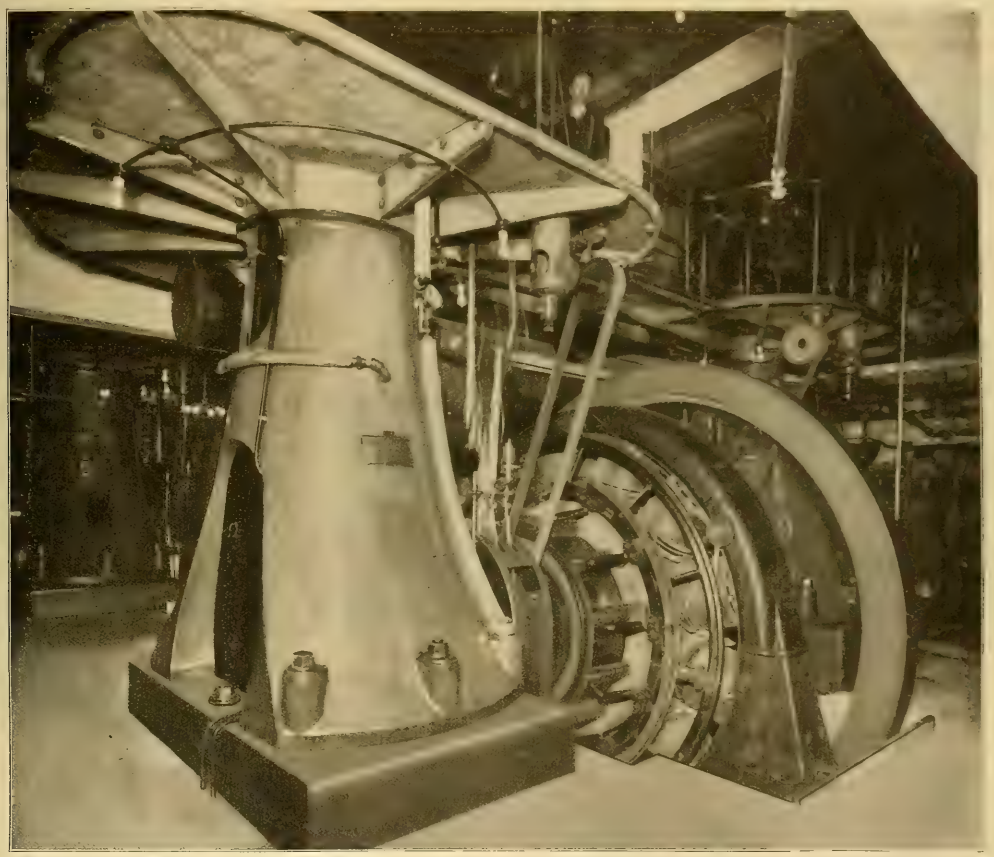


FIG. 1. DEPARTMENT STORE PLANT FIFTY FEET BELOW STREET LEVEL.—ONE OF THE MAIN GENERATING UNITS.

the lower part of each engine and the generators being at the first level. The upper parts of the engines, however, project up through to the floor above, so that no good view of the units as a group could be obtained. Examination of Fig. 1 will show a good example of heavy concrete construction, the beams and floors being entirely of this material.

The electrical load on the system of a department store of this size is a decidedly varying quantity, requiring great flexibility of the system in order to secure efficient and economical operation of the plant. For this reason it was necessary to install units of widely different capacities. To illustrate this point it is of interest to follow the operation of the plant for a 24-hour run.

Beginning at 8 a. m., two of the 400-kilowatt units carry the load until 5:20 p. m., when the store is closed to shoppers. This is evidently the period of heaviest load, since all departments of the store are running full blast, and even in the daytime lighted [illegible] 400-kilowatt horizontal unit is made to carry the entire load, which consists largely of window lighting. From 11:30 p. m. to 8 a. m. and on Sundays the small unit of 100 kilowatts capacity is kept in operation.

Engines and generators comprising the portion of the plant just described are standard apparatus with no features distinguishing them particularly from the equipments ordinarily furnished by the Allis-Chalmers Company. There are one or two things which may be mentioned, however. One of these is the use of a device for shifting the generator brushes, not in relation to the commutating field but in a direction parallel to the generator shaft. This arrangement is intended to bring about a more even wear of the brushes with a consequent better contact with the commutator bars, and is said to be of decided advantage. The arrangement is used only on engine-type generators and is driven directly from the shaft by a belt. The belt in turn drives a small shaft, which is connected

by means of gearing and eccentrics to the brush-holders, the revolution of the eccentrics moving the brushes back and forth periodically. Another interesting feature is the operation of large units at 125 revolutions a minute. The operation of Corliss engines at this speed might be thought by some to be of doubtful advisability, but apparently in this case the speed has no disadvantage aside from a slightly greater vibration of the valve gear than would be found with a lower speed. The plant is so deep in the ground and rests upon such a firm foundation that the higher speed may be used without transmitting any perceptible vibration to the building.

Steam is generated by six boilers located in the boiler room adjacent to the generator room, and, as stated before, three feet below the level of the latter. The boilers were built by the Richard Boiler and Engine Company of Toledo, Ohio, and are equipped with automatic stokers. They have a combined capacity of 2,000 horsepower.

The boiler room floor is six feet below the level of the freight tunnel in the street, and although connection has not as yet been established between the coal-storage bin and the tunnel system, this will be done later, and the coal supply will be brought in through the subways.

One main steam header passes directly to the generator room, and is divided into two sections. An auxiliary eight-inch header is also installed, giving greater flexibility to the system. The auxiliary header is fed on each side of the expansion loop and can be operated independently of the main header. Thus steam may be supplied to the engine by two paths.

An excellent view of the switchboard is shown in Fig. 2. It is a handsome slate structure, built by the Western Electric Company, and is locatetd on the north side of the engine room. It consists of five generator panels, one wattmeter panel, one power-feeder panel, three compensating panels and three lighting-feeder panels. It is designed for the 220-volt three-wire system, the division of voltage being obtained by compensators. The extreme panel at the right is for the 100-kilowatt generator, the adjacent one for the 200-kilowatt generator, and the next three for the 400-kilowatt generators. Each generator panel is equipped with a Weston ammeter, Western Electric type-F knife switches and I. T. E. overload and reverse-current tandem toggle circuit-breakers. These circuit-breakers are of the "non-closable type," that is, they cannot be closed when an overload or short-circuit exists on the line.

On the totalizing panel there are installed a 6,000-ampere recording wattmeter and two Weston illuminated-dial voltmeters mounted on a swinging bracket. One of the voltmeters is permanently connected to the buses and the other voltmeter is so connected that it can be used on any of the generators.

The power-feeder panel controls six feeders. Each feeder is equipped with a two-pole switch, fused on the rear of the board on both sides and protected on one side by an I. T. E. overload single-pole circuit-breaker. The capacity of each power feeder is 400 amperes.

Protection of the generator and feeder circuits on this switchboard by automatic circuit-breakers is a feature of especial interest and one which commands the attention of those who keep in touch with the rapid development and increased use of this class of apparatus. The aim of modern switchboard design is to obtain simplicity of arrangement, adaptability to requirements and effectiveness in use.

The latest improvements in circuit-breaker manufacture have materially aided the switchboard designer to attain this end, by enabling him to combine many safety devices in one piece of apparatus so that fewer appliances are required on the switchboard and more freedom from the liability to accidents, due to careless handling, is obtained. The circuit-breakers here used are the latest designs of the well-known I. T. E. breaker, manufactured by the Cutter company of Philadelphia. Each generator is protected by Reversite breakers, equipped with overload and reverse-current features. With breakers of this type it is impossible to send a short-circuit through an idle generator, nor is it possible to throw a generator in circuit until it is brought up to the proper voltage.

Division of voltage, as mentioned before, is obtained by the use of compensators (motor-dynamos), which are three in number, located at one end of the switchboard. Two of these are of 55-kilowatt capacity and the other of 20-kilowatt. One of the two largest is kept in operation for 48 hours in succession, the other acting as a reserve. The small set, when it is put in commission, will take care of the night and Sunday load.

The compensators automatically keep the voltage on each side of the neutral to within two per cent. of half the voltage between the outside wires without resorting to external devices, such as neutral relays, short-circuiting switches, etc. The design of the compensator panels is very simple. Each panel is equipped with a starting box, a double-pole single-throw switch for the main line, a single-pole single-throw switch for the neutral, a single-pole equalizer switch, a single-pole field-break-up switch, two rheostats, an ammeter and a set of six-point receptacles.

When starting up the compensators the main-line switch is closed first and the starting resistance cut-out. The single-pole field-break-up switch is kept open so as to place an electromotive force of 220 volts upon the fields of the two machines which are connected in series when starting up. The voltage of each machine is then adjusted by means of the two rheostats. By inserting the four-point plug into either side of the six-point receptacle the voltage on either side of the neutral may be obtained. After the voltage is equalized the equalizer switch is closed first and then the neutral switch.

The foregoing shows that the paralleling of the compensators can be as readily accomplished without mechanical devices as that of compound-wound generators.

Each feeder panel is provided with six three-pole single-throw knife switches. The lighting feeders are protected on the rear of the switchboard by enclosed fuses of the knife-blade National Electric Code type.

The individual units in the compensators are standard Western Electric type E machines, the two units being mounted on a common cast-iron sub-base and having their shafts connected by a flexible insulated coupling. The fields of each machine are compound wound.

A motor-operated refrigerating plant of 25 tons capacity supplies ice for the café and for cooling the drinking water. It is of the carbonic-acid-gas type, the compressor being driven, through a belt, by a 30-horsepower Northern motor.

Three heavy-duty steam-driven Laidlow-Gordon-Dunn pumps furnish water at 750 pounds pressure for the operation of the hydraulic elevators, working in conjunction with two hydraulic accumulators. The pilot-valve arrangement for the elevator system is operated by an Allis-Chalmers motor of 25-horsepower capacity.

An automatic house pump is driven by a 25-horsepower motor. The pumps for circulating the drinking water are also operated by motors. The motors are of three horsepower each, one unit being used as a spare. The sump pumps are operated by two vertical motors of nine horsepower each, an emergency steam set being also installed for this purpose. The automatic pumps are all controlled from a separate switchboard.

A complete fire-protection system is one of the features of the plant. This is fed by two 16 by 9 by 12-inch pumps, furnishing 750 gallons a minute.

Adams & Schwab, consulting engineers of Chicago, were the designers of this plant, which was installed under rather unusual and exacting conditions.

FIG. 2. THIRTEEN-PANEL SWITCHBOARD IN DEEP-LEVEL DEPARTMENT STORE PLANT.

Electrical Mechanism for Firing Guns.

An ingenious method of firing guns which does away with the intricate breech mechanism is suggested by a patent recently issued to Martin E. Thomas of Batavia, Ohio. As shown by the accompanying illustration, the firing is accomplished by a spark which is generated by dry cells and an induction coil contained in the stock of the gun. The charge is contained in a cartridge as usual, but instead of the cap in the end of the shell, electrodes are provided which are insulated from each other. When the shell is in place in the gun and the breech closed the terminals of the electrodes in the cartridge come in contact with the terminals of the secondary circuit of the induction coil. This circuit may be closed by a button or trigger, as also the primary circuit, to cause a spark between the electrodes in the shell and ignite the powder. In this way the two circuits must be closed before the discharge takes place, which adds materially to the safety of the arm.

ELECTRICAL MECHANISM FOR FIRING GUNS.

An Extensive Signaling System.

E. H. Harriman has authorized J. Kruttschnitt, director of maintenance and operation of the Union Pacific and the Southern Pacific railroad companies, to install automatic electric block signals of the most advanced type from Omaha to San Francisco, 1,800 miles, and from San Francisco to Colton, through Los Angeles, 542 miles, the route of the Overland Limited. These 2,342 miles will undoubtedly be the longest line of continuous automatic electric block signals in the world; the cost will aggregate $3,000,000. The plans include the erection of three generating plants operated by gasoline engines to operate the signals in the Wyoming division. These plants will also supply the current for an independent telephone system along the Union Pacific lines in this division.

New Methods of Motor Control.

Among the recent inventions in motor control apparatus two devices have been patented, one by Charles A. Eck of Newark, N. J., and the other by Charles D. Gilpin of Cleveland, Ohio. Mr. Eck's plan, while relating generally to a system of motor control, has particular reference to a simple and efficient means for varying the resistance of the magnetic circuit of a motor. Mr. Gilpin embodies in his invention a widely different device consisting of a novel arrangement for controlling motors from a distance by means of a master controller having but two wires connecting it to the remainder of the system.

In the apparatus suggested by Mr. Eck, which will be first described, the feature of novelty is an adjustable yoke between the poles whose sectional areas varies so that when the yoke is adjusted to one position the magnetic lines of force will flow through that portion of the yoke having a large cross-sectional area, and when adjusted to another position the magnetic lines of force will flow through that portion of the yoke whose cross-sectional area is smaller.

Fig. 1 is an end elevation of a motor embodying the invention with the interior parts exposed and partly in section and showing the yoke adjusted to the position where the magnetic lines will flow through that portion having the larger cross-sectional area—that is, the starting position. Fig. 2

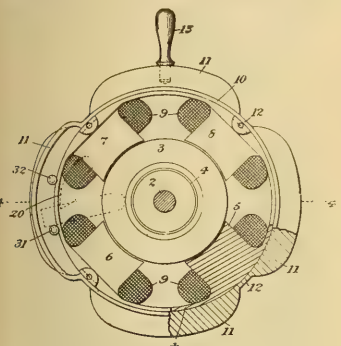


FIG. 1. END ELEVATION OF ECK MOTOR.

is a view similar to Fig. 1, but broken away and showing the position of the yoke when greater speed is desired and when the magnetic lines of force pass through that portion of the yoke which has the smaller cross-sectional area. Fig. 3 is a sectional view taken on line (4 4) of Fig. 1.

Mounted upon the motor casing, and adjustable, is a yoke in the form of a ring (10) and composed of a series of portions (11) of a relatively large cross-sectional area and connected by a series of portions of a relatively small cross-sectional area. It will be noticed that each portion (11) is somewhat longer than the distance between the poles, so that when properly positioned, as shown in Fig. 1, it will overlap from one pole to another. This

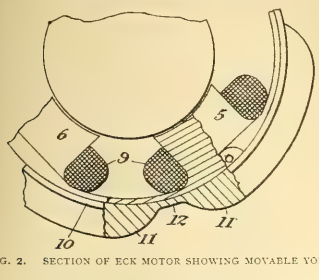


FIG. 2. SECTION OF ECK MOTOR SHOWING MOVABLE YOKE.

ring is provided with a suitable handle so that it may be readily adjusted by the operator.

Suitably secured in the casing is a member (14), which is in the form of a plate with cut-out portions and adapted to be inserted from the end of the motor, and when turned around will be properly held in the grooves (16) of the ribs (17) on the casing. The removable cover (18) is then placed over this and secured to the framework by means of screws or otherwise.

Mounted upon the member (14) are two contact plates (19) and (20), properly insulated by means of fiber, and between the two contact plates the switch lever (23) is adapted to play. This switch lever is pivoted at (22) and fits snugly between the two contact plates, so that when moved between the contact plates it will remain there by reason of the fact that it is composed of two parallel bars spaced apart by means of washers, leaving the main portion of the switch lever resilient. This switch lever is normally held out of engagement with the two contact plates by means of a spring and has connected to it the wire (29), while one of the contact plates has connected to it the other wire (30). Mounted upon the adjustable yoke-ring are two stops (31) and (32) (Fig. 1).

It will now be seen that when the parts are in the position shown in Fig. 1 the motor will be in the starting position and the magnetic lines of force passing through the portion (11) having the large cross-sectional area, the motor will run at its slowest speed. If the handle is now turned to the right of the figure the stop (31) will continue to move the switch lever between the two contact plates so as to keep the motor in circuit and will at the same time gradually bring the portion (12) of the yoke-ring having the small cross-sectional area into the position shown in Fig. 2, thereby gradually increasing the speed of the motor by causing the magnetic lines of force to travel through a constantly decreasing cross-sectional area of yoke. If the handle (13) is turned in the opposite direction, then the stop (32) will gradually move the switch lever out of contact between the two plates, and when that point is reached, then the spring will snap it back on a quick action, thereby reducing sparking.

Fig. 4 is a diagrammatic view of Mr. Gilpin's apparatus and connections, comprising his motor-controlling system. (A) is the armature of the motor to be operated and controlled, its field-winding being shown at (A′) and the controlling resistance being illustrated at (B). Electromagnetic switches (C), (C′), (D) and (D′) are connected to serve as reversing means for the motor, their connections being such that when switches (C) and (C′) are closed current flows through the motor armature and field winding in a definite direction, thereby causing rotation of the armature in a certain direction. When, on the other hand, the switches (D) and (D′) are closed, the direction of current flow in the armature is reversed, though it remains the same through the field winding, and as a consequence the direction of rotation of the armature is reversed. In order to prevent the possibility of more than one pair of these four switches being in a closed position at the same time, locking bars are provided, of which one (c^2) extends between the blades of switches (C) and (D), while the other (d^2) extends between the blades of switches (D′) and (C′), the bar (e^2), for example, making it impossible for the switch (C) to close while the switch (D) is closed, and vice versa.

One end of a body of resistance (B) is connected to the free end of the motor field winding (A′), and there are at intervals along its length taps connected to what in the case illustrated are the upper terminals of the resistance-controlling switches (E) (E′). The lower terminals of these switches are connected directly to one of the current supply mains (in the case shown the positive), while the lower terminals of the switches (C) and

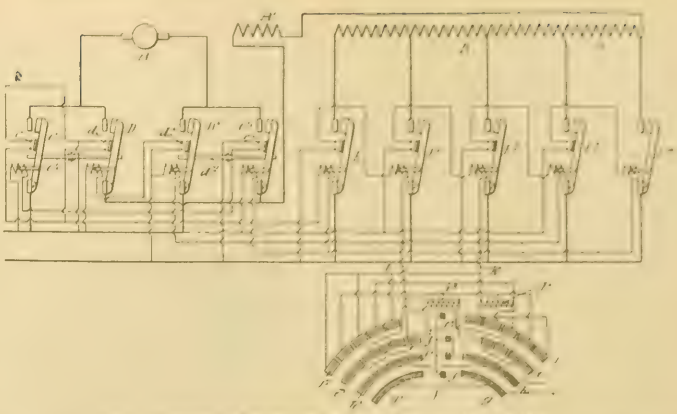


FIG. 4. DIAGRAM OF [illegible]

(D) are connected to the other current-supply main.

[illegible] master controller (F) consists of a number of segments [illegible] two groups along the arc of [illegible] An operating lever for the [illegible] mounted upon a [illegible] respectively nearest to and farthest from the center—namely, (i) and (i²)—are connected to each other and to one of the current-supply mains, in the present instance the positive, while the contacts (h) and (h²) of the next two rows of the controller are similarly connected to each other and to the other current-supply main, namely,

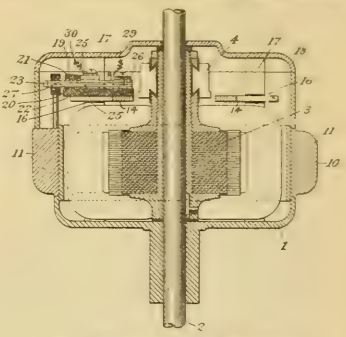


FIG. 3. SECTIONAL VIEW OF ECK MOTOR.

the negative. Of the contacts (j) and (j²), arranged along the arc of the greatest radius, the first, third and fifth of each of the two groups are electrically connected to each other and to a single wire (k), extending from the master controller to the motor-controlling switches of the system.

The bank of resistance (j′) has one end connected to the first of the segments (j) and its other end connected to the second segment of the same group, as well as to the second segment of the group (j²), while the fourth segments of both of the groups (j) and (j²) are electrically connected to each other and to a point of the resistance (j′) intermediate of its ends. The segments of the third arc of the controller are, like the others, divided into two groups (l) and (l²), there being in the first of these groups but three segments, of which the first and third are electrically connected to each other and to one end of a bank of resistance [illegible], as well as to a wire (l³), constituting the second conductor, extending between the master controller and the motor-controlling switches of the system. Also connected to this wire are the first, third and fifth segments of the group (l²),

while the fourth of this latter group is connected to the second of the contacts (i) and to a point of the bank of resistance (j^2) intermediate of its ends, it being noted that the second end of this bank of resistance is connected to the second segment of the group (i').

The wire (k) connecting the master controller with the remainder of the system is electrically connected to one end of the actuating coils of switches (C') (E') (E^2) and (E^4), while the second connecting wire (l) is connected to one end of the actuating coils of switches (D') (E') and (E^3). It may here be noted that the bank of resistance (j') is so proportioned that when by the operation of the master controller it is placed in series with the actuating coil of one of the switches of the system it permits sufficient current to flow to hold the switch closed, if it is already closed, although this current is not of sufficient magnitude to cause closing of the switch if it be open.

That portion of this same bank of resistance included between its intermediate connection and that end connected to the wire (l) is also so proportioned that if it be connected in series with two switch-actuating coils in multiple with each other it will hold these two switches closed if they be already closed, though, as before, this current will be insufficient to cause the switches to close if they are open. This same statement is true as regards the bank of resistance (j'), that portion included between the end connected to the wire (k) and its intermediate connection being similarly so proportioned that if it be placed in series with the coils of three switches respectively connected in multiple to each other the current flow will be such that these switches will remain closed if they are already closed, though they will not be operated if they are in their open position. The actuating coil of switch (C) has one end directly connected to the negative supply main, while its second end is connected through the auxiliary switch of switch (C') to the positive supply main. The coil of switch (C') while having one end in connection with the wire (k), has its second end directly connected to the negative supply main. The auxiliary switch of the switch (C) has one terminal connected to the negative supply main and to one terminal of the auxiliary switch of the main switch (D), while its second terminal is connected to one end of the actuating coil of the main switch (E). The second terminal of the auxiliary switch (d) is connected to the line extending between the auxiliary switch (c) and one terminal of the actuating coil of switch (E), while the actuating coil of switch (D) has one terminal connected to the negative supply main and its second terminal connected through the auxiliary switch (d') to the positive supply main. The coil of the switch (D'), while having one end connected to the wire (l), has its second end connected directly to the positive supply main.

As regards the resistance-controlling switches (E) to (E^4), inclusive, it will be seen that the first, third and last of these have one terminal of their respective coils connected to the wire (k) from the master controller, while the second terminal of the first of the coils is connected to the negative supply main through the auxiliary switch (c) of main switch (C), which in operation is actuated just before the switch (E). Similarly, the second terminal of the coil of switch (E^2) is connected to the negative supply main through the auxiliary switch of switch (E^1), while the second end of the coil of switch (E^4) is also connected through the auxiliary switch of main switch (E^2) to the negative supply main. The coils of the two switches (E') and (E^2) each have one end, as noted above, connected to the wire (l) and their other ends connected through the auxiliary switch of the main switch, which in operation is actuated immediately before them, to the negative supply main.

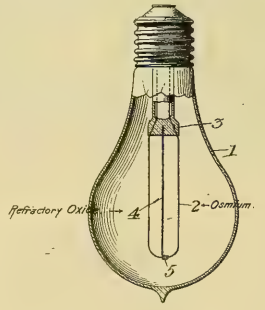
With this arrangement of apparatus and connections, if the operating lever of the master controller (F) be moved, for example, to the right of its vertical position, so as to bring its contacts into engagement with the right hand group (j) of the controller segments, it will be seen that the first of this group will be in direct electrical connection with the positive supply main, and current will flow through the wire (k) through the actuating coil of switch (C') to the negative supply main, thereby causing this switch to close.

While the coils of switches (E) (E^2) and (E^4) are also connected by this operation to the positive supply main, none of them can close, because in each case their circuit includes an auxiliary switch of another main switch which is still open. The closing of main switch (C') closes its auxiliary switch (c), and so permits current to flow from the positive supply main through the actuating coil of switch (C) to the negative main, so that this latter switch closes, and consequently closes its auxiliary switch, which in turn permits current to flow from the positive supply main to the master controller through the wire (k) to the coil of switch (E), and hence to the negative supply main. The closure of this last-named switch completes the circuit through the motor, and current will flow from the positive supply main through switch (E), and all of the resistance (B), field winding (A'), main switch (C'), armature (A) and switch (C) to the negative supply main. The motor will therefore start and continue to operate at its lowest speed until the lever of the master controller be moved to its succeeding points, the path of the current from these points being readily traceable.

Support for Osmium Lamp Filaments.

Osmium filaments for incandescent electric lamps when brought to a dazzling white heat are quite flexible, so that if brought into a horizontal or inclined position they tend to droop or sag by their own weight. Moreover, owing to the relatively high specific gravity of osmium and a certain degree of brittleness inherent in the filaments the latter are particularly liable to be broken during transportation, the lamps being of necessity frequently exposed to more or less violent shocks and jars. To obviate these disadvantages and dangers it is desirable to provide the osmium filament with a suitable support disposed within the lamp bulb, so as to maintain the filament against excessive flexure or vibration under the varying conditions of use of the lamp and the vicissitudes of shipment and of handling.

Heretofore it has been proposed to support carbon filaments against vibration by the employment of wires of platinum or nickel, extending from some point of anchorage within the lamp bulb and engaging at their free ends the carbon filament. The employment of metallic wires of this character would, however, be impracticable with osmium filaments, for the reason that when brought into contact with white-heat osmium the platinum or nickel at the point of contact would alloy with osmium and would be vaporized, driven off, and deposited as a black coating upon the inner surface of the bulb. Moreover, a platinum or nickel support tends to adhere by fritting to the white-hot osmium filament, thereby interfering with the free expan-



SUPPORT FOR OSMIUM LAMP FILAMENTS.

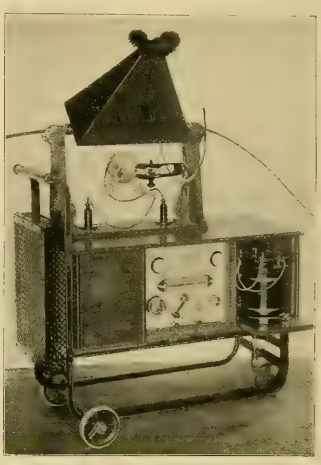
sion and contraction of the filament and subjecting it to corresponding liability of rupture. Supports of carbon would be likewise unsatisfactory for osmium filaments, because of the inevitable formation of osmium carbon compounds, which are more volatile than the pure osmium.

Dr. Carl Auer von Welsbach of Vienna, the inventor of the well-known incandescent gas mantle which bears his name, has made an invention bearing on this interesting point. One form is illustrated herewith. The purpose is the production of supports from a material, first, sufficiently rigid when in filamentary form to sustain the osmium filaments; second, so highly refractory that it will not frit when the latter is brought to white incandescence, and, third, of such a character that it will not react chemically upon the incandescent osmium filament.

Dr. von Welsbach discovered that it is feasible to make supports embodying these desirable characteristics from certain oxides, either separately or mixed, but preferably from an intimate mixture of about 10 parts, by weight of pure thoroxide and about one part, by weight, of magnesia. These oxides in a finely divided or powdered condition should be well ground to a paste by the addition of an organic viscous binding material—as, for instance, a solution of sugar. The paste thus produced is then shaped into flexible filaments of suitable length, and one end of the filament is bent or fashioned into the form of a small loop, hook, or spiral, designed subsequently to engage the osmium filament at the required point of support. The paste filaments are then dried and subsequently burned in free air until all the organic substance is consumed. Finally, they are subjected to the action of a very high temperature until the particles are sintered or fritted together. The resultant structure possesses the required stiffness and rigidity, and the straight end may then be sealed by fusion or otherwise into a hollow glass stem of appropriate diameter, adapted to be subsequently mounted within the lamp bulb in such relation to the osmium filament that the loop or hook of the support will engage and sustain the osmium filament against sagging or vibration.

Portable X-ray Apparatus for Testing Cables.

In the manufacture of deep-sea cables, as well as other high-grade cables with heavy insulation, it is very essential that they be as nearly perfect as possible, the conductor evenly covered with in-



PORTABLE X-RAY APPARATUS FOR TESTING CABLES.

sulating material and occupying a position exactly in the center of the cable.

A valuable and practical device has recently been brought out in Germany for use in inspecting heavily insulated cable, making use of the Roentgen rays and the fluoroscope. The accompanying illustration shows the arrangement of the apparatus and position of the cable as designed by the Elektricitäts Gesellschaft Sanitas of Berlin, Germany. The entire electrical equipment is mounted on a truck with small rubber-tired wheels, so that it can be moved easily about the cable factory. The induction coil is mounted in a case arranged on this truck with a marble panel switchboard on the front provided with the necessary instruments, rheostat and switches. The section of the case at the right, as shown in the illustration, is occupied by an electric motor, which drives, by belting, the interrupter.

The X-ray tube is mounted above the case on a framework directly over the induction coil and just below a pair of pulleys, over which the cable to be inspected is passed. The fluoroscope is mounted on an adjustable frame above in such a manner that it may be moved at any angle desired to obtain a clear view of the conductor and its location within the insulation of the cable.

This apparatus is one of the most practical applications of the X-ray in commercial work, and undoubtedly will make it possible to prevent defective cable from being laid, which would otherwise possibly result in great expense and loss of time in relaying for repairs. F. C. P.

Mayor Dunne has vetoed the ordinance passed by the Chicago Council granting jointly to the Northwestern Elevated Railway Company and St. Paul steam road permission to electrify the latter to Evanston and operate cars to run over the elevated road to the Loop.

Central Electric Railway Association Discusses Signals and Brakes.

The first regular bi-monthly meeting of the amalgamated or new Central Electric Railway Association was held in the Claypool Hotel, Indianapolis, on March 22d. About 250 interurban men, consulting engineers and representatives of supply houses, were present. The meeting was called to order by E. C. Spring of Springfield, Ohio, president of the association. President Spring congratulated the association on the large attendance and auspicious opening of the first bi-monthly meeting. He said the association had started on a most successful career and reviewed briefly what had already been accomplished during the short existence of the Central headquarters established in the Traction Terminal Building in Indianapolis, in charge of J. H. Merrill, secretary of the association. Mr. Spring explained what was being done in Ohio to forestall adverse legislation, and concluded by saying that the Central headquarters was the home of and open to all interurban men and supply men, and very courteously invited all interested in the success of the interurbans to make it their home.

Mr. Spring said a number of things were contemplated. A "way finder," or interurban railway guide, will be issued shortly by the association, showing all the interurban connections in Ohio, Indiana and Michigan, which will be of great service to the traveling public.

The first topic on the programme was "Electric Railway Signals," and was presented by a paper read by E. J. Burke, president of the Blake Signal Manufacturing Company of Boston. Mr. Burke said in part: "The Blake signals are practically visual telephone signals and their use removes the one-sided feature of railway-line telephone systems as at present installed. These signals complete the calling system so that the telephones can be used to their full advantage by both dispatcher and car crews. The purpose of the signal is to allow the dispatcher selectively to signal to any point on the line when he wishes to communicate with the passing crews. The operation is simplified in that, instead of communicating with a telegraph operator, giving orders and having the operator set a signal and repeat the orders to train crews, the dispatcher sets a signal and gives the orders to train crew direct by telephone on its arrival at a certain station. The basic principle of the signal is that the time of vibration of a pendulum varies with its length. Therefore, if we, at some critical point, such as a dispatcher's office, start in vibration a pendulum of a certain length, allowing it as it vibrates to open and close an electric circuit, electric impulses will be set up in that circuit, synchronous with the vibrating pendulum. As the pendulum swings it opens and closes the signal-line circuit, sending impulses over the line synchronous with its vibration. At the end of 13 seconds this line-signal pendulum swings through an arc wide enough to trip a lock and drop the semaphore arm. The car stops at the station and the motorman or conductor calls the dispatcher by telephone, saying, "Brown and Hayes at No. 9 for orders." The dispatcher then transmits his orders to the conductor or motorman. The conductor or motorman, if so instructed by the dispatcher, then pulls a cord which sets the semaphore at 'Clear' position ready for future operation."

Mr. Burke exhibited charts and drawings to illustrate the workings of the Blake signal apparatus and then gave an interesting demonstration of the possibilities of the Blake signal system on a complete working model, set up in the hall, securing electric power from the local street-railway company for the purpose.

The afternoon session was opened with a paper by S. B. Hutchins of Columbus, Ohio, special representative of the Westinghouse Air Brake Company, on "Recent Advancements in the Air-brake Art." Mr. Hutchins said that the developments and advancements in the direction of heavier equipment, higher speed and quicker service on electric trains are restricted to the capacity of the power brakes to destroy the energy and overcome the inertia of a moving train. Every advancement in the motive power and other conditions that make higher speed possible is a menace to the traveling public unless the factor of safety is increased correspondingly. The most important problem to be considered is the distance which it takes to bring the car or train to a stop in an emergency. In 30 years' experience in the development and manufacture of air brakes this point has been considered paramount. It is now possible to stop a modern high-speed train representing a total weight of 700,000 pounds from a speed of 60 miles an hour in less than 1,000 feet.

M. V. Turner, chief mechanical engineer of the Westinghouse Air Brake Company, who is regarded as the highest authority on air-brake matters in the country, was introduced by Mr. Hutchins, and proceeded with an exhaustive lecture on the air brake in all its phases. The lecture was interestingly illustrated with stereopticon slides showing the gradual steps taken from the earliest crude crank-chain brake and the cars equipped therewith up to the present remarkable development of the air brake upon which the safety of human life depends so largely. At the close of his lecture Mr. Turner gave a practical illustration of the points he had

E. C. SPRING, PRESIDENT OF CENTRAL ELECTRIC RAILWAY ASSOCIATION

[illegible] resenting each of the cars in the supposed train. "Heretofore," said Mr. Turner, "there has been no brake that could be applied to more than one car. The present system, however, is applicable to trains of any number of cars, the brake on each car being separate and automatic. Our idea is that all interurban electric cars should be so equipped with brakes that they will be interchangeable, just as cars on steam roads are interchangeable. The time is coming when all electric cars will be run in trains instead of singly, and it is in anticipation of this change that the general managers of the electric railways are interesting themselves in the automatic instead of the straight air brakes."

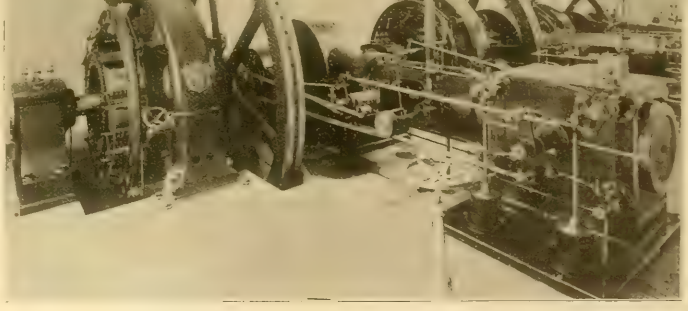
The next bimonthly meeting of the association will be held in Columbus, Ohio, and the programme will be devoted largely to train service and the annoyances and troubles thereof, and a general discussion and exchange of experiences will be held

One of the topics of conversation among the officials who attended the meeting was the performance of the private car Kenilworth, of General Manager C. D. Emmons of the Fort Wayne and Wabash Valley road, which made an average speed of 60 miles an hour from Fort Wayne to Indianapolis. The car is soon to be placed in special service on that line. S. S.

At the town meeting in Braintree, Mass., on March 19th it was voted to appoint a committee of seven to investigate charges that the town's municipal electric lighting plant is not being run as economically as it should be.

Electrical Equipment of Paper-box and Bag Factory.

[illegible]



ELECTRICAL GENERATING PLANT IN PAPER-BOX AND BAG FACTORY

[illegible] operate the elevators and any small portion of the works where it might be necessary to carry on work at night or other times when the general plant is shut down. The exhaust steam escapes from the feed-water heater into a 12-inch heater, from which it is sent out to factory buildings. When heat is needed the steam is drawn through the system of heating pipes by means of a pump in the boiler room, which brings all the steam back into the heater, passing into the feed-water section.

The plant is equipped with individual and group motor drive throughout. Sixty motors of various sizes, ranging from five to 30 horsepower each, are employed.

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CONTENTS OF THIS NUMBER.

Department Store Plant Fifty Feet Below Street Level. Illustrated 251, 252
Electrical Mechanism for Firing Guns. Illustrated 252
An External Signaling System 252
New Methods of Motor Control. Illustrated 253, 254
Support of Osmium Lamp Filaments. Illustrated 254
Portable X-ray Apparatus for Testing Cables. Illustrated 254
Central Electric Railway Association Discusses Signals and Brakes 255
E. C. Spring. Portrait 255
Electrical Equipment of Paper-box and Bag Factory. Illustrated 255
Editorial 256
International Electrical Units 257
Nominations for Institute Election 257
Iowa Cities Oppose Municipal Ownership 257
National Street-railway Convention to Be Held in Columbus, Ohio 257
Proposed Ordinance Respecting Electric-light Rates in Chicago 257
Maintenance of Way Men Meet in Chicago 257
Influence of Load Factor on Hydro-electric Installation. (Papers by S. B. Storer and D. B. Rushmore.) Illustrated 258
West Shore Railroad Electrification. Illustrated 258
The President Recommends Legislation to Preserve Niagara Falls 259
New Line of Graphic Recording Instruments. Illustrated 259
Large Steam-turbine Power Stations for Paris 259
Westinghouse Electric and Manufacturing Company Increases Its Capital Stock 259
Selling Electricity 260, 261
Electric Signs Must Burn Till Midnight in Seattle 260
The Central Station and the Bakery 260
Electrical Show for Fond du Lac 260
Wanted a Heating Pad in a Hurry 260
"Co-operation" Meeting in New York 260, 261
Boosts for the City of Lights 261
A New Way to Soothe Disgruntled Customers 261
New-business Notes 261
Automatic Electric Elevators 261
What It Costs to Cook with Electricity 261
Burglars Don't Like Electric Light 261
Illustrated Technical Definition 261
Operation of Direct-current Generators in Series and Parallel. 262
Massachusetts May License Electricians 262
The Modern Tendency in Underground Electrical Construction 262, 263
New England Street Railway Club 263
Long Electric Railway for Canada Proposed 263
National Electric Company's Assets Sold 263
New Companies 263
Michigan Independent Telephone Association 263
Telephone Rate-reducing Campaign in Chicago 263
Manufacturers and Dealers 263
Annual Report of American Telephone and Telegraph Company 264
Indiana Telephone Items 264
Ohio Telephone Notes 264, 265
Telephone News from the Northwest 265
General Telephone News 265

DEPARTMENTS.

Correspondence 265, 266, 267
Great Britain 265
Dominion of Canada 265
New York 265, 266
New England 266
Southeastern States 266
Ohio 266
Indiana 266
Michigan 266, 267
Central Illinois 267
Northwestern States 267
Personal 267
Electric Lighting 267
Electric Railways 267, 268
Power Transmission 268
Publications 268
Societies and Schools 268
Miscellaneous 268
Trade News 268
Business 268, 269
Illustrated Electrical Patent Record 269, 270

DATES AHEAD.

Fond du Lac Gas and Electrical Show, Armory E, Fond du Lac, Wis., April 9th to 14th.

Iowa Electrical Association (annual convention), Kirkwood Hotel, Des Moines, April 18th and 19th.

Iowa Street and Interurban Railway Association (annual convention), Kirkwood Hotel, Des Moines, April 19th and 20th.

American Electrochemical Society (general meeting), Ithaca Hotel, Ithaca, N. Y., May 1st to 3d.

Southwestern Electrical and Gas Association (annual convention), Galveston, Tex., May 16th, 17th and 18th.

Indiana Independent Telephone Association (annual meeting), Indianapolis, Ind., May 17th.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

Trustees of the Sanitary District of Chicago and the finance committee of the Chicago City Council are widely at variance in their opinions regarding a just and equitable rate at which electricity generated by the waterpower of the Drainage Canal shall be sold to the city. As has been previously stated in the Western Electrician, the trustees have agreed to furnish 15,500 horsepower at the substation in Chicago at $26.40 a horsepower-year. This price is about one-half what it costs the city to generate electricity at its municipal plants, and it was thought that the city would be willing to accept this price without question. But now City Electrician Carroll, acting on the advice of the finance committee of tthe Council, sends word to President McCormick of the Board of Trustees that the city will only consent to pay $5.76 a horsepower-year for 24-hour service. The grounds upon which this demand is made are that the Sanitary District is not justified in adding to its estimate of the cost of production the large item of $140,000 for interest on investment. Alderman Bennett, chairman of the finance committee, says that there is no substantial difference between the Sanitary District and the people of Chicago. Chicago's citizens paid about 95 per cent. of the cost of the canal and waterworks, and therefore they should not be charged with interest on the investment which in reality belongs to them. In making the estimate of operating expenses the trustees of the Sanitary District also added the cost of operating the Lawrence Avenue and Thirty-ninth Street pumping stations, together with interest on investment for the latter. These items the committee on finance did not see fit to allow, and they, together with the dropping of the $140,000 first mentioned, caused the discrepancy between the Sanitary District's offer and the offer of the city.

Lightning rods are not now in use to so great an extent as in former years, although a more scientific study is made of methods of protection from lightning. But, while the limitations of the lightning rod are better known than formerly, the device is by no means discredited by the best authorities. Actual observation has demonstrated that lightning rods when properly made and installed have averted the destructive effects of lightning discharges in many instances. In spite of this, however, statistics show that the manufacture of lightning rods is on the decline. Mr. Alfred J. Henry, professor of meteorology, in a recent bulletin of the United States Weather Bureau, prepared under the direction of Willis L. Moore, chief of the bureau, and entitled "Recent Practice in the Erection of Lightning Conductors," gives some interesting facts.

According to the United States Census statistics, there were in 1860 20 establishments manufacturing lightning rods, which turned out a product valued at $182,750. In 1870 the number of establishments had risen to 25 and the value of the products to $1,374,631. In the next decade the number of establishments fell to 20 and the value of the product to $801,192, and finally in 1890 the number of establishments rose to 22, but the value of the product diminished to $483,296. At the census of 1900 the classification in vogue from 1860 to 1890 was abandoned. There is no way of determining absolutely whether the large decrease in the value of the manufactured product from 1870 to 1890 marks a decline in the use of lightning conductors, but it is certain, however, that the "lightning-rod man" is not so much in evidence as he was in the early '70's.

Prudence requires that isolated buildings in the open country be protected in some way from the destructive effects of lightning, but in large cities the use of lightning conductors is not imperative, owing to the prevalence of modern steel structures. Still, the number of buildings requiring protection is steadily on the increase as the rural districts expand, and even if steel construction is becoming more prevalent in cities, this fact cannot be held accountable for the marked falling off in the production of lightning conductors. The real reason seems to be that people are coming to believe that lightning rods, for economical reasons, are not worth while, especially as fire-insurance policies usually cover the loss, or much of the loss, due to lightning.

Metric weights and measures are again actively under consideration by the committee on coinage, weights and measures of the House of Representatives. The cause is the Littauer bill, which, if recommended and passed, will make the use of the metric system compulsory in all departments of government. One of the leading champions of the decimal system is Alexander Graham Bell, the telephone inventor, who addressed the committee last month in favor of the bill. Dr. Bell explained the importance of the bill, and it will be of interest to quote part of what he said:

This is one of the smallest bills I ever saw in my life, only seven lines, but it is pregnant with consequences to the people of tthe United States. It means very much more than appears upon its face. This is a mandatory bill requiring the use of the metric system in the departments of the government, but, of course, Congress would not be justified in passing a mandatory bill of this kind unless they had made up their mind that the whole of the United States is going to have the metric system. So that this really means, if you pass it, that you have decided to abolish all this chaotic mass of measures and weights that we now have and substitute the metric system, not simply for the government departments but for the whole of the United States. And this, then, is the logical step in the consummation of such an idea. I hope such an idea will be carried out. It would be a great thing for the people of the United States, and this, of course, is the first step.

On the other hand, the manufacturing interests of the country are pretty nearly unanimous in opposition to the proposed change, and it is perhaps unlikely that the Littauer bill will become a law.

There are few subjects apart from politics and religion on which English-speaking people differ so sharply and honestly as on the constantly recurring proposals for the legal adoption of the metric system. Few dispute the great advantage of the decimal system of weights and measures over the inconvenient, illogical and antiquated units which are now in use in Great Britain, the United States and the British colonies. But there are many who consider it inexpedient to attempt to adopt the metric system at present or for many years to come. A drastic law without the support of public opinion would perhaps make the improved system so unpopular and irksome that it might have to be repealed and the whole reform set back a generation. And there is no question that the metric system is known by name only to practically the whole mass of population in the United States. Ask the average lawyer, doctor, clergyman, business man, how long a centimeter is, and he will either confess ignorance or else say that he has forgotten and will have to look for the answer in a book, or, perhaps, after some mental calculation, he may answer, "About two-fifths of an inch." It will be observed that at best he has no mind-picture of a centimeter. He translates it in terms of inches. But the inch or foot has a positive value to him. And if this is the case with those whom we call well educated, what shall we say of the mechanic, the clerk, the laborer?

In this situation should not the earnest advocates of the metric system turn their attention to the schoolmaster rather than to the legislator? In other words, should not the reform be brought about by education rather than by legal enactment? It will be a slow process, no doubt, but, whatever the experience of other countries, we are inclined to believe that in the United States the change can be brought about in no other way.

Spelling reform affords something of an analogy. English spelling is open to as many objections, perhaps, as English weights and measures. But will the advocates of a compulsory metric system contend that there should be a law providing that in every communication addressed to the government the word "though," for instance, should be spelled "tho"? In both cases compulsory, mandatory or peremptory action would be unwise. The people must be taught to appreciate the metric system and to know how to use it before they can be persuaded to adopt it. And in such a fundamental matter as the weights and measures in daily use it will probably be found that this is a government of the people.

International Electrical Units.

It will be remembered, says the London Electrician, that as a result of the International Electrical Congress at St. Louis in 1904, it was determined that steps should be taken toward arriving at an agreement with regard to electrical units and standards by the constitution of an international commission representing the governments concerned. As a preliminary move a meeting of representatives of government laboratories was convened, and was attended by the following delegates:

United States of America: H. S. Carhart, professor at the University of Michigan.

Belgium: Eric Gerard, president of the Commission des Unites Electriques, and P. Clement, secretary of the commission.

Germany: Dr. Th. Lewald, president of the Kuratorium of the Physikalisch-Technische Reichsanstalt; Prof. Dr. F. Kohlrausch, formerly president of the Reichsanstalt; Prof. Dr. E. Warburg, president of the Reichsanstalt; Prof. Dr. E. Hagen, director at the Reichsanstalt, and Prof. Dr. W. Jaeger and Prof. Dr. St. Lindeck, members of the Reichsanstalt.

England: Dr. R. T. Glazebrook, F. R. S., director of the National Physical Laboratory.

France: E. Mascart, director of the Bureau Central Meteorologique.

Austria: V. v. Lang, president of the Normal-Eichungs-kommission, and Dr. L. Kusminsky, referee for electrical measures at the Normal-Eichungskommission.

Meetings were held in Berlin on October 23d, 24th and 25th last, and the official report of the proceedings has now been published. The following decisions were arrived at:

Formal Decisions.

That only two electrical units shall be chosen as fundamental units.

The international ohm defined by the resistance of a column of mercury, and the international ampere defined by the deposition of silver are to be taken as the fundamental electrical units.

The international volt is that electromotive force which produces an electric current of one international ampere in a conductor whose resistance is one international ohm.

The Weston cadmium cell shall be adopted as the standard cell.

The conference recommends the following procedure for the realization of the ohm:

1. The method which avoids the end correction (Ausbreitungswiderstand) should not be employed (Wissensch. Abh. der Phys.-Techn. Reichsanstalt, 2, S. 383, 1895; Phil. Trans. Roy. Soc., London 204, S. 81, 1904).
2. The Reichsanstalt will put itself in communication with Messrs. Schott & Co. of Jena, in order to determine whether glass tubes of sufficiently uniform section can be produced of the glass 59^{III}.
3. The glass tubes used in setting up mercury resistances are to be carefully annealed.
4. The tubes are to be filled in vacuo without heating.
5. In determining the weight the mercury column is to be bounded by planes at the terminal cross-sections of the tube and to be at a temperature of 0° C.
6. The length measurements are to be made as far as possible at 0° C. with the aid of contact pieces.
7. The electrical measurements are to be carried out at 0° C., and a method is to be employed which avoids the use of thick connecting wires. Among such methods the Kohlrausch differential galvanometer method, the Thomson double-bridge method, and eventually the compensation method are recommended. The current employed in measurement shall be limited by the condition that the mercury shall not be warmed sufficiently to produce appreciable error.
8. The mean of at least three fillings shall be taken as the value of the resistance of a tube.
9. The mean of at least five tubes must be taken to determine the value of the mercury unit.
10. The mercury standards shall have a resistance of approximately one ohm.
11. As the value of the wire standard the mean of at least five resistances of one ohm shall be taken.
12. A comparison of the wire standard with the mercury units shall be carried out at appropriate intervals of time.

The Weston standard cell shall contain solid hydrated cadmium sulphate; the strength of the cadmium amalgam shall be 12 to 13 per cent. of cadmium.

In the form of the normal element of the standard cell to be finally specified, sources of disturbance at the negative pole are to be avoided.

Resolutions.

The conference expresses the wish that an international convention should be summoned in order to arrive at agreement in the electric standards which are in use in the different countries.

The following resolution was further adopted: "In view of the fact that the laws of the different countries in relation to electrical units are not in complete agreement, the conference holds it desirable that an official conference should be summoned in the course of a year, with the object of bringing about this agreement."

The conference further expresses the opinion: (1) That the information before it is not sufficient to enable it to propose any alteration in the formerly accepted value for the ampere. (2) That [illegible]

[illegible]

Nominations for Institute Election.

At the meeting of the board of directors of the American Institute of Electrical Engineers [illegible] New York on March 23d the [illegible] "directors' nominee" was made [illegible] at the coming election:

For president—J. Wallace Rice, Jr., of Schenectady, N. Y., or Samuel Sheldon of Brooklyn.

For vice-president—A. H. Armstrong, Schenectady; H. H. Humphrey, St. Louis; F. G. Baum, San Francisco.

For managers—Paul Spencer, Philadelphia; P. M. Lincoln, Pittsburg; A. M. Schoen, Atlanta; J. J. Carty, New York.

For treasurer—George A. Hamilton, New York.

For secretary—R. W. Pope, New York.

Three vice-presidents and eight managers hold over.

A regular meeting of the Institute was held in New York on the evening of March 23d at 44 West Twenty-seventh Street. Dr. S. S. Wheeler, the president, was in the chair. T. C. Martin, chairman of the land and building fund committee, announced that the total amount subscribed toward extinguishing the debt on the land for the United Engineering Building was $132,389, or more than two-thirds of the sum required. Of this amount over $87,000 is in bank. A subscription not heretofore mentioned in the Western Electrician is that of $1,000 from the Edison Electric Illuminating Company of Brooklyn.

J. B. Taylor of Schenectady read a paper entitled "Some Features Affecting the Parallel Operation of Synchronous Motor-generator Sets." W. L. Waters of Milwaukee discussed the paper briefly.

In the absence of the author the paper by S. B. Storer of Syracuse, N. Y., on "The Relation of Load Factor to the Evaluation of Hydro-electric Plants," was read by title.

David B. Rushmore of Schenectady then read his paper on "Design of Hydro-electric Power Stations." There was little discussion, and adjournment was taken. (See page 258.)

Iowa Cities Oppose Municipal Ownership.

Municipal elections in the state of Iowa this week generally went against municipal ownership. At Waterloo and Webster City, where a test was made, municipalization was defeated by large majorities. At Waterloo the issue was whether the city should have its own water plant and at Webster City it was the gas question. Municipal ownership also was defeated in Council Bluffs.

At Creston the proposition for the city to buy the new plant of the Mutual Electric Light Company carried by a small majority, but the force of this expression is in doubt on account of the state laws limiting indebtedness. A franchise was given to the Des Moines-Creston interurban. A franchise for the old electric-light and gas company was defeated by a majority of 17.

In Decorah the question of granting a franchise to the Upper Iowa Power Company to operate an electric plant carried by a large majority. Aldermen were elected in five wards with a campaign for reform and lower taxation as the battle cry.

National Street-railway Convention to be Held in Columbus, Ohio.

The Ohio correspondent of the Western Electrician writes: "President R. Grosvenor Hutchins, president of the Board of Trade at Columbus, has received a telegram from President W. Caryl Ely of the American Street and Interurban Railway Association saying that at a meeting of the executive committee in Boston it was definitely decided to hold the annual meeting in Columbus the week of Monday, October 15th. Columbus has been fighting hard for the meeting and it is quite a victory for the town. It is believed that the city is able to take care of the visitors as it has three large hotels besides a number of smaller ones."

Proposed Ordinance Respecting Electric Light Rate in C[illegible].

[illegible]

shown by meters in [illegible] year, eight cents [illegible] third, and six cents [illegible] years.

This section also requires the [illegible] Company to furnish [illegible] construction for street [illegible] for each arc lamp not exceeding [illegible]

Section six makes the [illegible] 20 days after its passage and [illegible]

Maintenance of Way Men Meet in Chicago.

A very successful convention of the American Railway Engineering and Maintenance of Way Association was held in Chicago on March [illegible] 22d, and there was a large attendance.

President H. G. Kelley, chief engineer of the Minneapolis and St. Louis railway, presided. The president said in his address that "The recent progress toward the partial electrification of steam roads indicates that the new [illegible] in the immediate future require the attention of the members of this association. It is opening up a new and broad field for original thought and work."

Committee reports upon the various plans of railway maintenance were the special features of the convention. These committee reports were upon uniform rules, ties, ballasting, yards and terminals, iron and steel structures, records, reports and accounts, classification of track, roadway, signs, fences and cattleguards, signaling and interlocking, rails, masonry, buildings, tracks, water service, wooden bridges and trestles and economics of railway location.

Election of officers took place on Thursday the 22d. The president of the association holds his office two years, and as Mr. Kelley was elected last year he has still another in the position. Walter G. Berg was elected vice-president (two years). The remaining officers chosen were:

Secretary—E. H. Fritch.

Treasurer—W. S. Dawley.

Two directors (two years)—W. C. Cushing and J. P. Snow.

Wednesday evening occurred the annual dinner. This function was largely attended. The speakers were Mr. John F. Wallace, past president of the association; Mr. F. A. Delano, president of the Wabash railroad; Prof. C. Frank Allen of the Massachusetts Institute of Technology, and Mr. Willard A. Smith of the Railway and Engineering Review.

The Isthmian Canal Commission is inviting sealed proposals until April 13th for furnishing equipment for an electric-light plant, to be erected on the Isthmus of Panama. Blanks and full information will be furnished upon application to D. W. Ross, general purchasing agent, Washington, D. C., or the assistant purchasing agent, 24 State Street, New York.

Influence of Load Factor on Hydro-electric Installation.

The March meeting of the American Institute of Electrical Engineers in New York brought out two excellent papers relative to the construction of hydro-electric power plants, with particular reference to the influence of the load factor. One of these papers was by S. B. Storer of the Westinghouse Electric and Manufacturing Company, Syracuse, N. Y., upon "The Relation of Load Factor to the Evaluation of Hydro-electric Plants." The other paper was upon the subject of "Notes on Design of Hydro-electric Power Stations," and was written with reference to the influence of load

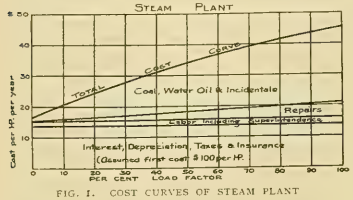


FIG. 1. COST CURVES OF STEAM PLANT

factor. The author of the latter was David B. Rushmore of the General Electric Company, Schenectady.

Mr. Storer in the concluding portion of his paper said: "It is generally conceded that the only object in developing a waterpower is to generate electrical energy at a cost much below that of generating it in any other way, and users of power are so well educated to this fact that they will not buy hydro-electric power unless the saving effected is considerable. It must be much more, in fact, than that for which they would for any other purpose make an expenditure several times as great as that necessary to replace other prime movers.

"Comparing the cost of generating hydro-electric power with that from coal or gas is somewhat difficult, but the general method to be followed is

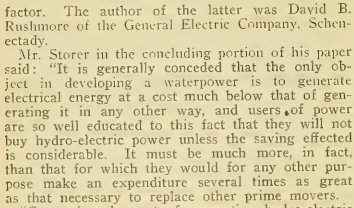


FIG. 2. COST CURVES OF HYDRO-ELECTRIC PLANT.

shown graphically in the curves given herewith. Figs. 1 and 2 are made respectively for both steam plants and hydro-electric plants, and show the cost of production per horsepower per year with relation to load factor. In neither of these cases is the value given from an actual installation, but is merely an approximation indicating the general conditions as they might exist in any well-built power house of a rated capacity of from 5,000 to 50,000 horsepower. The principal difference between the two curves is due to the introduction of the variable items of coal, water and labor in the steam plant, while the fixed charges in both cases form the base of the area included under the curve. As usual, the fixed charges include interest, depreciation, taxes and insurance. With hydro-electric plants the operating expense is so nearly constant as also to become practically a fixed charge. The item of repairs is really the only variable in the

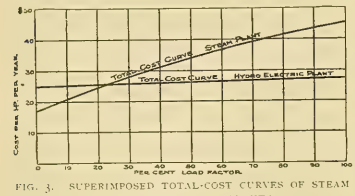


FIG. 3. SUPERIMPOSED TOTAL-COST CURVES OF STEAM AND HYDRO-ELECTRIC PLANTS.

curve, this generally being considered as increasing in direct proportion to the load factor.

"By superposing the two curves, as shown in Fig. 3, it will be seen that in this assumed instance they cross each other at 25 per cent. load factor, the cost per horsepower per year being identical at this point. At load factors less than 25 per cent. the steam plant has the advantage, and hydro-electric power must be sold at a loss in order to be competitive. At all load factors above 25 per cent., however, the advantage lies with the hydro-electric plant. The relative value of the two may be obtained by considering the variables—coal, water and labor—of the steam plant as the equivalent at any given load factor of a fixed charge, and by capitalizing this at a rate that will include interest, taxes and depreciation and adding it to the first cost of the steam plant we can thereby obtain an approximate value of the hydro-electric development.

"Making the comparison in another way the water operating the hydro-electric plant can be made a variable following the line taken by the coal of the steam plant and by capitalizing the difference between the two curves an approximate value of the potential energy of the water can be obtained. Due consideration must be given to the fact that at load factors of less than 25 per cent. this capitalization is negative and must be taken from the actual cost of the plant, so that it is only at load factors above 25 per cent. that it has any real value. In addition the curve representing power cost from the steam plant must be discounted by an amount corresponding to whatever reduction must be made in hydro-electric rates to effect its sale.

"The conclusion is that in all places where the flow of water is constant throughout the year the load factor determines the earning power, and hence establishes the value of any plant. Where an intermittent or insufficient supply of water may be stored and used during times of peak loads at a rate much higher than the normal flow of the stream the earning power is not dependent on the load factor to so great an extent, but such hydro-electric plants are generally of small capacity, adapted for lighting purposes only, and are to be considered as an exception to which the above method of evaluation will not apply.

Speaking of load factor and load curves, Mr. Rushmore said:

"Upon the exact definition of load factor there is lack of agreement. It will here be called $\frac{\text{average output}}{\text{maximum output}}$ No definition is satisfactory for all classes of load without explanation. A limit on the time of peak load or the use of rated capacity considerably modifies the figure obtained.

"Commercial loads—nearly always mixed in character—can be divided into railway, lighting, general power, pumping, hoisting and electrolytic. These have seasonal as well as hourly and daily variation. Railway and lighting loads are particularly subject to abnormal variations from unusual causes. Both have large peaks over certain hours, and for a part of the day approach zero load. General power load has an even curve for nine or 10 hours with light load at noon, and is then off entirely or very light. A pumping load may be very steady and continuous over the day. During some seasons the pumps, if employed for irrigation work, may be out of use entirely. Fire pumps have a great and unknown load variation, but are seldom used as part of larger loads. Hoisting loads are extremely variable in themselves, but the effect on the system may be smoothed out by the use of a large number of hoists or by the proper adaptation of flywheels and methods of control. Electrolytic loads are ideally constant at all times.

"Machinery must be installed to carry the peaks; and the determining of the best methods of meeting large load variations constitutes the problem of prime importance in designing waterpower installations.

"In no other place is there opportunity for the display of better judgment in the adaptation of a plant to definite assumed load conditions than in the proper subdivision and rating of the elements of plant design. These principal features are reservoirs, ditches, flumes, pipes, wheels, generators, transformers and lines. The factors especially concerned with the conditions of load are (1) number of units, (2) the characteristics at different loads, (3) the limiting conditions in the design, (4) commercial considerations of investment, (5) repair and depreciation charges, (6) possibilities for meeting future conditions.

"For large developments the selection of reservoir sites and capacities requires special investigation. Often several main reservoirs check the river flow, and a regulating reservoir at the head of the pipe line gives constant ditchflow and carries the load temporarily in case of accident to the water supply. The cost of storage increases at high heads and often decreases at low heads for increasing capacities. If great fluctuations in stream-flow obtain, it is seldom possible, from a commercial standpoint, to store all the water. Where development exceeds minimum stream-flow there are but few high-head propositions where storage is not desirable; conversely, in many low-head installations the cost of storage is prohibitive.

"Ditches, flumes and pipes all come under the head of water conductors. A number of installations have more than one source of water supply. Erosion in ditches and loss of head in pipes are the usual limits of design. For flumes there is a grade for maximum capacity which, if exceeded, decreases the amount of water that can be carried by causing a wave motion. The load conditions have much to do with allowable velocities in pipes, which are similar in principles of design to electrical conductors. The loss of head at maximum load is important. High velocities and rapidly varying loads make regulation difficult. A sub-division of the pipe line is desirable. Pipe lines for high heads are costly, and investments for different arrangements are studied before a final decision is reached. Flumes have a definite and at times a troubled life. Ditches need repairs, but no depreciation charges. With pure water, pipes show no deterioration if properly protected.

"Wheels and generators demand careful study to decide the best capacities. The size of the generator is usually indicated by some conditions in the proposition. The loss of one unit should not cripple the service. The generators and wheels should operate at points of best efficiency. The generator and wheel combinations are limited and speeds are fixed by number of wheels, type, head and output. For one-plant systems the number of generators is preferably not less than four nor more than eight. For multiple-plant systems, one unit to the station is not uncommon."

"The cost and value of efficiency in power-plant designing is an important but not clearly understood subject. The rough approximation usually made is to compare the selling price of the increased output with the interest charge on the greater cost. Where the saving in energy can be sold, as is usually the case, a higher efficiency in water conductors means a greater output and a greater capacity of installed apparatus with higher total cost, so that the investment charge for the gain in power is greater than usually considered. This is true of all parts of the chain of energy transformation.

"With a limited water supply, storage of water determines the possible development. Variations in load occur by the hour, day, season and year. Auxiliary or regulating reservoirs at the head of the pipe line take care of daily peaks, keep an even load on the water conductors and serve to carry the plant over temporary ditch troubles, also serving as sand boxes. The location of the pipe line often renders storage at this point impossible. In one case a flume of large dimensions is used for peak storage. In another, the water supply to a flume several miles in length is cut off entirely and the total stream-flow used for another station.

"Main reservoirs are on the river and regulate its flow. If these are of sufficient size the total run-off can be used. The reclamation service is at present doing a great work in water storage, in some cases over a term of years. Snow is a natural form of storage, well illustrated at Puyallup, where with a great variation in rainfall a nearly constant stream-flow is obtained. Forests, vegetation and the soil fill the function of reservoirs. Dams are built to catch the underground waters.

"For suddenly varying loads, as in railway and hoisting work, a flywheel is used to provide for instantaneous peaks. Irrigation laws may forbid the storage of water in old ditches. Electrical storage at the distributing points bears to the electrical system the same relation that the regulating reservoir does to the hydraulic.

"The capacity of waterpower installation can usually be largely increased by the use of steam auxiliary plants. A steam plant can supply the deficiencies of stream-flow and can carry peaks in any season. It may act as a regulator with steam turbine floating on the lines, the hydraulic generators running under constant load; it may act as a reserve in case of breakdown on a line; and may serve to furnish the wattless current for the system, allowing other machines to carry greater overloads. The turbine unit may be run idle part of the year as a synchronous condenser, or may float on the line as such for part of the day and deliver energy at other times. Contracts for supply of continuous power, with severe penalty clauses, may necessitate the installation of an auxiliary plant at the distributing end of the line. Such a plant is now being installed at San Francisco.

"With improvements and reduction in cost and operating expenses of steam-generating apparatus the auxiliary plant becomes of an increasing importance, and in some instances threatens to become the more important.

"A form of waterpower auxiliary was recently suggested in which the installed generator capacity far exceeds the normal flow of the stream. Water is stored throughout the day and the plant operated for but a few hours on peaks of the system."

West Shore Railroad Electrification.

Directors of the Mohawk Valley Company, the holding company for the various electric railways in Central New York now controlled by the Vanderbilt interests, have finally decided to adopt the third-rail system on the West Shore Railroad. The section of the road between Syracuse and Utica, a distance of about 60 miles, will be equipped with the new system as rapidly as possible. It is announced further that the management hopes ultimately to be able to have the line from Rotterdam Junction to Rochester equipped with the third-rail system. The trolley will be used in the city limits of Syracuse and Utica. Four sub-stations will be erected on the Utica-Syracuse section. The Wilgus under-running type of third rail will be used and also the Sprague multiple-unit control.

General Manager Allen has just placed an order for 15 interurban cars to be used on the electrified West Shore. These cars are to be 50 feet in length and will seat 54 persons. They will be equipped with all of the modern and up-to-date conveniences, and each will weigh 35 tons.

The President Recommends Legislation to Preserve Niagara Falls.

The American members of the International Waterways Commission (a body whose work is familiar to the readers of the Western Electrician) made their report to Mr. Taft, the secretary of war, on March 24th. They recommended legislation to restrict the amount of water to be taken from the upper Great Lakes and Niagara River, to the end that Niagara Falls may be preserved as a scenic spectacle. Parts of the report read as follows:

"The total quantity of water to be taken from the river by works now authorized is 60,900 cubic feet per second. Of this amount 26,700 cubic feet is to be taken on the American side, and the remainder, 34,200 cubic feet, on the Canadian side. That is, 27 per cent. of the average discharge and 33 per cent. of the low water discharge of the Niagara River will cease to pass over the falls when these works are completed and in full operation. The quantity to be diverted is more than double the quantity which now passes over the American Fall, which at the average stage is about 27,800 cubic feet. That this will in general have an injurious effect upon the falls seems self-evident. The volume of water to be diverted is about the equivalent of the entire discharge of Lake Superior over the Sault Ste. Marie. The amount thus far actually diverted is but 17,800 cubic feet per second and has an appreciable effect on the falls.

"To foretell with accuracy the effects in detail of the full diversion authorized would require a more complete knowledge of the bed of the river than is now obtainable. The water taken on the Canadian side below the crest of the rapids will affect the Horseshoe Fall alone. If all the water taken on the American side should affect the American Fall alone it would practically leave it dry; but it seems probable that only a part of this diversion will be at the expense of the American Fall. Exactly what portion that will be cannot be stated with precision, but from a study of the channels and reefs, so far as they are known, a reasonable estimate is that the water will come from the two arms in about the proportion of one-sixth from the American Fall and five-sixths from the Horseshoe Fall. Exactly what form the changes in the two cataracts will take, whether they will be made narrower or be broken up into a greater number of streams or simply be reduced in volume, retaining in general their present form, cannot now be foretold, for the reason that there is no accurate knowledge of the forms of and depths of the water on the crests. If 60,900 cubic feet of water be diverted per second the loss will be important; but if the diversion be limited to this amount or reduced as hereinafter indicated it may not prove disastrous. This cannot be definitely determined until the works now under construction have been completed and put in operation. When that happens, if it be found that the falls have not suffered serious damage as a scenic spectacle, it does not follow that additional water may be diverted with impunity. Additional diversion would be an experiment even more dangerous than that now being tried, and, in our opinion, should not be permitted.

"In return for the impairment of the falls thus far authorized the state of New York will receive practically nothing for the 342,000 horsepower authorized on that side, and the Queen Victoria Niagara Falls Park will receive an annual rental of $270,000, or an average of 65 cents per horsepower for the 415,000 horsepower authorized on the Canadian side. These figures do not include the 8,000 horsepower being developed by the electric railway, nor the power developed by the Hamilton company with water from the Welland Canal.

"Charters have been granted to corporations which propose to divert additional amounts in quantities not now limited. The sums of money invested, or being invested, in the works now in operation or under construction and in the industries dependent upon them amount to many millions of dollars. It is probably not expedient to attempt the withdrawal of the rights thus utilized. The commercial value of the waterpower of Niagara Falls is very great, but if compared with values set aside by wealthy communities elsewhere for park purposes this value is not too great to be devoted to similar purposes. The falls are annually visited by about 800,000 people.

"If the falls are to be preserved it must be by mutual agreement between the two countries. As a step in that direction we recommend that legislation be enacted which shall contain the following provisions, viz.:

"The secretary of war to be authorized to grant permits for the diversion of 28,500 cubic feet per second, and no more, from the waters naturally tributary to Niagara Falls, distributed as follows:

"Niagara Falls Hydraulic Power and Manufacturing Company, 9,500; Niagara Falls Power Company, 8,600; Erie Canal or its tenants (in addition to lock service), 400; Chicago Drainage Canal, 10,000. All other diversions of water which is naturally tributary to Niagara Falls to be prohibited, except such as may be required for domestic use or for the service of locks in the operation of canals. Suitable penalties [illegible] to be prescribed.

"The foregoing provisions [illegible] two years and then to [illegible] of the head [illegible] in the [illegible] ernment shall have [illegible] the diversion of water [illegible] to Niagara Falls [illegible] second, not including the amount [illegible] domestic uses or for the service of [illegible] tion canal.

"It is assumed, however, that [illegible] upon this subject would be reached [illegible].

"The object of such legislation would be [illegible] a stop to the further depletion of the [illegible] at the same time inflict the least possible [illegible] upon the important interests [illegible] dependent [illegible] this water power. The amount to be diverted [illegible] the Canadian side, 36,000 cubic feet, has been fixed with a view to allowing the companies [illegible] the amounts for which they now have works under construction.

"Such legislation would give to Canada the advantage of diverting 7,500 cubic feet per second more than is diverted in the United States. The advantage is more apparent than real, since the power generated on the Canadian side will be to a large extent transmitted to and used in the United States. In the negotiation of a treaty, however, the point should be considered.

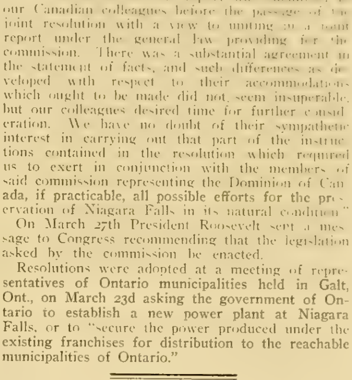
"The substance of this report was submitted to our Canadian colleagues before the passage of the joint resolution with a view to uniting in a joint report under the general law providing for the commission. There was a substantial agreement in the statement of facts, and such differences as developed with respect to their accommodations which ought to be made did not seem insuperable, but our colleagues desired time for further consideration. We have no doubt of their sympathetic interest in carrying out that part of the instructions contained in the resolution which required us to exert in conjunction with the members of said commission representing the Dominion of Canada, if practicable, all possible efforts for the preservation of Niagara Falls in its natural condition."

On March 27th President Roosevelt sent a message to Congress recommending that the legislation asked by the commission be enacted.

Resolutions were adopted at a meeting of representatives of Ontario municipalities held in Galt, Ont., on March 23d asking the government of Ontario to establish a new power plant at Niagara Falls, or to "secure the power produced under the existing franchises for distribution to the reachable municipalities of Ontario."

New Line of Graphic Recording Electric Instruments.

Accurate records of the performance of a central station or power plant have a value which will be readily appreciated by operating companies. It enables a close estimate to be made of fuel and supplies necessary for any season of the year, and affords a ready means of checking the efficiency



NEW GRAPHIC RECORDING INSTRUMENT.

of employes. Such records can be made only by accurate recording instruments, a complete line of which has been placed on the market by the Westinghouse Electric and Manufacturing Company.

These instruments, one of which is illustrated herewith, are arranged to operate on the relay principle, the motor element actuating contacts, which in turn energize a pair of solenoids arranged to move the pen. They are designed for switchboard mounting and are enclosed in glass cases 13 by 16 inches by nine inches, with a removable high glass front, giving access to the interior.

The alternating-current ammeter, voltmeter and wattmeter coils are arranged in a manner similar [illegible]

[illegible]

Recording [illegible] and [illegible] A [illegible] It is [illegible] to last two months [illegible].

The clock is an [illegible] design, and requires no [illegible] consume no more energy [illegible] switchboard instrument [illegible] the meter transformer. The solenoids [illegible] from a separate source of current [illegible] the meter transformer [illegible] are of sufficient torque to render the [illegible] tween the pen and the paper negligible. [illegible] struction throughout is rugged [illegible] delicate parts being used.

Large Steam-turbine Power Stations for Paris.

The Compagnie Generale de [illegible] Electrique of 12 Rue de [illegible], Paris, [illegible] signing the erection of a [illegible]-kilowatt turbo-generator power station on the banks of the Seine, at Vitry, close to Paris. The turbines are of the 6,000-kilowatt Curtis type, the generators being 25 cycles, 13,200 volts. Two of the turbine equipments are on order in the United States. The whole of the electrical equipment is being furnished by the French Thomson-Houston Company. Contracts have not yet been made for the supply of the remainder of the power-station equipment, including coal conveyors, cranes, pumps, boilers, stokers, etc. The first mentioned company is open to receive bids for the various material. The station is expected to be in operation in somewhat over a year from date, and all possible speed is being made in settling the constructional details.

The power station will supply current for two or three of the electric railway companies operating in the south and east of Paris, which will make considerable extensions to their existing networks. This is the first application of large Curtis turbo-generators in France, where at present there are installed a few 1,000-kilowatt groups.

The only other large power station with steam turbines in France is situated on the north of Paris, at St. Denis, where 10 6,000-kilowatt groups of the Brown-Boveri-Parsons type are about to be installed, four being already mounted. The current from this station is used for the needs of the Paris Metropolitan railway. Both of these stations will be completed during 1907. M. V.

Westinghouse Electric and Manufacturing Company Increases Capital Stock.

Stockholders of the Westinghouse Electric and Manufacturing Company at a recent special meeting in Pittsburg unanimously decided to increase the capital stock of the company from $25,000,000 to $50,000,000. The recent action of the board of directors, by which the company issued $15,000,000 convertible gold bonds of $1,000 each, was also ratified. The meeting was well attended, 380,543 shares being represented. The date of the next annual meeting has been set for the fourth Wednesday in July, when it is said that a full financial statement of the business will be made to the stockholders.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Electric Signs Must Burn Till Midnight in Seattle.

While many of the lighting companies in central and eastern cities are just now being subjected to investigations looking to the lowering of rates, it must be of some satisfaction to the lighting interests of Seattle, Wash., to read in the Seattle Times that "The gas company and the electric-light company have given cheap light and good light and plenty of it, even to the most isolated residences. A careful study of the lighting conveniences of Seattle must convince even the most skeptical that the city is more fortunate than scores of the wealthy and old settled municipalities of the East." There are many difficulties, too, in the way of the lighting companies in Seattle. The city is extremely hilly and it covers three times as much ground as many cities twice its size.

With two big electric companies, a well-organized gas company and a municipal light plant, the latter built primarily for illuminating with electricity the streets of the city, Seattle is one of the best-lighted cities west of the Mississippi River. The source of power for the electric companies is unlimited. As a consequence electricity is cheap. Many tiny cottages that, in other municipalities would be lighted with oil lamps are, in Seattle, illuminated by gas or electricity.

There are three lighting companies in the field: The Seattle Electric Company; the Seattle-Tacoma Power Company, generally known as the Snoqualmie Falls and White River Power Company, and the Seattle Lighting Company. The latter supplies gas and the first two electricity.

The large power plant of the Seattle Electric Company at Electron, on the Puyallup River, has been in successful operation for nearly two years. The corporation operates not only a well-patronized lighting department, but also conducts the street-car system of Seattle and supplies power for manufacturing concerns. The plant of the company from whence the power is generated is almost at the foot of Mount Rainier. On the Puyallup River, just above the headworks, a sheer dam and flume was put in and the water carried to a point almost above the power station. There a penstock with an 800-foot fall was made, bringing the source of power to a reservoir at the works. The company has been lighting a considerable portion of the city and supplying power for 15 years. The present Seattle Electric Company absorbed the Union Electric Company and several other concerns in the field.

From Snoqualmie Falls, "the Niagara of the Northwest," as it has sometimes been called, comes the power used by the Seattle-Tacoma company. Snoqualmie Falls is 270 feet in height. From it, both in Seattle and Tacoma, has been generated 15,000 horsepower that has materially assisted in making Seattle attain some of its well-deserved reputation as a splendidly lighted city. The company does a large amount of the city's lighting, and from its power many factory wheels turn.

Neither the Seattle Electric Company nor the Seattle-Tacoma Power Company exerts a purely local influence. In the case of the latter company Tacoma is almost as dependent upon it as is Seattle, and Renton, Kent, Puyallup, Sumner, Swansea, Issaquah and Auburn all owe a goodly portion of their excellent lights to the Seattle-Tacoma company. Wherever the cars of the Seattle Electric Company go—and beyond—light and power is supplied by that corporation. As a result, indirectly, scores of the smaller cities about Seattle are dependent upon this town for their light and power.

The first original gas company came to Seattle 23 years ago. The present corporation is a consolidation of the Seattle Gas and Electric Company and the Citizens' Light and Power Company, the consolidation taking place two years ago.

In January, 1903, the city of Seattle went into municipal ownership to a very small extent and started operating a lighting plant in conjunction with the city's waterworks. Cedar Falls, 35 miles from the city, was "harnessed," and early in 1904 the first current to be used in street lighting was sent into the city over the city's wires. Since that time operations have proceeded slowly, L. B. Youngs, superintendent of the plant, feeling every step of the way, appreciating the fact that, in the excellent light furnished by the private corporation, he must be very cautious in entering the competitive field for commercial lighting. Up to date the municipal plant has been mainly utilized in lighting streets and furnishing illuminations to a few private individuals.

One of the best evidences of the cheapness of electric lights in Seattle is the large number of illuminated street signs to be seen at night. On First and Second avenues and on Pike Street and other business thoroughfares, thousands of electric signs burn until midnight. All the stores, hotels and restaurants have them. Even small stores have their big lighted signs. A city ordinance makes the interesting provision that no permit for an electric sign shall be given except with the stipulation that such sign will burn until midnight every night in the week. This provision does not deter any business man from getting his permit. "Electricity is cheap in Seattle, and makes the very cheapest form of advertising." This is the way he reasons it out, and it seems a logical way. It is a pretty sight to approach Seattle at night on one of the big steamships. Two or three miles away the city is a blaze of light.

The Central Station and the Bakery.

In every large city there are so many different uses for electric light and power that it is easy to overlook the smaller tradesmen in the campaign to secure new business from large factories and the like. Nothing short of a sort of perpetual canvassing of the central station's territory will disclose the possibilities. Hundreds of groceries and meat markets in every state are still to be educated to use electric power and light in competition with the old hand methods of grinding coffee, chopping meat, and "fussing around" with greasy kerosene oil, dangerous matches and ghastly Welsbach burners. In any establishment where food products are sold to a first-class trade, cleanliness counts for more in the retention of custom than almost any other point, and this should be the trump card of the central-station solicitor in such cases.

The bakery offers an attractive field for the sale of power and light, for this very reason. The power required by dough mixers is well worth the contract price, for example, for motors of substantial size are needed in such work. Scaling machines, pie-crust trimmers, ice-cream freezers, tumbling apparatus and many other devices can be operated more economically and at a higher rate of production by electric motors than in any other way, and a bakery lighted by Nernst or Meridian lamps, or by enclosed arcs, is in itself the best kind of an advertisement if visitors are encouraged. Bakeries often maintain scores of horses and delivery wagons, necessitating a small machine or blacksmith shop about the premises. The applications of electricity are obvious, and the bakery, large or small, should not be forgotten by the central-station man who is trying to do more business this year than ever before.

H. S. K.

Electrical Show for Fond du Lac.

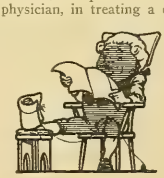
The enterprising Eastern Wisconsin Railway and Light Company, which does the electric-light, gas and street-railway business of Fond du Lac, Wis. (see Western Electrician of October 8, 1904), announces a gas and electrical show to be held at Armory E in that city during the entire week of April 9 to 14. The exhibition will be on a large scale, in fact, it is intended to eclipse anything of the kind ever held in the state heretofore. The exhibit hall is large and well located. Admission will be free. Electrical manufacturers are invited to make exhibits, space, light and heat being furnished without charge, provided early application is made to Mr. L. E. Holderman, superintendent of the electrical department of the company. On April 12th a gathering of electrical central-station men and salesmen will be entertained by the company.

The project is a creditable and interesting one and will no doubt be carried out with complete success. It shows how vigorously the new-business campaign is carried on in many of the smaller cities of the country.

Wanted a Heating Pad in a Hurry.

One of the noted physicians of New York said recently that the medical profession has tried for many years to find a device that would give a constant, uniform heat for exterior application. The hot-water bag is unsatisfactory, but the electric heating pad fulfills all requirements.

This same physician, in treating a case of cancer, called upon the Edison company in his city for help. The patient's apartment was without electrical service. A call was sent to the company at 10 a. m.; in 20 minutes a contract was signed; by 12 o'clock the meter was set, and by five o'clock the patient was enjoying the healing effects of an electric heating pad.



COMFORT WITH ELECTRIC HEATING PAD.

"Co-operation" Meeting in New York City.

Promotion of the co-operative movement among the various electrical interests was the object of the meeting and dinner in the Hotel Imperial, New York city, March 23d. Many men prominent in the electrical industry, in some phase or other of its development, were present. The business session was taken up by the voicing of ideas, on the part of a number of speakers, relating to co-operation in the line of publicity and to the possibilities of the co-operative movement from the viewpoint of the central-station manager, the manufacturer, the jobber, the contractor and the technical paper. The business session was opened with introductory remarks by Chairman E. E. Jackson, Jr., followed by a sketch of the proposed organization of electrical industries on a co-operative basis by J. Robert Crouse of Cleveland, who is at the head of the movement. After-dinner remarks were also called for from a number of prominent men in the electrical business upon the subject of co-operation from the top, from the bottom, from the middle and from all sides.

Mr. Crouse's address upon "Profitable Co-operation," in which he sketched the proposed organization, puts the matter squarely before the electrical interests, which were represented at the meeting, in a manner readily interpreted. Some extracts from this interesting address follow.

"This great common market, the public, is obviously twofold: First, the central station, whose entire business and interest is furnishing electric service at a profit, and within the range of whose service is comprised a population of 33,411,090, or 43.96 per cent. of the total population of the census of 1900. Second, the isolated purchaser to whom electric service, individually generated, is either partially essential or auxiliary—always a means to some other purpose.

"The commercial energy reaching this common market spends itself as follows, in whole or in part: Manufacturer, jobber, dealer, contractor, salesman, trade-paper advertising. It will be observed that it is competitive in the highest degree and under constant spur to commercial activity.

"The central station, on the other hand, is conceded by economists to be in its very nature properly monopolistic, and subject, therefore, to no competition for like service. In consequence, laying aside any other adverse conditions, it lacks the keen and constant commercial stimulus. It likewise lacks, by reason of isolation, either the ready opportunity or a very great incentive toward active aggressive co-operation. This, too, in spite of the fact that it is a natural situation where extensive co-operation (as the stations are non-competitive among themselves) reasonably promises the greatest results from such work. The opportunity and the incentive are, therefore, offered to the manufacturers and others for initiating co-operative work with and for central stations, and of cultivating the entire possible market broadly in addition."

"A propaganda of 26 pieces of commercial literature will be issued in co-operation with the new association to all central stations. It will deal in the broadest way with the problem of business extension from the standpoint of good service, solicitation and advertising. The subject will be dealt with, not on the basis of any theories on these topics, but will be founded on the practice of the most progressive central stations judged on the basis of their annual per capita sales. It will further be distinctively suggestive and educational in character, recognizing that conditions under which central stations operate vary, and that consequently a set or arbitrary formula for business extension cannot be successfully advanced."

"For the purpose of putting the entire industry in touch with the co-operative work under way and enlisting general co-operation, a mailing list of 4,700 individuals identified with the electrical business as manufacturers, jobbers, contractors, including their salesmen, as well as officers of electrical associations and societies of all sorts, was some months ago carefully prepared. To this entire list statements regarding the scope and character of the work proposed have been issued. The commercial literature above described, which is sent to all central stations, will likewise be furnished to this supplemental list. There will be sent to them in addition periodical reports of progress whenever any results of especial interest may have been accomplished, or new policies outlined in the prosecution of which their active co-operation would be sought."

"In addition, through the co-operation of the Electrical Salesmen's Association and the Rejuvenated Sons of Jove, the effort will be made to interest salesmen generally in the more careful observation of the commercial practices of the most progressive central stations visited, so that it may become increasingly the fashion and the mark of

the best salesmanship to pass every good selling scheme along to other managers in the territory covered.

"Likewise, through the co-operation of such associations, or through other means, to get the fashion of boosting the game (if you will permit an expressive phrase), by requesting electrical massage at the barber shop (insisting upon it if there happen to be no facilities), calling attention to the usefulness of the electric cigar lighter at cigar stands, patronizing stores or shops where electric service is most freely installed, with complimentary mention in reference to it; registering, in addition to the name, a diplomatic complaint to hotel proprietors where electric service is niggardly used in the office and lobby only."

"The plans contemplate the establishment at the proper time of a national electrical press bureau, through which news write-ups could be systematically furnished to the daily papers, as well as to trade papers in other lines of business, especially adapted to the use of electric service. This is at once a most subtle and powerful influence, concerning which you will hear later from an expert in this field."

"There are additional to those in the electrical field (who are naturally interested directly in the wiring of new construction work) the following lists in other fields, having more or less directly to do with the question of wiring buildings, 5,206 architects, 2,433 large building companies, 5,786 general contractors, 42,516 real-estate agents, 40,406 carpenters and builders, a total of 86,357.

"Probably no single condition retards the growth of electric service to the extent of the properties of all sorts which have been erected within the last 10 years without provision for electric wiring. There are undoubtedly thousands of buildings in which tenants would gladly use electric service were it not for the fact that the properties are not equipped. It is a further well-recognized fact that it is extremely difficult to induce owners or the agents of properties to submit to having the interiors of the buildings torn up (as is the popular impression) for the installation of wiring.

"In the development of the plans it would be contemplated to attempt a vigorous line of co-operation with the central stations, electrical contractors and others through the employment of a competent representative whose entire time would be taken up in co-operative work through every conceivable means to secure the wiring of old and new buildings. This would contemplate his attendance at the national and state conventions of the above classes of trade, or professions, and the presentation of papers which would forcibly bring to their attention the very great importance, not only of wiring properties, but of specifying in addition the necessary extra outlets for the use of diversified appliances in the field of light, heat and power."

At the conclusion of the meeting several resolutions were passed which in substance were as follows: That the co-operative commercial campaign for the purpose of increasing the use of electric current by the public for light, heat and power, as both an end and a means to the increased demand for electrical apparatus and supplies as presented and discussed, gives good promise of highly profitable returns to all concerned, and that the general plans for its prosecution, through the Co-operative Electrical Development Association, can be undertaken along equitable and practicable lines; that a committee of 11 or more representatives of electrical interests be appointed by the chair for the purpose of considering the plans submitted for the organization of the Co-operative Electrical Development Association, and to complete and agree on a practicable form of organization with a view of putting the same into operation; that this committee be authorized to confer on the subject with co-operating committees already appointed, or other representatives which may be appointed from other well-defined lines of the trade; that the plans of organization, when completed by this committee, be submitted to the representatives of the interests present, and that when, in the opinion of this committee, a sufficient number of the interests have agreed to co-operate in the work, it shall be authorized to perfect the organization and to supervise its initiatory work.

The chairman of the meeting appointed the following committee as required by the resolutions: W. M. MacFarland, acting vice-president of the Westinghouse Electric and Manufacturing Company (chairman); J. R. Lovejoy, General Electric Company; Walter Cary, Sawyer-Man Electric Company; A. D. Page, General Electric Company; F. S. Terry, National Electric Lamp Company; W. H. Swope, Western Electric Company; W. C. Bryant, the Bryant Electric Company; F. J. Newbury, John A. Roebling's Sons Company; A. T. Clark, American Circular Loom Company; W. H. Blood, Jr., president of the National Electric Light Association; F. Bissell, the F. Bissell Company (representing the electrical jobbers), and James R. Strong (representing the electrical contractors).

Grand Island, Neb., has voted to appropriate $35,000 for the construction of an electric light plant.

Boosts for the "City of Lights."

[illegible]

With characteristic enterprise the [illegible] Gas and Electric Company [illegible] entitled "Boost" [illegible] clippings from 12 leading daily papers [illegible] States [illegible] boosting method [illegible] to see the "City of Lights" [illegible] done so. The Denver Gas and Electric Company has been preaching that every time a [illegible] puts in a light display he boosts for his business, and that means a boost for the whole city.

Displays made by the [illegible] and firms have really given the city the right to style itself "The City of Lights." Most of the concerns having places on the main streets have some kind of display, many of them very elaborate. The important point about the Denver boosting for better lights is the fact that it has created a new line of semi-public effort to benefit the entire city. This has spread among the business men at a great rate, and as a result Denver is being benefited in every way.

A New Way to Soothe Disgruntled Customers.

An electric-light company in a city of about 40,000 people recently purchased a monogram or talking sign and erected it in a prominent location on the main street. The work was completed and the sign ready for operation on the Saturday before Christmas—a particularly propitious time to start an exhibit of this kind, as the street crowds were naturally larger than usual.

When the first word flashed out people stopped to watch, and by the time the company had wished them a "Merry Christmas" a large crowd had gathered, which cheered enthusiastically. Finally the assistance of the police was necessary to keep the street clear for the trolleys. The show lasted all evening and was the one topic of conversation among the shoppers. On Sunday, the day after, the manager states, he received many telephone messages at his residence congratulating him on his success.

A further use to which this same sign is to be put is both interesting and novel. The manager noticed, on sending out the January bills, that several of his best customers had charges beyond the average, which, although due to the holiday season, promised to result in complaint and dissatisfaction. He immediately called on these people and offered to each of them, without charge, the use of his sign for one evening during the coming month. They were naturally much pleased. Two important results were thus accomplished—a dissatisfied customer was converted into an ardent advocate of the company, and was led also to see the possibilities of advertising by an electric sign. As there is no better advertisement than a satisfied customer the success of the talking-sign experiment was assured.—C. H. B. Chapin, in Cassier's Magazine.

New-business Notes.

The electrically driven horse-groomer is said to do better work in two minutes than two men can do in four hours with the old-style currycomb and brush.

The open season of iced drinks and frozen confections will soon be here, and most of those who deal in these things are preparing to meet the expected demand. Let us recommend most earnestly the adoption of electric power for the operation of carbonators and ice-cream machinery. It is at once economical, safe, efficient, reliable, silent and clean; and is always ready. Those who have used it know, and will tell you if you have not, how true this is.—The Electric City.

H. A. Seymour and D. H. Howard of the advertising department of the Chicago Edison Company have copyrighted an ingenious folder, purporting to contain a facsimile of an important and recently discovered inscription of the Chaldees. On holding the sheet up to the light it is seen that the legend is of very modern import and has to do with the new-business movement of central-station companies. The folders may be used as a supplement with other publications or distributed separately.

Automatic Electric Elevators.

[illegible] minute. Vario[illegible]

[illegible] with an operator.

What It Costs to Cook With Electricity.

The experience of a Portland [illegible] of six, consisting of five adults [illegible] a timely and interesting [illegible] utility and economy of electricity for the purposes of the household.

During the last three months this family has used electricity exclusively for cooking and for operating the flatirons used in the laundry. Three meals were prepared each day, and the laundry work included the clothing of the entire family.

An examination of the bills for electric service supplied this family shows that the cost averages $5 a month; this, of course, does not include the lighting service.

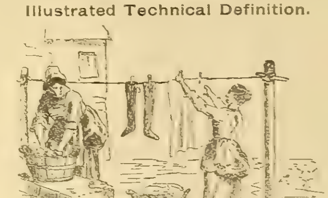
The head of this family, in conversation with a representative of the Portland General Electric Company, remarked that the advantages enjoyed by his family, in the use of electricity for cooking, the cleanliness, the absence of discomfort from leaky valves and smoking stoves, the absence of danger from flames, the perfect results so easily and quickly obtained with electric utensils, were both a revelation and a surprise to him, and that the cost for this service was no less astonishing by reason of its economy.

Burglars Don't Like Electric Light.

"One of the greatest blows to the burglar's trade is the electric light with push-button appliances," said Detective Charles Heidelberger of New York recently. "It is not far out of the way to say that the electric light has driven at least 30 per cent. of burglars out of the business, and the remaining 70 per cent. have had to learn their business all over again.

"The whole art of burglary was based, in the past, on darkness—a helpless darkness as regards the victim. There was one feat—a peculiar way of crouching, striking a match above one's head and tossing it to left and right—that took the burglar weeks to learn. It was valuable because it showed him what he wanted to see, while it misled the victim, who might be armed, as to the burglar's location. This trick is now worthless, for the victim, instead of cowering in black darkness at the burglar's mercy, now reaches over, touches a button at his bedside, and up flashes the light."

Illustrated Technical Definition.



Overhead Line Work.

—Electricity, London.

Operation of Direct-Current Generators in Series and Parallel.

W. E. M. of Chicago Heights, Ill., asks a question concerning the operation of four compound-wound generators in series and parallel. At present he has two 110-volt 600-ampere compound-wound direct-current machines running in series on one set of buses of a three-wire system in his shop. The negative of one machine and the positive of the other are connected to the neutral bus, the other two terminals being connected to the outside buses, which is, of course, the usual procedure. He has also two other machines, each of 110-volt 225-ampere capacity, compound-wound, which are similarly connected to three buses of another three-wire system in his shop. This is naturally an awkward arrangement at best, as it necessitates two complete systems. What he wishes to know is whether he can connect the two sets of buses together and then run the two groups of generators in parallel, the individual machines of each group being in series, so that all of the machines in each group will take their proper amount of the load.

ANSWER.

This connection may readily be accomplished so that each machine and group of machines will take its proper load. Connect the two larger machines in series as one group and the two smaller machines in series as the other group. The bus-bars having been joined (and care should be taken that they have the proper carrying capacity) the wire from the positive terminal of one of the machines is run through the main switch, the fuse and the ammeter to the positive bus. The wire from the negative terminal of that machine is run through the switch and fuse to the neutral bus. The wire from the positive terminal of the other machine in that group is run in a similar manner to the neutral bus, and its negative terminal is run to the negative bus. These two machines are thus ready to operate in series on the three-wire system, the only addition being a neutralizing bus or else a wire connecting the two series coils together. This should be of ample cross-section, so that the machines may regulate closely. The shunt coils must be connected as a single shunt, i. e., the two coils in series across the two outside terminals of the machines.

The other two machines should be connected to the buses in exactly the same way, care being taken that the positive and negative terminals are connected to the buses to which the corresponding terminals of the other group are attached. The two groups are now ready to operate in parallel, and they will do so if the machines are properly designed, regardless of the fact that the two groups are of different capacities. One group should be thrown on to the buses at a time. The last one to be connected must of course be up to speed and at proper voltage before the switch is closed.

There may be some difficulty in the operation of the machines, owing to dissimilarity in the characteristic curves, as was explained in the Western Electrician of March 10th in answer to A. G. K.'s question relating to the operation of shunt dynamos in parallel. (Page 197.) But it is not likely that any difficulty will arise.

Massachusetts May License Electricians.

On March 19th the Massachusetts legislative committee on mercantile affairs gave a hearing on the bill providing that the governor appoint a commission to examine and license electricians. A large number of opponents of the measure were in attendance, the electrical men of Boston and vicinity being represented by Z. W. E. Kimball. Two Boston labor unions were represented by Thomas Mullen, who argued that a statute providing for an examination in the city of Boston, passed in 1894, had been satisfactory and might well be made to include the remainder of the state.

William McLaughlin of Boston said that practically all the electrical workers' unions in the state were opposed to the bill, believing that it would be in restraint of trade, would be in the interests of a special class, and would create a practical monopoly. E. G. Brown, who represented the Central Labor Union of Brockton, said that there was ample inspection of electrical workers in that city and he thought the people did not want any more commissions. Mr. Barton, who said that he represented 1,500 workers, characterized the imposition of a license fee of $25, proposed by the bill, as a hardship. He said that the Boston examination was so exhaustive that graduates of the technical schools could not pass it without first doing the actual work of journeymen.

J. E. Potts of Boston declared that the bill's object was to create a monopoly of a given sort of work, and he thought that there were enough monopolies in the state at present. Representative Conway of Boston said that one of the petitioners present in the room, had had one of his helpers, a boy of not more than two years' experience, stringing wires in the city of Boston. "This," he said, "is not very consistent with his present attitude." Mr. Conway suggested the extension of the Boston act to the rest of the state.

The petitioners' representative argued in favor of general legislation for the protection of the public. The bill provides for a commission of three persons, appointed by the governor. At least one of the commissioners must possess the qualifications of a master electrician. The chairman is to have a salary of $1,000 a year and the others are to receive $500 a year each. Every person or firm engaged in electrical construction must be licensed by the commission, the fee being $25, and the licensee to file a bond for $2,000 for the faithful performance of contracts. The license is to be in force one year.

The Modern Tendency in Underground Electrical Construction.

Undoubtedly there is a tendency on the part of public authorities to require electric-light companies to put their wires underground in the "downtown" areas of cities of, say, 25,000 inhabitants and over, and even in some places of smaller size. Often underground construction in the business districts is desirable to both parties interested, and much new work of the kind is carried out each year.

The question of underground construction was thoroughly discussed in Chicago at the recent Northwestern Electrical Association convention, the subject being introduced by Mr. W. D. Burford's paper describing the underground construction in La-Crosse, Wis. The discussion which followed was of a more general nature and well worthy of careful consideration. What follows is taken from this discussion.

C. B. Springer, civil engineer of the Chicago Edison Company, contributed a written paper in which he gave a short description of the Edison company's methods.

The vitrified-clay conduit has so far been found to be the kind most nearly attaining the requirements. These conduits are made in both single and multiple duct, the single being about 3½ inches in diameter, or 3½ inches square, and 18 inches long. Multiple conduit is made in two, three, four, six and nine-duct sections, two to three feet long.

The single-duct conduit is most available in streets crowded with gas, water and other pipes, as the conduit may be divided into several layers, crossing over or under the many obstructions found in the streets of large cities. A conduit construction made up of single ducts where each horizontal and vertical joint is broken, also has the additional advantage of preventing fire from spreading from one duct to another as might occur in multiple conduit. The multiple conduit is, however, well calculated to be used in outlying communities, where there are not many obstructions, particularly in lines of from two to four ducts. This style conduit is somewhat cheaper to lay than single duct.

In laying the conduit a trench is dug sufficiently wide to allow three inches of concrete to be placed on each side of the ducts, and of sufficient depth to allow at least two feet six inches on top of the top layer of concrete. Three inches of concrete is laid in the bottom of the trench also, thus insuring a concrete protection of three inches on all sides of the ducts. The trench is graded from some point near the middle of the block to the manhole at each intersection, or from one manhole to the other, as the case may be, at a gradient of about two inches or more, as may be necessary, to 100 feet of trench, thus draining the ducts.

When laying the single-duct tile the ducts are placed close together, the joints and triangular spaces in the corners being plastered and filled with cement mortar of a mixture of one part cement to one part of sand. A wooden mandrel of about four or five feet long and three inches in diameter, with a rubber or leather washer three-eighths inch larger at one end, is drawn through each duct as the conduit is being laid; this is to insure any foreign particles or cement which may have gotten into the joints being drawn out. It also makes a good alignment.

Concrete which is used on the bottom, sides and top of the ducts is composed of one part of Portland cement, three parts of torpedo sand and five parts of one-half-inch crushed limestone. The concrete on being placed is well tamped as each layer of ducts is laid. A special side tamper about 2½ inches by four inches in size is used for the three-inch space on each side of the ducts. A bricklayer is generally used in laying the single-duct conduit, the cost being slightly more for a bricklayer and helper than for three ordinary laborers, as used in laying the multiple conduit. A good man, however, will lay from 1,600 to 2,200 duct-feet of single-duct conduit in an eight-hour day.

After the concrete is laid, the ducts are rodded and a steel mandrel of 3¼ inches in diameter or 3¼ inches square is drawn through each duct. This is found to be necessary, especially where ducts are laid in wet places, as sand or small stones occasionally get into the ducts and block them. In such cases the conduit has to be dug up, cleared of obstructions and repaired.

In regard to the cost of conduit construction, as Mr. Burford says, there are many varying figures given offhand. Indeed, the vast difference in local conditions makes it very difficult to give a set of figures which will hold good in many places, or, in fact, in the same place under different circumstances. There are often obstructions causing several feet difference in depth of trench, additional material and labor required, etc., to be considered, as well as variation in cost of material, labor and number of ducts installed. The following table, however, is submitted as a guide in approximating the cost of work of this character as a result of conduit construction covering 10 years in Chicago. The cost of manholes is not included in this table, but is given in one following:

TABLE FOR ESTIMATING COST OF CONDUIT PER DUCT-FOOT IN DIFFERENT GROUPS IN VARIOUS PAVEMENTS.

Kinds of Pavement.	Number of Ducts.								
	2	4	6	9	12	16	20	25	30
No pavement	$0.18	$0.18	$0.18	$0 18	$0.18	$0.18	$0.18	$0.18	$0.18
Macadam	.24	.21	.20	.20	.19	.19	.19	.19	.19
Cedar	.26	.22	.21	.20	.20	.19	.19	.19	.19
Cedar reserve and granite	.31	.24	.23	.21	.21	.20	.20	.20	.19
Granite reserve	.43	.31	.28	.24	.24	.23	.22	.21	.21
Asphalt and brick reserve	.68	.43	.37	.31	.29	.26	.24	.24	.23

The above table is based on the following prices:

First cost of ducts	$0.04 per duct foot
Average cost laying, including labor and material	0.115 per duct foot
Macadam repaving	0.30 per square yard
Cedar repaving	0.45 per square yard
Cedar reserve and granite repaving	0.75 per square yard
Granite reserve repaving	1.50 per square yard
Asphalt and brick reserve repaving	3.00 per square yard

Labor generally runs from 18 to 22½ cents an hour; bricklayers, 62½ cents an hour; Portland cement, $1.55 a barrel; sand and stone, $1.65 a yard.

Manholes for conduit lines of different numbers of ducts vary as to size and shape, and, while different conditions prevent the establishing of standard sizes, the following table may be used as an approximate guide:

IN CONGESTED DISTRICTS.

Handholes for services	3 feet by 4 feet in size
Six to 12-duct lines	6 feet by 6 feet in size
Sixteen to 30-duct lines	6 feet by 8 feet in size

Manholes at streeet intersections as large as necessary.

OUTLYING DISTRICTS.

Two, three and four-duct lines	3 feet by 4 feet to 3½ feet by 4½ feet in size
Six-duct short lines	4 feet by 5 feet to 4½ feet by 5½ feet in size
Six and nine-duct long lines	5 feet by 6 feet to 6 feet by 6 feet in size

TRANSMISSION-LINE MANHOLES.

Six-duct lines	5 feet by 6 feet to 1½ feet to 22 inches cut-off corners
Nine-duct lines	5½ feet by 6 inches to 22 inches cut-off corners
Twelve-duct lines	6 feet by 7 feet to 22 inches cut-off corners
Sixteen and twenty-four-duct lines	6 feet by 8 feet to 22 inches cut-off corners
Corner manholes for 6, 9 and 12-duct lines	7 feet by 7 feet in size
Corner manholes for 16 and 24-duct lines	8 feet by 8 feet in size

The depth of three-foot by four-foot handholes is governed by the depth of the conduit, being built only as deep as the bottom ducts. Manholes from four feet to five feet in size are four feet to five feet in the clear inside, and large manholes up to six feet and eight feet are 6½ feet in the clear inside in depth.

The manholes are built of sewer brick, laid in Portland-cement mortar, one to three. In manholes over four feet in size a concrete bottom four inches thick is put in after the manhole is finished, and a six-inch connection made to the main sewer. A grating covers the six-inch P-trap, which is also connected with an iron backwater gate, preventing the backing up of the sewage. One inch of cement mortar is plastered on the floor. In the small manholes and handholes no sewer connections are put in.

The roofs of manholes are generally of concrete, eight inches thick, the manhole being barricaded for several days until the concrete has set. In places where the traffic is unusually heavy, angle and tee-iron are used with brick between, laid in mortar. This latter method permits of the street being paved up at once and opened for traffic.

The covers to manholes are of cast-iron, of the closed and ventilated type. The closed covers are used on small manholes and handholes where there are no sewer connections. In the larger manholes having sewer connections, ventilated covers are used. A cover having 32 holes 1½ inches in diameter is used, permitting any gas which might accumulate to escape. High-voltage transmission cables are usually covered in the manholes with split vitrified tile, preventing fire from spreading from one cable to another. This method is much safer than hanging them on brackets.

In regard to the cost of building manholes, the same statement applies concerning the variability of figures. The following table contains approximate figures, based on conditions prevailing in Chicago, and may be used as a guide in estimating the cost

of conduit construction in connection with the table preceding:

TABLE FOR ESTIMATING TOTAL COST OF MANHOLES [illegible] DIFFERENT KINDS OF PAVEMENT.

Kind of Pavement	Size of Manholes in Feet									
	[illegible] Ft.	[illegible] Ft.	4x4 Ft.	[illegible] Ft.	[illegible] Ft.	6x6 Ft.	[illegible] Ft.	[illegible] Ft.	8x8 Ft.	[illegible] Ft.
No pavement	$41	$47	$5[illegible]	$64	$109	$1[illegible]	$142	$16[illegible]	$18[illegible]	$22[illegible]
Macadam	42	48	55	66	111	[illegible]	146	16[illegible]	19[illegible]	226
Cedar	43	49	56	67	112	136	146	164	19[illegible]	22[illegible]
Cedar reserve and granite	44	50	5[illegible]	68	11[illegible]	138	149	16[illegible]	198	23[illegible]
Granite reserve	46	5[illegible]	60	72	11[illegible]	144	15[illegible]	17[illegible]	20[illegible]	24[illegible]
Asphalt and brick reserve	50	58	67	80	126	[illegible]	168	188	22[illegible]	264

The above figures are based on the same prices for repaving, labor, bricklayers, cement and sand, as given in the table for conduit and the following unit prices:

Brickwork including labor and material	$12.50 a cubic yard
Concrete tops and bottoms	[illegible].50 a cubic yard
Backwater gates	6.50 each
Sewer grates	[illegible].00 each
Sewer connections	12.50 each
Sewer permits	[illegible].00 each
Manhole frames and covers	15.00 each

George H. Lukes of the North Shore Electric Company of Evanston, Ill., said that the policy his company follows is not to economize on the main lines. Those are put in with just as substantial construction as possible. "If we must economize we economize in the outlying districts, where one or two ducts are sufficient for the purpose. For instance, in suburban districts, where it is a matter of getting an arc light circuit underground, or one feeder, perhaps, where one single-phase feeder will supply the district for a long time, we have used new sewer pipe to a large extent, with cement around the joints. It is much cheaper, and if anything goes wrong with it there is not so much at stake, but in the main lines, consisting of four to 10 or 12-duct lines, we believe that it is policy to surround the conduit with concrete. The depreciation on conduits made in a substantial manner is very small. It is the most permanent part of the equipment. There is no reason why a conduit line should not be in shape to be used 25 years from now, if it is rightly put in."

George Cutter of Chicago asked for a little more detail about connecting arc circuits to the poles themselves. To this Mr. Lukes answered that they use rubber-covered lead cable from the manhole to the top of the pole. They put in no switch at all. Porcelain potheads are used to connect the cable with the overhead wire, and rubber-covered wire of good quality is put in with medium tension from the porcelain pothead to the line.

Mr. H. B. Gear, the inventor of the porcelain pothead referred to, was called upon to explain its construction, which he did. Then Mr. Cutter related an experience of his. He said that he was called into a plant that had underground wires in the center of the city only, and iron poles made of four-inch pipe at the bottom and reduced until the curve at the top was of two-inch pipe, holding an alternating-current lamp at the outer end of the curve. When this was put in the conduit was run close to the base of the pole, the underground part of the pole being the same shape as a gas post, thus leaving an opening for pipes that were extended from the conduit connection with elbows up into the iron pole. They were connected to an absolute cut-out switch, it being the intention of the company that the trimmer should not handle the lamp itself on a live circuit. From there up they had rubber-covered wire to the lamp itself. They had trouble in a very short time. The moisture from the conduits, condensing in the iron pole, would settle on the cable, and the switch would very soon get coated with iron rust. Finally they had to take out the switches, run lead-covered cable up, and put the absolute cut-out switch at the end of the gooseneck. Up there they even had to make a double bell, an outer iron bell screwed to the end of the gooseneck, and then one inside of that holding the switch, with a space between the two for the lead-covered cable. This made it impossible for the moisture to drop onto the switch itself. In attaching the lamp, it being an alternating-current lamp, they used mechanical rubber bushings, so that the vibrations would not interfere with the insulation in the lamp itself.

Harold Almert of Chicago emphasized the necessity for seeing that there is no moisture in the bend going up into the pole. A great many underground insulations, put in by men who did not have sufficient experience, permitted this moisture to gather there, and even water got in. They would not have any trouble with the first winter, but this water being present and having a strong iron pipe outside, when the water would freeze and thaw near the surface of the ground, the trouble became apparent in about a year or two. The coefficient of expansion being small, when the water froze it would simply press the lead covering of the cable toward the conductor, and diminish the distance between the conductor and the lead sheath. At first there would be no trouble, but sooner or later the distance becomes so short that the dielectric strength of the material between the conductor and sheath would not withstand the high tension of the arc circuit, and then the trouble began. Many have encountered that difficulty, and had to [illegible] reason.

Regarding the [illegible] and that a [illegible] five years ago had [illegible] pole, and some met with [illegible] with no [illegible]. Some of [illegible] made cutouts of [illegible] tion for the distance from the [illegible] contact to ground have given no trouble, [illegible] in some cases where the contact [illegible] springs that were under hard tension [illegible] fatigue of the metal would [illegible] open the circuit. In [illegible] outs were dispensed with entirely, [illegible] where there was plenty of [illegible] cut-out as in [illegible] tubes, and that [illegible] trouble. But, as a general rule, where [illegible] struction has been used, they have dispensed [illegible] them, and if a lamp gives trouble it [illegible] handled until the current is off the [illegible] because the cut-outs have been [illegible] greater [illegible] of trouble than the lamp going out.

New England Street Railway Club.

The New England Street Railway Club held its sixth annual banquet at the Hotel Somerset, Boston, on March 22d. There were 350 members present. Perplexing engineering subjects were laid aside for the evening and the after-dinner talk were along the lines of promoting social intercourse among the members. Paul Winsor, the newly elected president, inaugurated the speaking and was followed by Hon. Russell A. Sears (toastmaster), W. Caryl Ely, Samuel L. Powers, Charles F. Libby and others. Mr. Winsor, the new president, is chief engineer of the Boston Elevated Railway Company, and is one of the prominent electrical engineers of New England.

The officers elected are as follows: President, Paul Winsor of Boston; vice-presidents, H. E. Reynolds of Boston, L. Bentley of New London, Conn., E. T. Millar of Concord, N. H., W. E. Robertson of St. Albans, Vt., Myron A. Webber of Westerly, R. I., F. C. Carr of Brunswick, Maine; secretary, John J. Lane of Boston; treasurer, N. L. Wood of Boston; executive committee, E. E. Potter of New Bedford, E. P. Shaw, Jr., of South Framingham, M. C. Brush of Newtonville, W. H. Blood, Jr., F. M. Nellis, E. L. James, Charles B. Price of Boston; finance committee, Paul Winsor, John W. Corning, P. W. Davis.

Long Electric Railway for Canada Proposed.

It is reported that $20,000,000 of British capital is to be invested in the Canada Central electric railway. This new system will be 670 miles in length, running first from Montreal to Ottawa, thence westward, practically cutting in two that broad zone of country that lies between the Canada Atlantic railway system and the Grand Trunk and Canadian Pacific lines that run up the St. Lawrence Valley and along the north shore of Lake Ontario to Toronto. The western water terminal will be at Port Stanley, Ont.

National Electric Company's Assets Sold.

As announced, the plant of the National Electric Company, including all assets, was sold on March 26th at the office of John S. Maxwell, referee in bankruptcy, in Milwaukee. The sale was to Charles L. Sullivan of Chicago for $500,000. The statement of Receiver John I. Beggs showed assets of $1,350,691, and liabilities of $1,242,000. Creditors will receive approximately 40 per cent. of their claims.

NEW COMPANIES.

The Citizens' Telephone Company of Atkinson, Neb., has been incorporated with a capital of $5,000. J. H. Brady and Frederick Swingley are among the incorporators.

The farmers living east of Harvey, N. D., are organizing a company to build and equip a telephone line. Dors Leetum is president, O. C. Frost vice-president, and Harry Buik secretary.

The Park Region Telephone Company of Underwood, Minn., has been organized with a capital of $10,000. Thomas Larson is president, C. H. Richardson vice-president, and E. S. Evenson secretary and treasurer.

The Hamburg and Norway Telephone Company of Fessenden, N. D., has been incorporated for the purpose of conducting a telephone business. William F. Shanafelt, Nick Iverson, William Scheer and others, all of Fessenden, are interested.

Among the recently incorporated telephone companies are the following: Cimarron Valley Telephone Company, Ripley, Okla.; Oline Farmers' Mutual Telephone Company, Aline, Okla.; Inman Mutual Telephone Company, Inman, Kan.; Plymouth Mutual Telephone Company, Plymouth, Iowa.

Michigan Independent Telephone Association.

[illegible] W. B. [illegible] phone Company, Detroit.

At the evening [illegible] were given [illegible] president Saugatuck Telephone [illegible] Cedar Supply [illegible] "Crowding [illegible]" Grand Rapids [illegible] R. C. Smith, manager Home [illegible] "The Indiana Outlook," Mr. B[illegible] "Ohio's Success," Frank L. Beam [illegible].

Friday morning's session was devoted to reading of reports, the election of officers and the transaction of unfinished business. The papers and addresses served to show the growing strength of the Independent telephone movement in Michigan and were very encouraging.

Telephone Rate-reducing Campaign in Chicago.

As a part of its programme in securing information upon which to base a report to the Chicago City Council, the Council committee on gas, oil and electric light visited the plant of the Chicago Telephone Company last week. The committee is charged to fix an equitable basis of telephone rates in Chicago, which the company will be asked to accept if its franchise is to be extended. The committee has been gathering information from many sources, and, as stated last week, there is a diversity of opinion among subscribers as to the desirability of a measured-service or flat-rate basis. The telephone company is advocating the measured-rate plan by which each subscriber pays a fixed amount each time he uses the telephone.

The members of the council committee were much impressed with the working of the main exchange of the Chicago company. They visited all the departments and learned many things about the telephone business. The school for operators, which was described and illustrated recently in the Western Electrician, impressed the aldermen because of the thorough and efficient manner in which it is conducted. General Manager Hibbard was kept busy answering questions of the aldermen.

The latest development in the telephone situation is an offer from the Illinois Manufacturers' Association to organize a company and install a telephone system in Chicago. The rates are to be low and the company would ask only a return of four to six per cent. on the investment.

The plans of the association are not yet given out, but it is said the organization of manufacturers will soon present the details of a feasible plan for a new telephone system.

At present, accountants for the city are going over the Chicago Telephone Company's books, and in the meantime statistics from other cities are being compiled. When these two tasks are completed the committee expects to report to the council, giving its opinion as to what the telephone rates should be in Chicago.

MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards at Holton, Kan.; Tonopah, Nev.; Nashville, Tenn.; Elkhart, Ill.; Grand Ridge, Ill.; Bryson City, N. C.; Brantford, Ont., Canada; New York city, N. Y.; Sunset, La.; Mt. Upton, N. Y.; Carthage, Ill.; Central Square, N. Y.; Marcus, Iowa; Franklin, N. C.; Auburn, N. Y.; Ladd, Ill.; Diagonal, Iowa; Lytton, Iowa; Woodstock, Ill.; Rochester, N. Y.; Seattle, Wash.; Fontana, Kan.; Clarksville, Tenn.; New Cambria, Mo.; Cambria, Mo.; Rupert, Idaho; Elkville, Ill., and Ohio, Ill.

Annual Report of American Telephone and Telegraph Company.

From the report of Frederick P. Fish, president of the American Telephone and Telegraph Company, to the stockholders of that company, dated March 27, 1906, the following is taken:

The results of the business for the year 1905, as shown by the treasurer's statement appended, were as follows:

Gross revenue	$21,712,831.29
Expenses, including interest and taxes	8,678,792.90
Net revenue	13,034,038.39
Dividends paid	9,860,355.00
Carried to reserve	1,743,295.16
Carried to surplus	1,424,388.23

The following were the corresponding figures for the year 1904:

Gross revenue	$18,546,659.21
Expenses, including interest and taxes	7,270,957.46
Net revenue	11,275,701.75
Dividends paid	9,799,117.50
Carried to reserve	586,149.20
Carried to surplus	890,435.05

The net output of telephones during the year 1905 was 1,217,694, making the total number of hands of the operating companies 5,698,258.

The number of exchange stations at the end of the year operated by the companies which constitute our system in the United States was 2,241,367, an increase of 441,734. In addition to this number there were 246,337 exchange and toll stations operated by so-called sub-licensees, namely, independent companies or associations under sub-license or connection contracts and making use of our telephones. Adding also our telephones employed for private-line purposes, our companies had a total of 2,528,715 stations as against 2,003,213 stations at the close of the previous year.

The total mileage of wire in use for exchange and toll service was 6,043,518 miles, of which 1,372,480 miles were added during the year. These figures do not include the mileage of wire operated by sub-licensees.

Including the traffic over the long-distance lines, but excluding sub-licensees, the daily average of toll connections was about 368,000, and of exchange connections about 13,543,000, as against corresponding figures in 1904 of 301,000 and 11,149,000; the total daily average for 1905 reaching 13,911,000, or at the rate of about 4,479,500,000 per year, being 54 telephone calls for each man, woman and child in the United States.

The amount added to construction and real estate by all the companies, excluding sub-licensees, constituting our system in the United States during the year 9905, was:

For exchanges	$36,771,312
For toll lines	9,832,204
For land and buildings	4,177,390
	$50,780,906

The amount added in 1900 was $31,619,100; in 1901, $31,695,400; in 1902, $37,336,500; in 1903, $35,368,700; and in 1904, $33,436,700, making the grand total of expenditure upon these properties during the six years $219,547,306.

The amount expended by this company in 1905 for the construction, equipment and supplies required for its own long-distance lines was $3,805,053, making the total investment in long-distance lines and equipment up to the close of the year $34,694,763.

The growth of the business during the last year has been greater than ever before. There is no doubt that the business will continue to increase. The use of the telephone is extending more and more in every section of the country and in every class of the community. It is revolutionizing business methods and social relations to a substantial extent.

The plant is to a large extent stable and standard. Fifty-four and one-tenth per cent., in miles, of all the exchange wire in the country is now in cables underground; and in the very many places where for technical or economical reasons it is impossible to go underground with exchange circuits, overhead cable construction has taken the place of the open wires formerly in use, to the great advantage of the telephone companies and their subscribers, inasmuch as liability to injury by storms is reduced and the service greatly improved.

At the end of the year 1905, all except about 20 per cent. of the exchange wire in the Bell system was in cables, overhead or underground.

At the present time the companies making up the Bell system have in use not less than 320,000,000 pounds of copper wire, much of it in cables of a permanent type, the value of which, as copper, if removed and sold, it is easy to estimate; not less than 8,000,000 poles and 95,000,000 duct feet of underground conduit are installed and in use to support or contain this wire; but the actual value of this aerial and underground plant is no more to be measured by the value of the raw materials than is the value of a first-class railway in actual service to be based upon what could be realized from the rails and sleepers if they were to be removed and sold as junk.

The real estate owned by the companies making up the Bell system at the end of the year 1899 amounted to $12,997,458; at the end of the year 1905 it was $29,763,741.

The requirements of the telephone business are such that in the larger cities it is a distinct economy and great advantage to the service that the companies should own their own buildings. Even in the smaller places it is often impossible to find proper quarters that may be leased, and an intelligent and conservative investment in real estate is as essential an element of a proper and well-organized telephone system as poles and wires and central-office equipment.

Since January, 1900, the number of telephones in the hands of our companies increased from 1,580,101 to 5,698,258; the total number of stations using Bell telephones, from 675,761 to 2,528,715; the miles of wire in toll and exchange use, from 1,518,609 to 6,043,518; the number of officers and employes of all classes, from 29,599 to 87,212; the number of yearly conversations, from 1,708,800,000 to 4,479,500,000. The American Bell system of the United States now exceeds, in the number of subscribers, mileage of wire and extent of traffic the telephone systems of Great Britain and all of continental Europe combined.

The aggregate capitalization of the American Telephone and Telegraph Company and its associated companies in the United States, including capital stock, and bonded and floating debt, was on January 1, 1906, as shown in the following table, which also shows certain other details of capitalization:

Entire capitalization (stock bonds and all obligations as above) of all the companies, including this company	$334,524,583
Number of stations (excluding sub-licensee and private line stations)	2,241,367
Average capitalization per station	$149
Deducting cost toll lines	$99,293,987
Balance, cost of exchanges*	$235,230,596
Average capitalization per station (excluding toll line investment)*	$105
Miles of toll wire	1,265,236
Average investment per mile of toll wire	$78

*In these items are included all the capitalization and investment of the companies, excepting only the cost of toll lines.

It is only upon the aggregate capitalization above stated that our companies, including the American Telephone and Telegraph Company, have to earn and pay dividends and interest.

The active competition which has existed for many years in many portions of the country still continues, in some cases to the detriment of certain of our companies. It seems clear, however, that within the last three years the general situation, in so far as competition is concerned, has become distinctly more favorable to our interests.

In many portions of the country in which our business was unprofitable a few years ago it is now in satisfactory condition, and there are but few companies of those which have had to face strenuous competition in which there are not definite indications of an improved condition. In some instances the recovery may be slow, but we believe that it is sure to come everywhere in a reasonable time.

That the competition of two telephone companies, operating in the same field, is an economic mistake from the standpoint both of the investor and the telephone-using public is coming to be more and more fully recognized.

The subscriber, to derive the greatest value from telephone service, should be enabled to connect with all subscribers in his exchange area. If there are two companies, the subscriber having considerable business interests finds it almost indispensable that he should be connected with both companies, at increased cost and inconvenience. Those who have the service of one company only cannot carry on conversation by telephone with the subscribers of the other company, and have therefore no connection with a portion of the telephone-using public.

The competing companies, having an erroneous idea of the cost of giving service, for the most part undertook to secure subscribers by offering telephone service at a price that was unremunerative. This has been shown in many ways, among others by their repeated efforts to raise the low rates originally established. Many of them were and are capitalized at a high rate, from $200 or $250 and even above $350 per station, as compared with a much lower average per station of the Bell companies operating under similar conditions; and their gross revenue, as far as the same is made public, is, as a rule, far below the amount requisite to cover expenses of operation and even a moderate return upon the capitalization. It is hard to find a competing company that in its published figures does not purport to operate at an aggregate expense of not more than 60 per cent. of its gross receipts; and in some cases from the figures and prospectuses of such companies it would appear that from 35 to 50 per cent. of the gross receipts are regarded as sufficient to pay all the expenses of carrying on the business, including maintenance and depreciation, to the extent to which, as it is not infrequently the case, these essential items of expense are not ignored.

The gross revenue of the Bell telephone companies throughout the United States for the year 1905 was $100,440,264; and their total expenses, including a proper allowance for maintenance and depreciation, were $74,110,795; the ratio of expense to gross income being 74 per cent. Eliminating all items of revenue and expense except those relating directly to the telephone business, the ratio of expense to gross revenue was about 73 per cent. It seems reasonable to suppose that a proper recognition of the element of depreciation and maintenance would in many, if not in most cases, carry the expenses of the competing telephone companies to a point so nearly equal to (if not exceeding) their gross receipts as to leave but little, if any, margin of return upon capital investment.

There are a large number of Independent telephone companies and associations whose projectors entered into the business and invested their capital in entire good faith and with the purpose of supplying service in small communities and rural districts which our system had not yet developed.

There has been a growing disposition on the part of organizations of this class, as is evidenced by the large increase of the number of sub-licensee stations to adopt the use of Bell telephones and connect themselves with the systems of our companies. This is true, also, of a considerable number of companies which have operated in direct competition with the Bell exchanges.

Indiana Telephone Items.

The Decatur County Telephone Company, with principal exchange in Greensburg, declares that nowhere else is the use of the telephone more general than in Decatur County. The company has 2,487 telephones in service. Its lines are stretched on every road in the county, with 887 telephones in service in the rural districts. Branch exchanges are maintained at St. Paul, Letts, Sardinia, Clarksburg and Andersonville.

The Central Union Telephone Company recently issued an open letter to the effect that it has made a proposition to the Citizens' Telephone Company of Columbus to enter into an operating agreement between the two companies and have only one telephone plant in Columbus, and thus do away with the dual service. The Citizens' company gives free country service, while the Central Union charges its patrons. The Citizens' company declares the proposition out of the ordinary and entirely incompatible. The Independent company points out that it would be foolish for it to combine with the Central Union, when it already has control of the country and the city patronage. The Citizens' company is owned and controlled largely by the New Long Distance Company. Since the proposition is declined, the Central Union will now put in a new plant.

Mayor Brouse of Kokomo carried out his threat to veto the ordinance passed by the council to allow the Citizens Telephone Company of Kokomo to make long-distance connection with the Bell company. The franchise of the local company prohibits this, and the ordinance vetoed made no mention of nor attempted to repeal the prohibitory section. No attempt was made to pass the ordinance over the veto.

The telephone situation at Evansville remains unchanged. It is understood that Mayor Buehne is favorable to the granting of a franchise to the Citizens' company, now applying, and when he learned the council had agreed to smother the petition last Monday night, he asked for a continuance for two weeks. In the meantime petitions are coming in from every section of Southern Indiana, asking for a foothold in Evansville by the Independents. S.

Ohio Telephone Notes.

A bill has been introduced in the Legislature providing for the entrance of new telephone companies into a municipality on the same basis as the old companies operate. This bill will aid the companies endeavoring to get into Cincinnati. Another bill makes the duties of a Probate Court broader in respect to granting franchises to telephone companies, where municipal councils delay or neglect to act. The recent decision of the Supreme Court was to the effect that the Probate Court could only direct the manner in which the streets should be used. The new bill permits application to the Probate Court for a franchise. This will also aid the companies to secure a foothold in Cincinnati. Frank L. Beam, manager of the Ohio Independent Telephone Association, has written a letter to all Independent managers, asking them to use their influence toward the passage of this bill.

The Cincinnati Board of Public Service has decided to enlarge the private exchange in the waterworks office to include all other departments except the police department. At present each office has a telephone. The change will reduce the cost of telephone service from $9,000 a year to about $5,000.

An office will be established in the Columbus Savings and Trust Building, Columbus, in a few days by the Stromberg-Carlson Telephone Manufacturing Company, and from this point the business of the Central West will be taken care of. A. E. Crawford will be in charge of the branch.

An increase of capital stock from $23,700 to $71,000 has been made by the Covington Home Telephone Company of Covington.

The Henrietta Rural Telephone Company of Henrietta has been incorporated with a capital stock of $4,000 by W. C. Porter and others.

Articles of incorporation have been issued to the Ragersville Telephone Company of Ragersville.

The capital stock is $5,000, and Daniel Dall, William Miller and others are among the incorporators.

F. H. Paul and others have incorporated a the Farmers' Union Telephone Company at Otway, with a capital stock of $1,000. C.

Telephone News from the Northwest.

The Great Northern Railway has about completed a block signal system between Larimore and Minot, N. D. It will be operated by telephone.

A local telephone exchange is projected at Minneota, Minn., by the Commercial Club.

The Dakota Central Telephone Company has bought the local exchange at Howard, S. D., and will extend and improve its long-distance connections with that city.

The Lewiston Telephone Company of Lewiston, Minn., will consider increasing the capital stock from $10,000 to $25,000.

The Nicollet County Telephone Company of St. Peter, Minn., proposes a line through Nicollet and Courtland townships.

A call has been sent out through North Dakota for a convention of Independent telephone companies of the state, to unite against the aggressions of the Bell interests. The date of the meeting has not yet been fixed.

The Northwestern Telephone Exchange Company seeks a franchise at Braham, Minn., for a local exchange, in competition with the Tri-State company.

The Park Region Mutual Telephone Company of Underwood, Minn., has been formed, with $10,000 capital stock.

The Sanborn Telephone Company of Sanborn, Minn., has been incorporated with a capital of $15,000. Henry J. Fink is among the incorporators.

Charles Swedberg has been granted a franchise for a local telephone exchange at Ripple, Minn.

The Farmers' Mutual Telephone Company has been organized at Ringsted, Iowa, with Andrew Larsen as president and E. T. Sorum, secretary.

R. L. Parker of Traer, Iowa, has purchased the toll line from Traer to Toledo.

C. W. Smith, owner of the telephone system at Toledo, Iowa, will install a modern switchboard.

The Traders' Telephone Company has sold its system at Delta, Iowa, to H. Bell of Delta and associates. R.

GENERAL TELEPHONE NEWS.

A Japanese inventor by the name of Kimura is said to have devised a practicable wireless telephone.

The Gurdon and Northwestern Telephone Company of Gurdon, Ark., has sold its business to the Southwestern Telephone Company.

Thomas H. Hilary of Stillwater, Minn., has been appointed district manager of the Northwestern Telephone Exchange Company.

B. H. Chase has resigned as manager of the Citizens' Telephone Company at Spencer, Iowa, and A. L. Ritchie of Mason City succeeds him.

Permission has been granted the Chicago Telephone Company to extend its long-distance lines from Bloomington, Ill., south through De Witt County.

The Washington Telephone Company of Bellevue, Iowa, has been organized with a capital stock of $1,500. John Chick is president and Henry Builerdick secretary.

Announcement is made of the consolidation of the Mattoon (Ill.) Telephone Company, the Coles County Telephone Company and the Charleston Telephone Company, all three companies being taken over by the Coles County Telephone and Telegraph Company, which was recently incorporated with a capital of $100,000.

The fifth district of the Illinois Independent Telephone Association will have a meeting at the Hotel Fey, Peoria, on April 16th and 17th. The clearing-house movement will be further considered, and the committee appointed at the meeting in January, consisting of J. W. Barrett of Pekin, S. Dailey of Chillicothe and C. A. Camp of Sparland, will submit its report at this meeting.

Linemen of the Wisconsin Telephone Company recently mistook a private horse for a livery rig and drove into the country with it, leaving their horse tied in Janesville. The sheriff, police of four towns, and the entire anti-horse-thief society of the county was called into action. The linemen were surprised to be met by a posse while at work stringing wires in the country. An explanation settled matters.

Independent telephone men from all parts of Illinois will meet in Peoria the last of April to discuss and devise ways and means to further their interests. E. R. Conklin, general manager of the Interstate Telephone Company, is president of the organization. The question of toll rates and connections will be taken up, and it is expected arrangements will be perfected so as to have uniform charges. A more extensive territory will then be covered.

CORRESPONDENCE.

Great Britain.

London, [illegible] [illegible] with regard [illegible] relating to London [illegible] will be [illegible] question has [illegible] ing the [illegible] consideration of [illegible] he has [illegible] that [illegible] the [illegible] attitude [illegible] of actual [illegible] a joint committee of both houses of Parliament [illegible] to allow them to take their normal [illegible] latter is to be adopted there [illegible] several delays, which may place [illegible] bill not passing into law through [illegible] was the case last year. The [illegible] already been postponed twice, and [illegible] case, the government cannot decide [illegible] to follow, it is not improbable that much [illegible] will once again be wasted in abortive proceedings. A very complete opposition is being organized to all the power bills, and it has been decided by the London Liberal members to oppose all the companies' bills, but to allow the London County Council bill to proceed. At any rate, we are one step advanced since last week.

The significance of the fact that the Brighton Corporation is abandoning the maximum-demand system of charging for its electricity seems to have been overlooked. It was Mr. Arthur Wright, the corporation's consulting engineer, who devised the system, and it has been used exclusively in Brighton since its birth. Even the advocates of the system have always acknowledged its complexity, and, in deference to a very generally expressed opinion in Brighton that a simpler system should be adopted, the following has been suggested by Mr. Wright: Existing consumers will be supplied upon a flat rate equivalent to their average price during the preceding year; new consumers will be charged a flat rate equivalent to the average charge made during the last year to the other consumers of that particular class. Finally, it has been agreed that the flat rate to be charged during any one year shall be fixed on the average quarterly readings of the previous year. Putting these proposals into practical effect, the committee has decided to charge a flat rate of 4d. per unit to any consumer not desiring to be charged upon the maximum-demand system.

Many rumors have been going around concerning the five municipal telephone systems in Great Britain, and at present it is unsafe to definitely make any statement as to the likely results. A short time ago it was officially announced that a survey of the systems in question had been undertaken at the instance of the Postoffice with a view to a transfer. This much has been done, and protracted negotiations in each case have taken place, which, some of the daily papers announced, had been broken off. It is pretty clear, however, that this is not so, and that a result is still being aimed at. But, to mystify the whole matter, comes the statement that the National Telephone Company has apparently in addition, also negotiated with the Hull Corporation, and practically come to terms for purchasing that exchange system. There was a similar rumor a short time ago relating to the Swansea undertaking, but it eventually came to nothing. In the Hull case, however, a definite proposal is to be submitted to the corporation, by its own telephone committee.

Much comment has been passed, both in financial and other quarters, as to the almost universal reduction in the dividends paid last year by the various electric-lighting companies in London. There are two main reasons for this. Up to the present it cannot be denied that the majority of supply companies have constituted a reliable investment, with the strong possibility of 10 per cent. return and upwards. But the advent of Mr. Merz's power scheme last year put a somewhat different complexion on the matter, and as the result of a very strenuous opposition, there was a pretty general reduction of two or three per cent. in the various dividends in order to meet the cost of that opposition. In the second place, a direct result of the "power" bill last year was an all-around reduction in prices, which was also somewhat precipitated by the very active and incisive competition which the gas companies are offering just now. In this connection there is a circumstance which flatters but will probably not please Mr. Merz. He complained before Parliament that the existing companies made no efforts to "push" the business. Since that memorable utterance there has been great haste in several quarters to organize canvassing departments all over London, and I do not doubt that much will be heard of these whenever the electric power bills reach the committee stage again, either this session or next.

All the necessary preparations are now being made for the transfer of the large system of horse tramways in the north of London to the London County Council. The actual change over will take place on April 1st, and a bill is now before Par-

[illegible]

Dominion of Canada.

[illegible]

[illegible] horsepower, making a [illegible] The [illegible] system [illegible] Canada, will [illegible] power generated [illegible] of the [illegible] having been installed [illegible]

New York.

New York City, March 24.—The [illegible] New York Connecting Railroad [illegible] back to committee by Mayor McClellan [illegible] ground that its terms [illegible] on the part of the Rapid Transit [illegible] connecting link will be very important for the Pennsylvania Railroad, as [illegible] cars to be run from the New Haven system [illegible] the connecting road to Long Island City [illegible] through the Pennsylvania's Long Island [illegible] Jersey City. It is noteworthy that the power house of the New Haven railroad at Stamford [illegible] equipped with 11,000-volt alternating-current generators of practically similar design [illegible] in the new Long Island power house [illegible] operates the sub-stations for the [illegible] third-rail traffic on the Long Island railroad.

Negotiations are pending between the Postoffice and the Pennsylvania Railroad for the [illegible] a central postoffice in the vicinity of the new Pennsylvania railroad depot on Twenty-third Street.

Chief Engineer George S. Rice reports that work is progressing favorably on the East River [illegible] He also makes a number of recommendations relating to subway traffic and suggests to the passengers that they distribute themselves better throughout the length of the train.

A trial has been made at the Worth Street subway station of a process of vacuum cleaning as applied to the tiling and girders. It is estimated that a traveling plant of this kind can clean a station in 30 minutes and pick up loose paper from the tracks when traveling between stations.

On Wednesday the state Senate amended the Elsberg rapid transit bill by eliminating its competitive features, but Senator Elsberg is expecting to have them reinserted. Yesterday Assemblyman Krulewitsch introduced a bill to compel the New York traction companies to sell six tickets for 25 cents.

The Independence League Railway Company has issued an elaborate scheme of Brooklyn traction, "By the people, of the people, and for the people." There are to be $10 shares, three-cent fares, and free transfers. This scheme has nothing to do with Borough President Coler's scheme for the building of a municipal railroad in Brooklyn.

The state railroad commission issued a lengthy order yesterday for the improvement of the Brooklyn Rapid Transit Company's service, but admits that it is impossible to increase the facilities for the rush-hour traffic over the bridge.

The Rapid Transit Commission has approved of a proposal to build a subway to Coney Island as an extension of the Fort Hamilton route.

This week the Brooklyn Rapid Transit placed in service four new snow plows, which not only clean the car tracks but also clear a space eight feet wide on the adjacent roadway. These plows weigh 30 tons each and are driven by means of four 50-horsepower motors. A fifth motor operates an air compressor, which in turn controls the projecting wings which clear the sides of the track.

An incandescent lamp with a metallic filament

which is neither platinum, osmium nor tantalum has been received in New York city from a California inventor. The filament is probably composed of tungsten.

Mayor McClellan has signed the bill fixing the price of gas in New York city at 80 cents per 1,000 cubic feet. The Consolidated Gas Company is still protesting against the reduction.

The Rural Home Telephone Company of Nassau, N. Y., has been organized by Albany men with a capital of $50,000.

E. M. Treman and associates of Ithaca, N. Y., have incorporated as the Associated Gas and Electric Company of Penn Yan, N. Y., capital $1,500,000, for the purpose of manufacturing engines, boilers and dynamos.

Bids are receivable until 11 a. m. on April 2d for the electrical equipment for a new public school on Robinson Street, Brooklyn, the amount of the security required being $3,500.

The Municipal Civil Service Commission on April 6th will hold an examination for male telephone operators. The minimum age is 21, and the salaries range from $480 to $900. D. W. W.

New England.

Boston, March 24.—Lawrence Colt of Waterford, Conn., proposes to bring suit against the New London and East Lyme Street Railway Company, contending that the company's freight and express service is seriously interfering with his general store. He alleges that the company discriminates against him in the matter of rates. He declares that the company's employes buy eggs from Waterford farmers and sell them in New London and that the corporation is practically engaging in a retail trade. Mr. Colt owns some of the company's stock, and he claims that he subscribed for the stock solely for the purpose of having a passenger service.

A lot of land on Berkeley, Clarendon and Stanhope streets and St. James Avenue in Boston has been bonded by the Massachusetts Institute of Technology Corporation, which intends erecting a clubhouse in memory of the late President Francis A. Walker. Architects are now preparing the plans.

The Consolidated Railway Company has bought control of the Hoosac Valley Street Railway Company, paying $180 per share for 4,000 shares of the stock. The stock was transferred to the Berkshire Street Railway Company, a subsidiary of the Consolidated company. By this purchase, the New York, New Haven and Hartford interests obtains control of electric railways between Worcester and the northwestern corner of the state. It is believed that the Hoosac Valley road will be extended to Bennington, Vt.

The heavy snowfall of Monday caused a great deal of delay to the Boston Elevated Railway Company's surface cars, while a slight accident to a car at an entrance to the subway so interfered with traffic that Park Street station become crowded to the danger point. This is a great argument in favor of more subways.

The General Electric Company has bought over two acres of land near its River Works plant in Lynn, Mass., and will build an addition to its foundry.

Perley K. Dodge, aged 21 years, a student at the Massachusetts Institute of Technology, was killed by coming in contact with a live wire in the United Shoe Machinery Company's power house in Beverly, Mass., last Monday night. He was making experiments which he intended to use in his graduating thesis. He lived in Beverly.

The Hartford Electric Light Company has built a distributing station from which it will deliver electric current at 10,000 volts to the Consolidated Railway Company for the operation of its road between Hartford and Rockville, Conn. The latter company will use its steam railroad between Burnside and Rockville for part of this line.

The automobile show in Mechanics' Building, which closed last Saturday night, showed that there is a decided boom for electric automobiles in this part of the country, there being twice as many such machines on exhibition as there were at last year's show. B.

Southeastern States.

Charlotte, N. C., March 24.—A favorable report has been made to the district committee of the Senate at Washington, D. C., on a bill proposing to grant a charter to the East Washington Heights Railroad Company.

The Reedy River Power Company of Western South Carolina has secured a charter with a capital of $50,000.

The Birmingham Railway and Power Company, among other improvements, has announced a new sub-station in Ensley, Ala.

A proposition has been set afoot in Richmond, Va., to put on the tickets in the coming aldermanic campaign the question of municipal ownership of lighting interests.

The lighting situation in Louisville, Ky., has been made more interesting by the entry into competition of the Atherton-Jones interests, and now it is stated that the Louisville Lighting Company proposes to cut rates provided the competitive company is not granted a franchise. The directors of the Commercial Club have signified their favor of granting the new concern a franchise at the hands of the city authorities.

The town of Elm City, N. C., has given a contract for a $10,000 municipal lighting plant to the Electric Construction Company of Richmond, Va., thus following the example of the town of Spring Hope, N. C.

The Durham (N. C.) Traction Company will install a large steam turbine with motor generator in the power and ice plant at Durham.

The Spencer Mountain Power Company, belonging to W. T. Love of Gastonia and J. C. Rankin of Lowell, N. C., is nearing completion and 3,000 horsepower will be available. The company will supply power to cotton mills and light to the town of Gastonia, N. C. L.

Ohio.

Cleveland, March 24.—An interurban route from Pittsburg to Cincinnati is made possible through the Steubenville and East Liverpool Railway and Light Company, which has been incorporated by W. Caryl Ely, Edward McDonnell, Charles A. Smith, George H. Owen and a number of others. All are interested in the East Liverpool Railway and Light Company. The plans of the new company include the construction of an electric line to connect Toronto and East Wellsville, the East Liverpool lines terminating at the latter point. The Beaver and Ohio Valley Traction Company, incorporated recently by men interested in the Pittsburg Railway Company, insures a line from the terminus of the Beaver Valley lines to Smith's Ferry, Pa., where connection is to be made with lines that will run down the Ohio River to Wheeling and there turn across the state by way of Zanesville, Newark and Columbus. Other lines connect Columbus and Cincinnati.

The lower House of the Legislature has passed a bill which makes it optional instead of mandatory for village councils, when endeavoring to establish a municipal plant, to first negotiate with the owners of a private plant, if one exists, before any other action is taken.

J. R. Curtis of Geneva has purchased the property of the Commercial Electric Company at Painesville. The company will ask for a franchise and a contract to furnish lights for the town.

Albert E. Boone and others have incorporated the Gallipolis, Huntington and Columbus Tramway Company of Gallipolis, with a capital stock of $15,000.

Representative Henry C. Hunt of Cincinnati has offered a bill in the Legislature providing for the construction of elevated railroads in cities. The bill has been offered in order to enable the company contemplating the construction of an elevated road in Cincinnati to proceed with its plans.

J. L. Hoyer of Cleveland has invented a new switch guard, operated from the vestibule of an electric car or the engine of a railroad train when going at high speed, by which accidents due to open switches can be avoided.

A movement is on foot to sell the municipal lighting plant at Ashtabula to a private corporation consisting of men interested in lighting plants at Columbus, Springfield and Dayton. In addition it is thought that the company will purchase the water plant, which has been operated by a local company. The franchise expires in August, and the council has been at loggerheads over its renewal. There has been some dissatisfaction over the rates charged for both light and water. Should the plants be sold they will be enlarged. The lighting plant will furnish light and power to many of the large industries which have not been able to secure it from the municipal plant on account of its small size.

Norman G. Keenan, president of the Cincinnati Gas and Electric Company, was elected to the vice-presidency of the Ohio Gas Light Association at its meeting in Cincinnati this week. Benjamin W. Perkins of South Bend, Ind., was chosen president and Thomas C. Jones of Delaware, Ohio, was made secretary-treasurer. Plans were made at this meeting for uniting this association with the American and Western associations, the merger to be known as the American Gas Light Association. For this reason the association adjourned without naming a place or date for the next meeting. One of the most important papers read was by W. H. Gardner of Boston, who gave his attention to the claims for municipal ownership. His address was a strong argument against the municipal-ownership fad.

Thomas Bracken, an engineer, representing New York capitalists, has been at East Liverpool looking over the ground with a view to establishing a lighting and power plant in the coal fields at West Point, near the former place, that will furnish current for all the towns between Pittsburg and Wheeling, W. Va., and between East Liverpool and Cleveland. He says that current can be conveyed on the high-pressure system for 100 miles with a loss of only 10 per cent., and that a plant can be operated in the coal fields much cheaper than electricity can be generated in the cities and towns.

The Dillonvale and Ohio River Traction Company has been incorporated to build a road between Dillonvale and Rayland, a distance of something over six miles. Louis Lipphardt and W. C. Fawcett of the Wheeling Traction Company are among the incorporators. O. M. C.

Indiana.

Indianapolis, March 24.—The Indiana electric railways have had the fight of their lives to counteract and displace the sleet and snow, which fell to a depth of 14 inches on their tracks. At no time was the traffic entirely suspended, although a few roads failed to get any trains through during the first half day. Only recently the interurban people boasted of increased earnings during the winter by reason of the freedom from snow, but this, the greatest snow in the history of their existence, has cost them large sums of money. The heavy snow occasioned the roof of the car barns of the Indianapolis Terminal Company to collapse, killing a motorman and injuring a number of employes. The glass roof of the terminal station also gave way under the heavy weight of snow, and will require a snug sum to repair the damage.

The Linton Traction Company of Linton, Ind., has filed articles of incorporation, proposing to construct electric railways in Jasonville, Dugger, Carlisle, Sullivan, Shelburn and Hymera. The towns will be connected by an interurban line for passengers and freight. The capital stock is $200,000. William J. Hamilton, William A. Craig, Frank A. Gage and D. D. Terhune are the directors.

It has been officially announced by Charles Fiske, chief engineer of the Louisville and Indianapolis Traction Company, that the construction of an electric railway, which will connect Louisville and Indianapolis, has been amply financed.

An election is being held today in Smith Township, Posey County, to vote $13,500 in aid of the construction of the Vanderburg and Posey electric line.

The promoters of the electric belt line to encircle Indianapolis at a radius of 14 miles, held a meeting with the representatives of the 15 towns and cities interested, and decided upon a permanent organization. The plan was shown to be feasible and the estimate cost of the 100 miles of road placed at $2,500,000. Representatives present from the towns and cities interested said there would be no trouble in securing franchises or rights-of-way. The survey will be made at once.

A concrete arch 200 feet long, 40 feet high and with a 97-foot span has been completed over Big William Creek, near Connersville, by the Indianapolis and Cincinnati Traction Company. This is said to be the largest concrete arch in the country, and contains 5,000 cubic yards of concrete, carrying 30 feet of earth.

Samuel C. Rowland has been appointed receiver of the Crawfordsville Water and Light Company, on petition of the Knickerbocker Trust Company of New York.

The Board of County Commissioners of Hancock County has annulled the franchise of the Indianapolis and Eastern electric railway, which occupies a portion of the National road. The action is the result of the company removing a number of stops, curtailing the cross-road accommodation and compelling school children and farmers to go to the stations to board the cars; also because of alleged failure to provide proper drainage and suitable crossings for the public highways intersected. The company is given 30 days in which to remove its tracks and property from the public highway. The National road is the only highway in Indiana wholly constructed by the government. The preliminary survey of this road from Richmond to Indianapolis was made in 1826. The portion in Hancock County was finished in 1850 and has ever since been kept in repair by the County Commissioners. The commissioners therefore claim jurisdiction over the National road.

The Town Council of the town of Linton has decided to offer the electric-light plant for sale. It was shown that the plant was not paying running expenses. The council has several propositions for the sale of the plant by companies which propose to reinstall the plant with modern machinery. S. S.

Michigan.

Grand Rapids, March 24.—It is stated on good authority that the Grand Rapids-Muskegon Water Power Electric Company will soon ask the Common Council of Grand Rapids for a franchise to deliver power in the city. It is said that the company has made several good contracts with some of the prominent factories of the city to furnish them with power. The company will have 1,000 horsepower to deliver in Grand Rapids after having supplied its customers in Muskegon and the Muskegon interurban railway. Dam No. 1 at Stanwood can furnish 6,000 horsepower and all of this has been contracted for.

The Board of Public Works of Grand Rapids has approved the contracts drawn by General Manager Freshney for a combination with the Grand Rapids Edison company for the laying of conduits in North Division Street. The city some time ago decided to lay conduits to accommodate the electric-light wires, and as the Edison company was about to

lay conduits an arrangement was made to do the work jointly, the expense to be paid in proportion to the number of ducts required by each to carry the wires. Under this arrangement the Edison company's expense will be much greater than that of the city.

Big Rapids has accepted a proposition from the Grand Rapids Muskegon Waterpower Electric Company to light its streets for 10 years at $55 a light a year. The company is to extend a wire from Rogers to Big Rapids to furnish power for manufacturing purposes. The city has been lighted for the last 12 years by the D. E. Donley Electric Company, which was obliged recently to suspend service on account of the washing out of the power dam.

A feature of the village election at Iron River was the proposition of bonding the municipality for $20,000 with which to install an electric-light plant. The proposition carried.

Glenn D. Smith of Jackson is the new manager of the plant of the Pontiac Standard Lighting Company of Pontiac. A new generator, switchboard and lights are to be installed, and it is stated that eventually current generated by Port Huron River will be transmitted to Pontiac for street lighting and commercial purposes.

A franchise has been granted for an electric railway from Long Lake to Alpena. Long Lake, eight miles north of Alpena, has become a popular summer resort, and a great many cottages have been erected there. The road will be built by Dayton W. Closser of Alpena, and Jackson and Monroe capitalists. It will have its own right-of-way from Alpena to Long Lake. L. W. B.

Central Illinois.

Peoria, March 24.—The finance committee of the City Council will recommend the appropriation of $6,000 to place the city police and fire-alarm wires underground. According to the franchises granted to the Central Union and the Interstate Telephone companies, the city has the use of their conduits, hence the appropriation will cover the cost of the cable and pulling it in.

The Illinois Traction Company has awarded the contract for wrecking the buildings now on its property to J. J. Jobst of this city. The foundations for the power house are to be of concrete and will be laid as soon as the wrecking is finished. The plans are not entirely finished, but the power house will be 154 by 151 feet.

The Peoria and Pekin Terminal Railway has raised the fare between the two cities from 15 cents each way to 20 cents, or 35 cents round trip.

The Peoria and Pekin Union, a steam road, which owns all the terminal facilities here, Union Depot included, has also raised its rate five cents, which, allowing five cents car fare from here to the depot, makes the fares alike.

Fire in the storeroom of the Central Union Telephone Company at Pekin, caused the loss of the generating equipment.

The Central Union Telephone Company will spend $15,000 in improving the plant at Canton. Many of the smaller cables will be replaced and new poles will be set.

The electric-light plant at Alexis was destroyed by fire, and the city was left in darkness. The fire is supposed to have been of incendiary origin.

At a meeting of the superintendents of the McKinley syndicate, held in Bloomington, E. A. McNutt was chosen secretary and George Mattis treasurer, to take the place of T. B. McCauley, who formerly held both offices.

The Diamond Meter Company has taken an appeal in the United States Circuit Court against the injunction secured by the Westinghouse company restraining the Diamond Meter Company from manufacturing meters under the Tesla patents. V. N.

Northwestern States.

Minneapolis, March 24.—The Village Council of Sauk Rapids, Minn., will receive bids shortly for lighting the village. It is thought that the new Watab Rapids Power Company will undertake the work.

Work is progressing rapidly on the new power plant being constructed near Carlton, Minn., by the Great Northern Power Company of Duluth. The work may be completed on the date originally set, July 1st. The big concrete dam across the St. Louis River is practically completed.

Charles A. Walsh of Ottumwa, Iowa, is promoting an interurban railway project from Ottumwa to Des Moines, via Oskaloosa.

The Grand Forks (N. D.) Gas and Electric Company is planning the erection of a new office building.

The Milwaukee Electric Railway and Light Company will begin work at once on a trolley road from St. Martin through Burlington, Wis., to Lake Geneva.

Active operations will be started this spring on the electric railway to be built from Sioux Falls to Bridgewater, S. D., by the Sioux Falls Electric Interurban Railway Company.

Preliminary steps in the organization of a corporation, to work in conjunction with the La Crosse (Wis.) Hydro-electric Light and Power Company, [illegible] The [illegible] to [illegible] to be conveyed [illegible] plant at Black River [illegible]

The [illegible] making extensive improvements [illegible]

L. H. Guthrie & Son [illegible] Mill [illegible] are contemplating [illegible] light for [illegible] and [illegible]

A. H. DeLong of [illegible] is organizing a company to develop power on the [illegible] River for generating electricity [illegible] field, Minn., and other neighboring [illegible]

Child, Hulswit & Co. of Grand Rapids, Mich., have purchased the gas and electric-light plant at Fort Dodge, Iowa. [illegible]

PERSONAL

Ralph D. Mershon, consulting electrical and mechanical engineer, has removed his New York office to No. 60 Wall Street.

William Henry Paddock of London, England, and Frank Carlton Sargent of Malden, Mass., former associates, have been transferred to full membership in the American Institute of Electrical Engineers.

Wallace D. Lovell, the well-known promoter of New Hampshire street railway companies, died at his home in West Newton, Mass., on March 19th. He was born in Weymouth, Mass., February 3, 1854. Of late he had been especially interested in the New Hampshire Traction Company. He was a member of the Massachusetts Street Railway Association.

At the recent annual meeting of the Wellman-Seaver-Morgan Company of Cleveland, Ohio, the office of general manager, which has been vacant since the death last June of Mr. Charles H. Wellman, was filled by the election of Mr. S. H. Pitkin, whose present title will be first vice-president and general manager. Otherwise no changes will be made in the officers of the company.

Prof. Henry S. Carhart of the physics department in the University of Michigan, who was one of the five American scientists invited to accompany the expedition sent to South Africa last summer by the British Association for the Advancement of Science, recently, at the university, gave an illustrated lecture on his trip, for the benefit of the Collegiate Alumnæ and the Ann Arbor Ladies' Library Association.

Robert Ogden Doremus, the noted chemist and inventor, died in New York city on March 22d. He was 82 years old and had been sick for 10 days. Dr. Doremus was born in New York city in 1824 and was prominent in developments along the lines of chemistry, medicine, scientific education and music. He devoted much time to the study of electricity and was popular as a lecturer. It is said that in 1855 at the Academy of Music he took daguerreotypes of all the persons in the boxes by an arc light and exhibited an induction coil with a six-inch spark—a marvelous achievement in those days.

J. W. Lieb, Jr., third vice-president and associate general manager of the New York Edison Company, lectured on the evening of March 15th before the members of the Electric Club at Pittsburg on the subject of "Generation and Distribution of Current for Lighting and Power on Manhattan Island." Mr. Lieb gave a statement of the growth of the apparatus and systems of his company from the earliest days, and presented in connection therewith some excellent illustrations by means of lantern slides. He cited various points in connection with the present operation, calling attention to the variety of service in different sections of the city. He also showed load curves which were characteristic for different sections of the city, and showed the variations in these curves at different seasons of the year. The lecture was well attended and highly appreciated.

ELECTRIC LIGHTING

The Peru (Neb.) Light and Power Company has been incorporated with a capital stock of $4,000.

Clay Center, Kan., will vote on a bond issue of $20,000 to establish an electric-light plant.

An electric-light plant will be installed in Novinger, Mo. The city clerk will give information.

John Martz of Seward, Neb., will have charge of installing an electric-light plant at Red Cloud, Neb.

The Goodland (Kan.) Heat and Power Company has received a charter and will build an electric-light plant in Goodland. The company has a capital of $50,000.

Bids will be received at the office of W. K. Palmer, city engineer, 718 Dwight building, Kansas City, Mo., until April 14th for furnishing all labor, equipment, material and supplies necessary for equipping and installing a complete electric-light plant and lighting system for Grand Island. [illegible]

The [illegible] Light and Power Company [illegible]

ELECTRIC RAILWAYS

The [illegible] bill [illegible] companies to carry freight [illegible] has been passed [illegible] at Trenton, N. J.

The directors of the Hot Springs [illegible] Railway Company have [illegible] Kan. [illegible] a power house [illegible] will be commenced at once.

The Board of Aldermen of [illegible] is securing plans and specifications as to the cost of building a street railway. The power [illegible] furnished from the city lighting plant.

Application has been made by [illegible] O. F. Paxton and [illegible] to the City Council of Eugene, Ore., for a franchise for the use of streets in Eugene for electric railway [illegible]

The Joliet, Plainfield and Aurora Electric Railway Company, operating an interurban electric railway between Joliet and Plainfield, Ill., has opened a local office in Aurora, in charge of William Miller.

It is stated that the deal of the New York syndicate for the purchase of the Pottsville (Pa.) Traction Company has been consummated. This is the concern that proposes to consolidate all the electric-light and trolley companies of Schuylkill County.

The City Council of Florence, Colo., has recently passed an ordinance designating the streets in which Thomas Robinson or his successor may construct a street railway. Mr. Robinson is president of the Florence Street Railway Company. The cars must be in operation by January 1, 1907.

The stockholders of the Long Island railroad have authorized the guarantee by the company of the bonds of the Long Island Consolidated Electrical Company. The authorized amount of the issue is $10,000,000. The bonds are collateral trust bonds and will run for 40 years. The bonds are for the purpose of developing the subsidiary electric lines of the Long Island Railroad Company.

The New York Central railroad on April 18th will ask its shareholders to authorize the issue of $100,000,000 additional capital stock. This amount will not be issued all at one time and the proceeds will be applied for various purposes, including electrical developments and general improvements. It is expected that $10,000,000 will be required to finance the Mohawk Valley company, which is a corporation formed to hold up-state trolley lines for the New York Central.

Employes of the Elgin, Aurora and Southern Traction Company celebrated the sixteenth anniversary of the company on March 16th. On the morning of March 16, 1890, the company began operation with rolling stock, consisting of three single-truck cars. Thomas Kennedy, the conductor in charge of the first street car that ever crossed the Fox River, is still in the company's employment. This company now serves the entire Fox River Valley.

The Kokomo, Marion and Western Traction Company, with main offices and power house at Kokomo, Ind., on the completion of the additions to its present power house now under way, will install a 1,000-kilowatt Allis-Chalmers turbine-generator unit. The new unit will generate current at 60 cycles, two-phase, 2,300 volts. Other electrical machinery, consisting of a 30-kilowatt direct-connected engine-type exciter set, a 35-kilowatt motor-generator set, together with switchboards, condensers and piping, will also be installed. The power derived from the new unit will be utilized for lighting and power purposes.

President C. S. Mellen of the New York, New Haven and Hartford railroad announced at Hartford a few days ago that the New Haven road was planning for electric developments at Hartford so that cars could be run over the local trolley lines and thus provide a fast suburban service, making Hartford an important electric-railway center. Full details of these plans and specifications have already appeared in the Western Electrician. It was announced that the New Haven railroad had acquired for $3,000,000 the trolley system at Worcester.

Mass. This purchase creates the possibility of a New Haven trolley system between New York and Boston.

Consolidation of the Aurora, Elgin and Chicago Railway Company, the Elgin, Aurora and Southern Traction Company and the Cook County and Southern Railroad Company was effected at a meeting of the stockholders last week. The roads operate in the Fox River Valley, entering Chicago over the Metropolitan "L." The new company will be known as the Aurora, Elgin and Chicago Railroad Company and will have a capital of $6,100,000. President L. J. Wolff says the merger is for the sake of economy.

POWER TRANSMISSION.

The Imboden Power Development Company of Imboden, Neb., has been incorporated with a capital stock of $200,000.

The Nanticoke (Pa.) Electric Power Company has purchased the dam in the Susquehanna River near Nanticoke for $30,000. The company will develop electric power.

A new company has been formed in Madrid, Spain, called the Sociedad General de Transportes Electricos, which will exploit the waterfalls of the Duero River, near the Portuguese frontier, and which will supply a large number of places, including Oporto, with electricity for power purposes. The largest fall is about 470 feet, and is estimated to produce 40,000 horsepower.

The York Haven Water and Power Company is installing five new generators at its big plant at York Haven, Pa., which, when completed, will bring the capacity of the plant up to 10,000 horsepower, just double what it was when the plant started and half of the ultimate capacity. Each generator is capable of producing 1,000 horsepower. The work on the sub-station at Steelton is nearing completion.

J. J. Chambers, president of the Inter-Mountain Power Company of Salt Lake, Utah, says that $500,000 will be spent this year by the company on improvements. A dam 600 feet long and 85 feet high will be built, forming a reservoir. A turbine wheel and generator will be put in at the dam. Contracts will be awarded during the next 30 days for 6,000-kilowatt electrical equipment and 3,500 feet of wood and steel pipe.

It is asserted by the Indian Textile Journal that operations will soon be commenced by the Bombay Hydro-electric Syndicate for the purpose of supplying the textile mills of Bombay and district, and other users with electric current obtained by utilizing the water in the Ghats, immense quantities of which are wasted during the monsoons. Pipe lines, giving a fall of 1,700 feet, are to be constructed to supply the power, while the electrical equipment is stated to be in the hands of Dr. John Mannheim.

PUBLICATIONS.

The Westinghouse Companies' Publishing Department has issued, in pamphlet form, a reprint of the paper read by W. S. Bartholomew, of the Westinghouse Air Brake Company, before the New England Street Railway Association on November 23, 1905.

Electrical equipment of a modern shipyard is made the subject of a recent bulletin issued by the Allis-Chalmers Company. The plant described is that of the Fore River Ship and Engine Company of Quincy, Mass., where the United States ship Rhode Island was built.

"Electric Lighting in the Department Store" is the expressive title of a pleasing booklet which has been prepared by the Westinghouse Companies' Publishing Department for the Nernst Lamp Company. It contains a dissertation upon the Nernst lamp and its adaptability to this field, and also several illustrations and letters complimentary to the system.

Vol. I., No. 1, of the Teephone World has made its appearance and is published the 15th of each month by the Telephone World Publishing Company of Lafayette, Ind. Its columns are devoted to matters of general interest pertaining to the telephone industry and champions the Independent cause. It is, apparently, identified with the interests of the Sterling Electric Company of Lafayette.

Jackson's extension ribs and jacks, convenient devices for caisson construction, excavation of trenches, etc., invented by George W. Jackson, chief engineer and general manager of the Illinois Tunnel Company of Chicago, are described in a neat pamphlet, which also illustrates the devices by numerous cuts. Mr. Jackson is prepared to quote prices to architects, engineers and contractors for the sale or rental of the ribs and jacks.

Single-phase motors for a wide variety of purposes are described in bulletin No. 75, issued by the Wagner Electric Manufacturing Company of St. Louis. During 1905 the company made a number fo important improvements in its single-phase motors, particularly in its lines of motors for elevator outfits and for variable-speed ventilating fans. Motors for elevator equipments are designated as type BS. When conditions require it these motors can develop 300 to 400 per cent. of normal full-load torque at starting, although usually 150 to 200 per cent. is sufficient. The motors for variable-speed fans are supplied with an auto-transformer controlling device and are built in sizes from one-quarter horsepower up. The descriptive matter relating to these and other types of single-phase motors built by the company is particularly comprehensive and will make interesting reading for those who are following the development of single-phase apparatus.

SOCIETIES AND SCHOOLS.

The annual convention of the Southwestern Electrical and Gas Association will be held in Galveston, Tex., on May 16th, 17th and 18th. M. M. Phinney of Dallas, Tex., is president and Frank J. Duffy of Beaumont is secretary.

Mr. Marconi will lecture on "Ether Telegraphy" before the New York Electrical Society in the auditorium of Horace Mann School, Teachers' College, Columbia University, Broadway and West One Hundred and Twentieth Street, April 4th, beginning at 8 p. m.

The Central Traffic Association and the Southwestern Excursion Bureau have authorized a rate of a fare and one-third from all points in their respective territories to Atlantic City and return for delegates and their friends attending the twenty-ninth convention of the National Electric Light Association, to be held June 5 to 8, 1906.

The executive committee of the Canadian Electrical Association has decided upon June 19th, 20th and 21st as the dates for the next annual convention, to be held in the Clifton House, Niagara Falls, Ont. Among the papers already promised is one by F. O. Blackwell of New York, reviewing the interesting points of the various Niagara power plants.

MISCELLANEOUS.

The Lake submarine boat, one of the five of the Simon Lake X type, built at Newport News, Va., by the Lake Torpedo Boat Company, is said to have outclassed six other submarines in a stringent test before the Russian Admiralty, and, as a St. Petersburg dispatch puts it, was given the verdict.

Anticipating an increase in the price of British coal in the near future, the harnessing of waterpower is engaging the attention of Italy. There is said to be 6,000,000 horsepower available in that country. The British consul at Naples says the annual coal bill of Italy is $40,000,000, most of which is paid to England.

The Black Carbon Coal Company has paid $15,750 for ground for its central steam-heating plant in Spokane, Wash., and will at once commence the installation of a $200,000 heating system. J. P. Badenhausen will superintend the construction. Charges for the heat will be based on the water condensed from the steam at the distributing point, in accordance with the usual measured-rate practice. F. C. Robertson is one of the chief promoters of the company.

The steamship Mauritania, now building at Wallsend, England, will be lighted by 5,000 lamps of 16 candlepower, which is more than double the number on the Cedric. Two electric passenger elevators are to be erected for conveying passengers between the six decks. There will be a telephone exchange on board which will connect up the chief passenger sections of the ship with the officers, and there also will be special telephones from the bridge.

A new steam turbine of the Schultz pattern was recently tried in Germany, with satisfactory results. It was direct connected to a three-phase alternator giving 550 volts at 3,000 revolutions. The turbine and dynamo form a compact set 16 feet long and seven feet wide, the two wheels of the turbine being placed on either side of the generator and having a diameter of 5.6 feet. This gives a peripheral speed of 875 feet a second. The governor adjusts the speed within five per cent from no load to full load suddenly applied, and to half this range for quarter load. On the tests the consumption of steam per kilowatt hour was found to be 22.2 pounds at full load, 23.1 pounds at three-quarter load, 24.8 pounds at half load.

Patterns for what will be the heaviest single casting ever poured at the works of the Allis-Chalmers Company, were completed recently. The casting in question is designed for the frame and slide of a monster horizontal rolling-mill engine being built for the Carnegie Steel Company of Sharon, Pa. Its cylinders will measure 50 and 78 inches in diameter, and will have a 60-inch stroke. The pattern for this piece, measuring 32 feet long, 11 feet wide and 10 feet high, represents the work of 10 expert patternmakers for a period of four months. The amount of lumber of various sizes used in its making aggregated 22,000 feet. The pattern was taken from the pattern shop directly to the foundry, where work was begun on the construction of the mold. The pit in which the piece will be poured will be 40 feet long, 15 feet wide and 11 feet deep. The mold, when completed and ready to receive the molten metal poured in it, will take approximately 133 tons of iron. The actual operation of pouring will consume from eight to 10 minutes. Nine ladles will be used to convey the liquid metal to the mold, four of which will have five tons capacity each, four, 25 tons and one 13 tons. After the metal is poured the casting will be allowed to stand to cool for six days before the mold will be removed. The weight of the casting will be 125 tons.

The Western Union Telegraph Company, in its quarterly report, anticipates a deficit of $48,322.50 for the quarter to end March 31st. The estimated net revenue for the quarter mentioned, based on nearly complete returns for January, partial returns for February and estimating the business for March, will be $1,500,000. From this amount is required $331,300 for interest on the bonded debt, and $1,217,022.50 is required to meet a dividend of 1¼ per cent. on the capital stock. To meet these amounts the total surplus of $16,738,355.61 shown on December 31, 1905, will be reduced, it is estimated, by $48,322.50. The net revenue for the quarter ended December 31, 1905, was $1,853,196.75. For the first quarter in 1905 the net earnings were $1,546,087, compared with $1,737,426 in 1904 and $1,842,269 for the corresponding period in 1903.

TRADE NEWS.

The J. G. Barr Electric Company of St. Louis, Mo., has been incorporated with capital stock of $100,000.

Sealed proposals are being invited until April 20th for furnishing the Smithsonian Institution and its various branches with electrical supplies during the next fiscal year. Specifications and detailed information will be furnished upon application to R. Rathbun, acting secretary, Washington, D. C.

Sealed proposals will be received by City Electrician Carroll, room 12, City Hall, Chicago, until April 2d, for furnishing the department of electricity one switchboard and accessories. Plans and specifications are on file with Mr. Carroll, who will furnish blank proposals.

The Watson Electrical Supply Company of Shreveport, La., has been incorporated. I. M. Watson is president, W. C. Evans vice-president, and W. W. Jones secretary-treasurer. Mr. Watson is a well-known contractor and Messrs. Evans and Jones are connected with the Shreveport Gas, Electric Light and Power Company.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until April 10th for furnishing eastern navy yards with the following supplies: Schedule 432, generating set, mica, miscellaneous electrical supplies; schedule 433, electrical cable, electrical supplies. Specifications and proposal blanks can be obtained at the Navy Pay Office in New York or upon application to the bureau.

There has recently been a merger of several well-known firms, forming what will be known as the Electric Service Supplies Company. The companies participating in the consolidation are the Mayer & Englund Company of Philadelphia, Porter & Berg of Chicago, and the Garton-Daniels Company and Electrical Devices Company of Keokuk, Iowa. The new company will have eastern and western warehouses and sales departments and a manufacturing department. All correspondence, orders, etc., may be sent to the same addresses as in the past. Railway supplies and materials will continue to be the specialties of the new company. The officers of the Electric Service Supplies Company will be: President, J. C. Mayer; first vice-president, J. W. Porter; second vice-president, J. V. E. Titus; secretary, Max A. Berg; treasurer, A. H. Englund. When organization is completed the company will have sales offices in Boston, New York, Philadelphia, Pittsburg, Cleveland, Chicago, Atlanta, Birmingham, New Orleans, St. Louis, Keokuk, Kansas City, San Francisco and Los Angeles.

BUSINESS.

The James I. M. Wilson Company of Pittsburg, wholesale dealer in chestnut poles, anticipates a large demand during the coming season. The company is prepared to furnish poles of various lengths and is in a position to fill orders promptly.

Economical buyers in need of new and second-hand leather belts are promised attractive prices on their requirements by the Leather Preserver Manufacturing Corporation, 27 West Monroe Street, Chicago. This company, as is known to many, also buys old belts of any size or condition.

A decree has been entered in the case of the Babcock & Wilcox Company against the Aultman & Taylor Machinery Company in the United States Circuit Court for the eastern division of the northern district of Ohio, in which the trade mark of the Babcock & Wilcox Company is sustained

as good and valid. This trademark consists of the word "steam" accompanied by a representation of the type of engine known as the "Aeolipile of Hero," which consists in part of a sphere. The Aultman & Taylor Machinery Company is enjoined from using or imitating this trademark.

In order better to handle its rapidly increasing business from the Rocky Mountain district, the Power and Mining Machinery Company, Milwaukee, Wis., has opened an office at 312 Seventeenth Street, Denver, Colo. This new office is in charge of Henry F. Jurs as district manager, who will give his personal attention to all inquiries coming from Colorado, Wyoming and New Mexico for the varied lines of machinery manufactured by this company. Mr. Jur's practical knowledge of the business, together with the high reputation of the company he represents, [illegible] curing his share of the business [illegible] mentioned.

The Rail Joint Company [illegible] for the enlargement and [illegible] work at [illegible] enable it to handle [illegible] It is now running day and night [illegible] provement are in progress [illegible] growing demand from [illegible] for the three types of base-supported rail joints known to the trade as the Continuous, Weber and Wolhaupter types, for tee and girder rails [illegible] also insulating and compromise or step joints to unite different sections of rail, maintaining a perfect surface, and doing away entirely with [illegible] joints. General offices of the company [illegible]

[illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

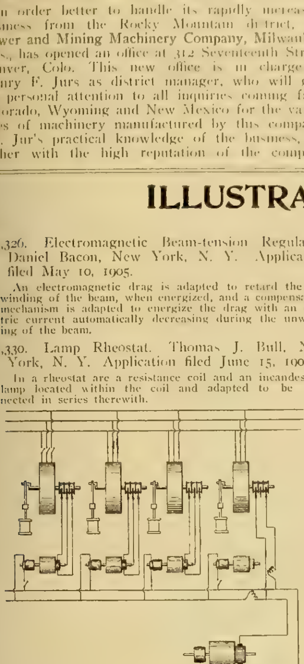
Issued (United States Patent Office) March 20, 1906.

815,326. Electromagnetic Beam-tension Regulator. Daniel Bacon, New York, N. Y. Application filed May 10, 1905.

An electromagnetic drag is adapted to retard the unwinding of the beam, when energized, and a compensating mechanism is adapted to energize the drag with an electric current automatically decreasing during the unwinding of the beam.

815,330. Lamp Rheostat. Thomas J. Bull, New York, N. Y. Application filed June 15, 1903.

In a rheostat are a resistance coil and an incandescent lamp located within the coil and adapted to be connected in series therewith.



NO. 815,356.—SYSTEM FOR EXCITING INDUCTION MOTORS.

815,356. System of Excitation for Induction Machines. Maurice Leblanc, Paris, France, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg. Application filed January 28, 1903.

In combination of a source of multiphase current are a phase-regulating dynamo-generator of the direct-current type having a set of dephased brushes connected to the multiphase circuits and a corresponding set of armature windings acting to produce field fluxes to generate regulating electromotive forces between the brushes upon rotation of the armature. (See cut.)

815,357. Process of Excitation for Induction Machines. Maurice Leblanc, Paris, France, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg. Original application filed January 26, 1903. Divided and this application filed February 5, 1904.

The process of producing the effect of an added negative resistance in one member of an asynchronous machine consists in impressing thereon an electromotive force of the frequency of the current in that member but of a phase in opposition to the voltage inserted by such current.

815,360. Device for Recharging the Storage Batteries of Automobiles. Lamar Lyndon, New York, N. Y. Application filed May 4, 1904. Renewed March 23, 1905.

A rectifying device is carried on the vehicle whereby alternating current may be changed so as to charge the battery.

815,365. Electromagnet. Ernest H. Miller, Lancaster, Pa., assignor of one-third to John W. Holman and one-third to Charles V. Rote, Lancaster, Pa. Application filed November 26, 1904.

A solenoid for power purposes comprises a tubular spool of non-magnetic material, a magnetic plug midway of the spool, a number of coil sections wound on the spool and connected in series, and movable cores entering the spool, the plug and cores having co-operating projections and recesses.

815,370. Safety Equipment for Series Electrical Distribution Systems. Frederick J. Murmann and Albert B. Shreve, Mount Vernon, N. Y. Application filed May 2, 1904.

An electric generator and two or more main-line loops in series circuit with the generator are connected to contact terminals normally in series circuit with the loops and generator. Automatic means electrically separate the contact terminals from one loop and consist of an electromagnetic cut-out and a spark-gap device governing the cut out, and adjusted to be operative by the electromotive force of the current in the main line during a rupture. (See cut.)

815,380. Telephonic Apparatus. John G. Roberts, Detroit, Mich., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 26, 1900. Renewed September 19, 1902.

Telephone central-office ringing apparatus comprises a rotable element having a pin or plunger in its periphery, a longitudinal plunger coacting with the peripheral plunger to project it beyond its normal position, a spring to force the plunger back into the cylinder, means to press on the longitudinal plunger to project the other end contacts located within operating distance of the projected plunger.

815,384. Static Discharger and Lightning Arrester. Henry M. Shaw, East Orange, N. J., assignor to Francis M. Shaw, East Orange, N. J. Application filed February 8, 1905.

In a lightning arrester and static discharger are a hollow composite body composed of alternating conductors and insulators and apertured conducting heads between which the composite body is held, whereby air may freely circulate through the composite body.

815,405. Automatic Ringing and Listening Key. Albert Carliss, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed June 20, 1901.

In an operator's key are a top plate, depending side plates, a key lever pivoted between the plates and having a handle portion projecting above the top plate, an arm carried by the lever beneath the plate, a magnet supported beneath the top plate and an armature having means to lock the arm when desired.

815,406. Automatic Electrical Self-soldering Reset for Thermal Protectors. Frank B. Cook, Chicago, Ill. Application filed April 27, 1905.

A thermal protector is normally held against operation by heat-susceptible material. Means operate the protector when the heat-susceptible material is softened, and means supply the protector with current for resoftening the heat-susceptible material and resetting the parts of the protector to their normal position for another operation.

815,418. Insulator for Electric Apparatus. Harleston C. Gesner, New York, N. Y., executrix of George W. Gesner, deceased. Application filed June 26, 1905.

An electric insulator or high-resistance body consists of an alloy of iron and hydrogen.

815,444. Motor. Frank E. Lewis, Troy, Ohio, assignor of one-half to W. Edgar Johnson, Troy, Ohio. Application filed June 15, 1905.

A motor comprising a sectional casing has opposite field poles, each pole comprising independent cores and heads. The heads of each pole are disposed in close relation but are entirely separate, the cores being respectively carried by different sections of the casing. A separate winding is provided for each core of each pole, and an armature co-operates with the heads. (See cut on next page.)

815,459. Alternating-current Machinery. Addams S. McAllister, Ithaca, N. Y. Application filed December 14, 1903.

A single-phase alternating-current generator made up of a number of field core sections is associated with field coils, one on each section and each coil closed upon itself and free from connection with the others of the coils, and an electric circuit including a rotor provided with a commutator. Several sets of brushes are adapted to contact with the commutator, and a switch connects at will either of the sets of brushes with the lead-wires. (See cut on next page.)

815,471. Insulator. George L. Ricks, Yuma, Ariz. Application filed March 8, 1905.

The insulator is in two parts adapted to be clamped together and carry the wire in a central opening.

815,474. Attachment for Electric Chandeliers. Julius C. Schaefer, Peoria, Ill. Application filed January 30, 1905.

Details are described.

815,490. Electrical Gun. Martin E. Thomas, Batavia, Iowa, assignor of one-half to Frank Fishel, Batavia, N. Y. Application filed November 1, 1905.

Instead of having a lock mechanism, the gun is discharged by a spark originated by dry batteries carried in the stock.

815,498. Electric Conductor. Welby D. Weir, Winnsboro, Tex. Application filed February 15, 1905.

A flexible supporting element, contact members carried by the supporting element and means for regulating the tension of the latter to compress the contact members and maintain them in constant engagement with each other are the features of the patent.

815,499. Automatic Overhead-trolley Contact Device for Operating Electric Signals. Beecher D. Whitcomb, Shawomet Beach, R. I., assignor of one-half to George M. Bronson, Providence, R. I. Application filed November 20, 1905.

A fixed contact is adapted to be connected with a signal device, and a movable contact member is capable of being continuously energized. Combined with these are self-setting holding means in normal engagement with the movable contact member, arranged so that the latter is adapted to automatically engage and energize the fixed contact member upon being released from the holding means.

815,5[illegible]. Process of Producing [illegible] and Their Derivatives. [illegible] Munich, Germany. Application filed [illegible] 1904.

[illegible]

815,557. Alarm for [illegible]. [illegible] Morristown, Ind. Application filed May [illegible].

[illegible]

815,563. Adjustable Lamp Support. [illegible] Stevenson, Ann Arbor, Mich. Application filed May 4, 1905.

Mechanical parts of an adjustable lamp support are described.

815,578. Controller Operating Means. Arthur J. Brown, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed July 11, 1904.

A device for operating an electric controller is made the basis of the patent.

815,605. Electrical Connector for Electric Lamps. Ernest A. Lowe, North Plainfield, N. J. Application filed January 21, 1905.

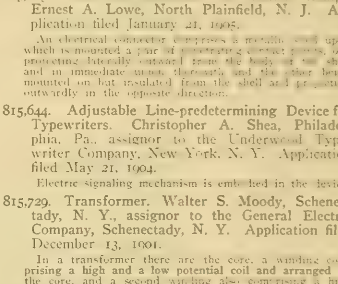
An electrical connector comprises a metallic shell upon which is mounted a pair of [illegible] contact points, one projecting laterally outward from the body of the shell and in immediate union therewith and the other being mounted on but insulated from the shell and projecting outwardly in the opposite direction.

815,644. Adjustable Line-predetermining Device for Typewriters. Christopher A. Shea, Philadelphia, Pa., assignor to the Underwood Typewriter Company, New York, N. Y. Application filed May 21, 1904.

Electric signaling mechanism is embodied in the device.

815,729. Transformer. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 13, 1901.

In a transformer there are the core, a winding comprising a high and a low potential coil and arranged on the core, and a second winding also comprising a high and a low potential coil; the second winding is arranged outside the first, and separated therefrom by a cooling and insulating space.



NO. 815,370.—SAFETY DEVICE FOR SERIES DISTRIBUTION SYSTEMS.

815,746. Fuse-clamping Terminal. Arthur C. Savage, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 20, 1904.

A clamping terminal for a fuse comprises a metal block provided with jaws, a wedge entering between the jaws, a screw engaging with the wedge and having a smooth shank rotable in a bearing in the block and a detent engaging with the screw.

815,748. Electromagnetic Device for Distributing Machines. Otto G. C. Schmitt, Frankfort-on-the-Main, Germany, assignor to the firm of Wagner & Brand, Frankfort-on-the-Main, Germany. Application filed May 20, 1904.

In [illegible] electromagnetic selecting device for use in [illegible] operated disturbing apparatus are an electromagnet movable to and fro upon a slide, the distributing part being likewise movable to and fro along a slide, and a [illegible] containing the matter to be distributed and having mounted on it the armature of the electromagnet.

815,750. Braking Mechanism for Electric Motors. William H. Scott, Norwich, England. Application filed March 27, 1905.

Associated with a motor comprising a magnetic frame having a yoke are pole pieces adapted to keep off the brake while the motor is running, the yoke and pole pieces being connected by non-magnetic material, and a movable magnetic plate bridging the non-magnetic material and connected with the brake.

815,752. Telephone Attachment. Joseph Silverman, San Francisco, Cal. Application filed January 25, 1905.

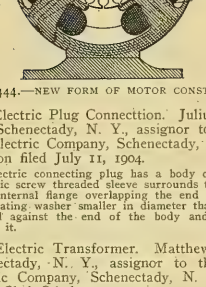
Combined with the receiver and mouthpiece of a telephone is a holding device for the receiver, the device comprising a stand having a vertical standard.

815,753. Telephone Attachment. Joseph Silverman, San Francisco, Cal. Original application filed January 25, 1905. Divided and this application filed November 23, 1905.

An attachment for the telephone has means for holding down the hook, the means including an adjustable arm carrying a vertically reciprocating part to embrace the hook.

815,756. System of Electrical Control. Frank J. Sprague, New York, N. Y., assignor to the Sprague Electric Company. Application filed September 22, 1898.

A controller for the translating device has a pilot motor. The main circuit in which the translating device is connected contains means dependent on the strength of the current in the main circuit for arresting the movement of the controller by short circuiting the armature of the pilot motor.



NO. 815,444.—NEW FORM OF MOTOR CONSTRUCTION.

815,764. Electric Plug Connecttion. Julius C. Tournier, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 11, 1904.

An electric connecting plug has a body of insulation. A metallic screw threaded sleeve surrounds the body and has an internal flange overlapping the end of the body. An insulating washer smaller in diameter than the sleeve is placed against the end of the body and clamps the flange to it.

815,765. Electric Transformer. Matthew O. Troy, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 20, 1904.

A multiphase transformer has its magnetic circuits combined in a single structure and a number of secondary coils for each phase, the coils are arranged to supply a three-wire system without unbalancing of voltages by unbalanced loads.

815,778. Electrical Speed Indicator. Robert Anderson, Cincinnati, Ohio. Application filed February 16, 1905.

In a speed-indicator for rotating shafts are combined an electrical circuit, a switch adapted to be actuated by the rotation of the shaft to make and break the circuit, an indicator in the circuit to register each time it is completed and a chronometer with a moving hand interposed in the circuit. One end of the circuit is broken by the chronometer being connected to the hand, a contact piece being in the path of the hand and connected to the other broken end of the circuit.

815,789. Electrical Warp-stop Motion. Richard Boardman, Tiverton, R. I., and William H. Sharples, Fall River, Mass. Application filed May 14, 1904.

Details are described.

815,792. Electric Time Switch. Milton T. Campbell, Indianapolis, Ind., assignor of one-half to John C. Ertel, Indianapolis, Ind. Application filed October 17, 1905.

A combination of a clock mechanism and a motor switch-operating device acts to close the switch at a predetermined time.

815,804. Thermal Cut-out. Charles E. Eveleth, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 4, 1903.

Between parts of a motor in which an arc is liable to form are means controlled by the arc for delivering a stream of fluid in the direction of the conductor and means for confining the stream in intimate association with the arc.

815,809. Telegraph Key. John J. Ghegan, Newark, N. J. Application filed January 28, 1905.

A telegraph key comprises a metallic base plate, a spring key lever adapted to move horizontally, mounted at one end of the plate and above it, and insulated from it, and contact points adjacent to the key lever.

815,814. Means for Preventing Accumulation of Static Electricity Upon Belting. Charles M. Green, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 5, 1903.

In combination with a belt are a pulley engaging the belt and means for making the surfaces of the pulley and the belt conductive of electricity in order to prevent the accumulation of static electricity upon the surfaces.

815,822. Relay. Reinhold Herman, Crafton, Pa., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 28, 1904.

In a relay are a pivoted lever provided at its end with a split-ring sleeve, an insulating collar carried within the sleeve, a contact block having a shank surrounded by and supported in the collar and an enlarged wedge-shaped head and stationary spring contacts adapted to be bridged by the block.

815,824. High-potential Switch or Circuit-breaker. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 7, 1900. Renewed November 3, 1904.

A high potential switch provided with a hollow insulator has a fixed terminal extending through the insulator, a movable contact-piece for the terminal supported in an independent insulator, a yoke on the movable insulator and a crank for raising the yoke, the crank being adapted for disconnection from the yoke.

815,825. Electric Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 27, 1904.

A double-throw electric switch has its movable element swung from a suitable support. An operating crank is mounted adjacent thereto, a link connecting the crank and movable element and operative to draw the element toward the support into either of its closed positions. Means are supplied for giving a transverse movement to the element corresponding to the initial movement of the crank.

815,826. Train-control System. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 20, 1904.

In a system of train control are a train wire or wires, a control circuit on each of the cars normally connected to the train wires, and means controlled from a single point upon the train for simultaneously breaking the connection between the train wires and the circuits.

815,830. Adjustable Electrolier. Alton Hopkins, Denver, Colo. Application filed March 24 1905.

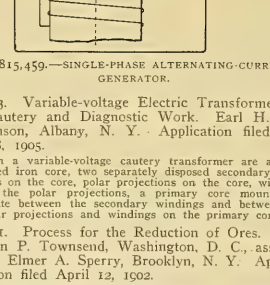
An electrolier with drum and slip-ring mechanism by which it can be raised and lowered is described.

815,836. Vapor Electric Apparatus. Alexander M. Jackson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 31, 1904. Renewed January 29, 1906.

In a vapor electric apparatus are an exhausted envelop provided with a condensing chamber, electrodes therefor and a shield protecting one of the electrodes from the vapor progressing toward the condensing chamber.

815,847. Dynamo-electric Machine. John P. Mallett, Madison, Wis., assignor to the Northern Electrical Manufacturing Company, Madison, Wis. Application filed May 21, 1904.

In combination with a field ring or yoke are a laminated pole piece permanently secured thereto, some of the laminæ composing the pole pieces being shortened to form a passage in the armature end of the pole piece, and coil-retaining pole-tip pieces secured to the pole piece by a bolt extending through the passage.



NO. 815,459.—SINGLE-PHASE ALTERNATING-CURRENT GENERATOR.

815,863. Variable-voltage Electric Transformer for Cautery and Diagnostic Work. Earl H. Rollinson, Albany, N. Y. Application filed July 18, 1905.

In a variable-voltage cautery transformer are a laminated iron core, two separately disposed secondary windings on the core, polar projections on the core, windings on the polar projections, a primary core mounted to rotate between the secondary windings and between the polar projections and windings on the primary core.

815,881. Process for the Reduction of Ores. Clinton P. Townsend, Washington, D. C., assignor to Elmer A. Sperry, Brooklyn, N. Y. Application filed April 12, 1902.

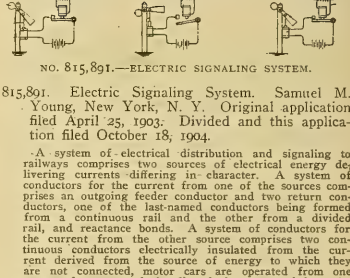
Reduced sulphide ores is accomplished by supporting the ore in a body of fused electrolyte which is substantially inert toward the ore and passing an electric current to the ore as cathode.

815,889. Telephone Transmitter. Ernest E. Yaxley, Chicago, Ill., assignor to the Monarch Telephone Manufacturing Company of Chicago, Ill. Application filed September 26, 1905.

A telephone transmitter includes a speaking diaphragm, an electrode actuated thereby, a second electrode, a chamber, and subdivided material within the chamber interposed between and in contact with the electrodes. The chamber includes thin apertured resilient diaphragms, lying close to the planes of the inner faces to the electrodes, the subdivided material having access to the electrodes through the apertures in the diaphragm.

815,890. Electric Signaling System. Samuel M. Young, New York, N. Y. Original application filed February 21, 1903. Divided and this application filed October 18, 1904.

Signaling apparatus comprises a source of power current, a source of alternating current, a working circuit wherein each of the traffic rails separately and independently form return paths to the sources of current, motor vehicles energized by the power current, transformers energized by the alternating current, and relay devices energized by the current from the transformers.



NO. 815,891.—ELECTRIC SIGNALING SYSTEM.

815,891. Electric Signaling System. Samuel M. Young, New York, N. Y. Original application filed April 25, 1903. Divided and this application filed October 18, 1904.

A system of electrical distribution and signaling to railways comprises two sources of electrical energy delivering currents differing in character. A system of conductors for the current from one of the sources comprises an outgoing feeder conductor and two return conductors, one of the last-named conductors being formed from a continuous rail and the other from a divided rail, and reactance bonds. A system of conductors for the current from the other source comprises two continuous conductors electrically insulated from the current derived from the source of energy to which they are not connected, motor cars are operated from one source of energy and signaling devices operated from the other source of energy, and adapted to be controlled by the movement of the motor cars. (See cut.)

815,903. Fluid-pressure System. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 24, 1903.

Fluid-pressure apparatus embodying a compressor and means for driving the compressor embodies also a magnetic clutch for throwing the compressor into and out of gear with the driving means and a governor responsive to variation of pressure in the system for opening and closing the circuit of the clutch.

815,908. Rheostat for Starting and Controlling Electric Motors. Winterton J. Day, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 14, 1904.

Combined with a motor starting and controlling rheostat are a pivoted arm, a no-voltage release magnet mounted thereon and a switch lever movable to the magnet in one direction for starting, the lever and arm being movable together in the same direction for controlling.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on March 26, 1906:

400,038. Electric-railway Plow. E. M. Bentley, New York, N. Y.
400,088. Galvanic Battery. C. E. Kammeyer, Chicago, Ill.
400,126. Galvanic Battery. F. Shaw, New York, N. Y.
400,130. Dynamo-electric Machine. Wm. L. Silvey, Cincinnati, Ohio.
400,139. Switch Stand for Dynamo Stations. R. E. Stewart, Dallas, Texas.
400,141. Telegraphic Transmitter. R. C. Stone, New York, N. Y.
400,179. Electric-railway Contact. E. M. Bentley, New York, N. Y.
400,180. Electric-railway Plow. E. M. Bentley, New York, N. Y.
400,181. Method of Detecting Grounds in an Electric Distributing System. E. M. Bentley, New York, N. Y.
400,183. Fault Detector for Electric Railways. E. M. Bentley, New York, N. Y.
400,198. Electric Arc Lamp. E. A. Edwards, Cincinnati, Ohio.
400,214. Electric-lighting System. Wm. L. Horne, Meriden, Conn.
400,215. Galvanic Battery. A. Imschenetzky, St. Petersburg, Russia.
400,224. Voltaic Battery. I. Kitsee, Cincinnati, Ohio.
400,225. Voltaic Battery. I. Kitsee, Cincinnati, Ohio.
400,226. Secondary Battery. I. Kitsee, Cincinnati, Ohio.
400,227. Voltaic Battery. I. Kitsee, Cincinnati, Ohio.
400,235. Galvanic Battery. E. Liebert and S. A. Rosenthal, Berlin, Germany.
400,239. Electric Burglar Alarm. J. Y. McKinney, New Wilmington, Pa.
400,300. Electric Conduit. H. A. Chase, Boston, Mass.
400,304. Hotel Call. E. J. Colby, Chicago, Ill.
400,308. Method of Constructing Underground Conduits. W. C. Cranmer and S. W. Arnold, Philadelphia, Pa.
400,311. Electric Motor. E. H. Davis and R. Westervelt, Elmira, N. Y.
400,312. Thermostat. E. H. Davis and R. Westervelt, Elmira, N. Y.
400,315. Regulator for Electric Motors. R. S. Dobbie, New York, N. Y.
400,325. Telephone. N. B. Ginochio, New York, N. Y.
400,326. Telephone. N. B. Ginochio, New York, N. Y.
400,327. Magneto-electric Generator. N. B. Ginochio, New York, N. Y.
400,375. Pneumatic Flexible Slot Conduit for Electric-railway Conductors. C. J. Vandepoele, Lynn, Mass.
400,378. Incandescent Electric Lamp. E. Weston, Newark, N. J.
400,395. Electric Distribution by Storage Batteries. S. C. C. Currie, Philadelphia, Pa.
400,404. Secondary Battery. R. M. Hunter, Philadelphia, Pa.

WESTERN ELECTRICIAN

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Generators of 10,000 Horsepower on Vertical and Horizontal Shafts.

By Orrin E. Dunlap.

Electrical engineers who visit Niagara Falls during the coming summer will have opportunity for the first time of inspecting hydro electric generating units of 10,000 horsepower operated on both vertical and horizontal shafts. In the station of the Niagara Falls Hydraulic Power and Manufacturing Company, on the New York side, at the water's edge, the generators and turbines are direct connected on horizontal shafts, each turbine operating two machines. This installation has always afforded interesting comparison with the installations of the big power houses of the Niagara Falls Power Company, also on the New York side, where the wheels and machines are connected by vertical shafts, which extend up the wheel-pit to the generators in the power house, which is placed over the pit.

When the Canadian Niagara Power Company planned its development on the Canadian side it adopted the wheel-pit and tunnel method of development, which led to the erection of more vertical shafts connecting turbines and generators, but while the Niagara Falls Power Company was operating units of 5,000 horsepower in its two stations on the New York side, the Canadian Niagara Power Company decided on a unit of 10,000 horsepower, and these were the first units of this size installed at Niagara. At this writing four units have been placed in position in the fine new station, while other units will be installed as rapidly as the demand makes it necessary.

So far as the Ontario Power Company is concerned, the system of development is very similar to that of the Niagara Falls Hydraulic Power and Manufacturing Company. The station of the Ontario Power Company is located near the foot of the Horseshoe Fall, at the water's edge, on the Canadian side. The water for the operation of the wheels is brought to a spillway, from which the penstocks feed through a big steel flume 6,500 feet long and having an inside diameter of 18 feet. This company also adopted a 10,000-horsepower unit for its development, and its mammoth generators are operated by twin turbines of Voith make, direct-connected on horizontal shafts, the installation being quite a novelty as compared with the other power plants at Niagara. Three units are now in place [illegible] fourth [illegible] nearly complete.

Considering the comparatively few years during which engineers have been studying and [illegible] to the power development at Niagara Falls, it must be admitted that to double the [illegible] development within 10 years is quite an advance. In the station of the Canadian Niagara Power Company it is proposed to develop 100,000 horsepower in 10 units, and in the station of the Ontario Power Company the plan is to have a development of 180,000 horsepower in 18 units. The turbines of these 18 units will be supplied with water that will flow from the forebays through three steel flumes, each having an inside diameter of 18 feet.

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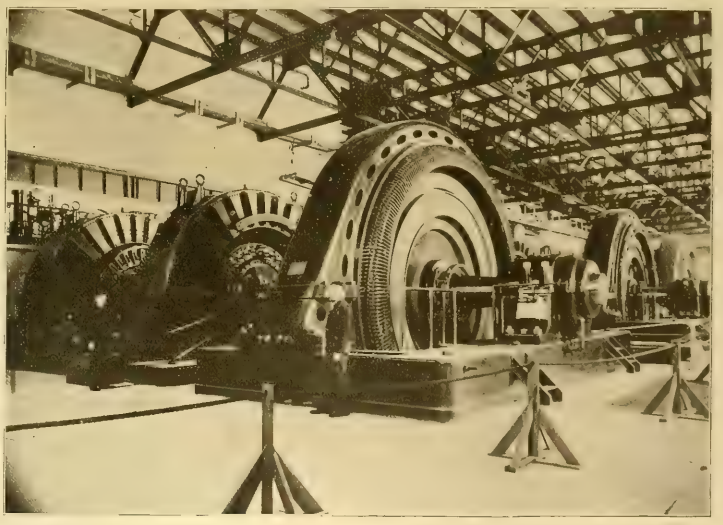
VIEW IN CANADIAN NIAGARA POWER COMPANY'S STATION, NIAGARA FALLS, SHOWING 10,000-HORSEPOWER GENERATORS ON VERTICAL SHAFTS.



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VIEW IN ONTARIO POWER COMPANY'S STATION, NIAGARA FALLS, SHOWING 10,000-HORSEPOWER GENERATORS ON HORIZONTAL SHAFTS.

Overhead Wiring Conditions in Grand Rapids, Wis.

Inspection of the electrical conditions of Grand Rapids, Wis., shows that current for street and commercial lighting is furnished [illegible] The street arc lamps are operated on the series [illegible] current system. The commercial circuits are supplied from a three-wire secondary system with the neutral grounded. The primary voltage is 2,300. No series arc lamps are used inside of buildings. The pole lines of the electric-light and telephone companies are said to be in need of considerable overhauling, and in their present state they offer serious obstruction to the use of fire-fighting apparatus as well as being in such condition as to invite crosses between the lighting and telephone systems.

On Grand Avenue the two telephone companies and the lighting company occupy the same set of poles. As the electric-light wires are beneath the telephone wires and but very little cable is used by the telephone companies, the possibility of serious crosses is imminent. The arrangement also brings the electric-light wires very low, so that they are, in general, on a level with the second-story windows. The lighting company intends to rebuild its lines in the business district during the coming spring. The placing of the telephone wires underground in the business district or the adoption of the "multiple-tap" system would materially lessen the obstructions. Beside the line wires the service wires of both the telephone and lighting companies would, in case of fire, offer considerable obstruction to the raising of ladders. The companies have promised to improve the present condition by elevating all service wires.

About 97 per cent. of the telephones are on the lines of the Wood County Telephone Company. This company has no protectors installed at the

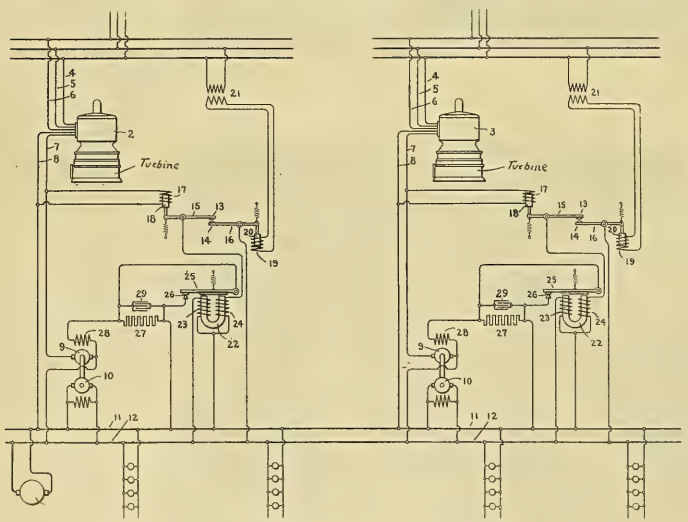
subscribers' stations. The matter of installing them was taken up with the management, but nothing more than a promise to provide them for future installations was obtained. Electric current is used in about 90 per cent. of the buildings in the business district. Of this number fully 95 per cent have been found to be defective. About seven per cent. of the latter are pronounced very hazardous, 19 per cent. hazardous and 32 per cent. poor.

There is no municipal ordinance providing a standard for interior wiring. Both the lighting company and the local independent contractor are anxious to install approved work, and they have agreed to execute all of their work in strict accordance with the rules and requirements of the National Electrical Code and not to connect up to any installation which does not comply with the Code.

Owners and occupants have been notified in writing of the particular defects incident to their wiring systems and have been requested to remedy these defects.

Emmet's System for Regulating Turbo-generators.

In many cases, particularly in plants where water or steam turbines are installed, it is desirable to operate large exciter units which will supply exciting current for the whole station and which will also operate certain auxiliaries, such as the oil pumps, electrical governors on the turbines, and the like. Under these circumstances it is not desirable to regulate the turbine-driven generators by regulating the voltage of the exciter, since the changes in the voltage required of the exciter might objectionably affect the other apparatus supplied by the exciter. To overcome these difficulties and at the same time to permit the use of a single exciting source W. L. R. Emmet of Schenectady, N. Y., has patented a system which makes use of a booster between the exciting source and the generator to be regulated, varying the voltage of this booster by means of a suitable regulator so



EMMET'S SYSTEM OF REGULATION FOR TURBO-GENERATORS.

as to obtain the desired voltage or current at the generator. The regulator employed for controlling the booster is the well-known Tirrill regulator.

Referring to the accompanying diagram, (1) indicates a source of exciting current for supplying any desired number of translating devices at the station. This source may be a single large exciter or it may be any other suitable source of direct current—such, for example, as the ordinary electric-light supply mains.

Since the exciter is driven so as to have ordinarily a constant voltage, regulation of the voltage or current supplied to the field of the machine (2) is provided for by making use of a boosting set consisting of a generator (9) in series, for example, with the leads (7), which generator is mechanically driven by an electric motor (10), receiving its power from the exciter bus-bars or mains (11) and (12).

To control the booster in response to the requirements of the generator (2), a suitable regulator is made use of—such, for example, as the Tirrill regulator. The portions of the regulator responsive to voltage consist of two floating contacts (13) and (14), each carried by pivoted lever arms (15) and (16), respectively. Each lever arm is controlled by a solenoid and core. The solenoid (17) receives the voltage at the terminals of the field-exciting circuit of machine (2). The solenoid (19) receives, by means of a small transformer (21), a voltage proportional to that developed on the alternating-current side of the generator (2).

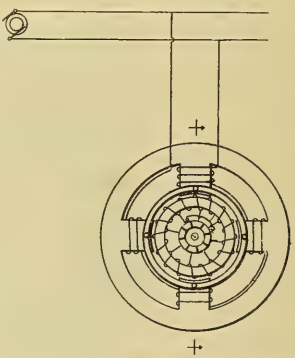
The contacts when they come together or separate serve to control a differentially wound relay magnet (22). This magnet has two windings. Winding (23) is connected across some source of current, such as the bus-bars, while the other winding is adapted to have its circuit closed by the contacts across the same source. Thus when the contacts are closed the two windings neutralize each other, and when the contacts are open the winding (23), being no longer opposed by its companion winding, then becomes effective.

When the magnet (22) becomes magnetized in the manner described its draws down its armature and completes the circuit by contacts (26) about a regulating resistance in series with the field windings of the booster (9). Upon the demagnetization of the magnet the contacts (26), which are shunted by a condenser to reduce sparking, are opened and resistance inserted in circuit. This resistance is so large that it tends to produce an excessive change of voltage. The contacts therefore keep up a rapid opening and closing, so that the resistance, being in circuit only part of the time, produces as a net effect the desired regulation. Thus, if the voltage on the alternating-current mains of the generator rises above normal the solenoid (19) causes the contacts (14) to be brought into temporarily longer engagement with the contact (13). This causes the magnet (22) to be de-energized and thereby opens a shunt circuit about the resistance (27) and includes the latter in circuit with the field of the booster (9). The booster voltage, which in this case is supposed to be added to that of the exciter source, is then reduced. This reduction of voltage is immediately felt by the controlling solenoid (18), whereupon the contact (13), controlled thereby, recedes from the lower contact (14), thus opening the circuit of the magnet (22), which had just been closed. This opening of the circuit in response to the field exciting voltage takes place more promptly than would be the case if the apparatus were constructed so as to open the contacts only after the alternating voltage of the machine had been reduced and the weakening effect transmitted to the solenoid. This promptness of action of the regulator prevents the surging or hunting of the voltage of the machine which would otherwise take place. The voltage having been thus adjusted, the contacts continue to vibrate regularly until some change of voltage occurs requiring correction, whereupon an action takes place similar to that already described.

Improvement in Motor Field Commutation.

The accompanying illustration indicates a method by which Mr. William L. Waters of Milwaukee proposes to render the magnetic field of electric motors, particularly alternating-current motors having salient poles, more suitable for commutation. Mr. Waters has received a patent on the device.

It has been found that by connecting together the sides of the poles near the faces with a solid magnetic ring the distribution of lines in the commutating field between two poles is so altered as to produce a field much more suitable for commutation than with the ordinary type of magnet pole. The machine when thus provided is said to possess properties intermediate between standard projecting-pole construction and the continuous type of field used principally in induction motors.



IMPROVEMENT IN MOTOR FIELD COMMUTATION.

The solid connecting ring shown in the diagram is provided at each end of the machine, and is made preferably of wrought iron. The rings lie close to the pole sides, near their faces, and are held in place by bolts or rivets. It is asserted that the use of the rings so alters the distribution of the lines of force in the commutating field that sparking at the brushes is practically eliminated.

Steam-turbine Investigation.

Mr. W. E. Moore of Connellsville, Pa., has been added to the committee for the investigation of the steam turbine, which is to report at the Atlantic City meeting of the National Electric Light Association. In order to complete the data for this report the committee met on Tuesday, April 3d, at the office of Mr. Irving E. Moultrop, in Boston. Mr. Moultrop has just returned from Europe, where he went for the purpose of gathering data regarding turbine operation abroad. From Boston the committee will visit the General Electric works at Lynn, Mass., and the Providence Engineering works, Providence, R. I. It will then proceed to Schenectady for a day at the General Electric works; will visit Utica, Chicago and Milwaukee, and on the return trip will visit the works of the Westinghouse company at Pittsburg. The coming report is expected to contain much interesting matter not heretofore published.

Rebuilding San Francisco Lighting Plant.

The San Francisco Gas and Electric Company, owing to the recent disastrous fire in its Station C building, is spending about $100,000 on the new building and $300,000 on machinery. Willis Polk is the architect who has prepared the building plans, and he is asking for the necessary bids from the contractors. The generating plant will be entirely finished inside with white enameled glazed terra cotta. It will contain eight General Electric 1,000-kilowatt motor-generators, 12 transformers of corresponding capacity, 176 bus-bar compartments, 194 20,000-volt high-tension switches and 173 lineal feet of switchboards, which will control all the lights in the downtown district. Every precaution is being taken to prevent a cessation of service, such as occurred in the late fire.

One of the chief features of the exhibit of Pirelli & Co. of Milan, Italy, at the Milan Exposition will be a cable which will be capable of withstanding a potential of 200,000 to 250,000 volts.

The Pennsylvania Railroad's Extension to New York and Long Island Long Island City Power Station.—I.

Introduction.

The Pennsylvania Railroad Company has had under consideration for a number of years plans for establishing a terminal for its lines on Manhattan Island. The earliest of these contemplated a bridge over the Hudson River, with elevated approaches and terminal in the city of New York. The demonstration that electric traction was practicable for heavy train units made possible, however, an entrance by means of tunnels, which would enable the adoption of a well-rounded-out plan for a terminal which would embrace not only the Pennsylvania Railroad main line business, but through connection with New England and the railroad system on Long Island.

The announcement that the Pennsylvania Railroad Company proposed to enter New York city was made in May, 1902, and since that date the project in all its features has been actively under way.

It is the purpose of the present series of articles to describe the first unit in the carrying out of the terminal plans which has been completed in operative condition—the Long Island City power house.

Organization.

Two companies have been incorporated through which the Pennsylvania Railroad Company is carrying on its New York extension work. One of these, the Pennsylvania, New Jersey and New York Railroad Company, will build all of that portion of the tunnel and approaches in the state of New Jersey and extending under the Hudson River to the boundary line of the states of New Jersey and New York; from this boundary the other, the Pennsylvania, New York and Long Island Railroad Company, will construct the tunnels, terminal station and yards on Manhattan Island, under the East River and in Long Island City. The officers of these companies are the officers of the Pennsylvania Railroad Company, the president being Mr. A. J. Cassatt.

The engineering and architectural features are subdivided in accordance with the character of the work, the whole project being under the general direction of the management of the Pennsylvania Railroad Company.

The tunnel work proper is divided into two parts, the East River division being under the direct charge of Mr. Alfred Noble, chief engineer, and the North River division under the direct charge of Mr. Charles M. Jacobs, chief engineer. The general railroad facilities and the electrical and mechanical features of the railroad and terminal are under the charge of Mr. George Gibbs, chief engineer of electric traction. These three officials, together with Brigadier-General Charles W. Raymond, chairman, constitute a board of engineers, to which the general engineering features of the whole plan are confided.

In addition, advisory committees consisting of officers of the road have been appointed to pass upon and work out the special problems relating to the required railway facilities and pass upon the adequacy of the operating features as developed by the labors of the various departmental bodies.

Messrs. Westinghouse, Church, Kerr & Co. were selected as engineers and contractors for the electrical and mechanical engineering, acting under the supervision of the chief engineer of electric traction. Messrs. McKim, Mead and White of New York are architects of the station building.

It will be seen that, by this comprehensive organization, a harmony of operation with proper degree of independence is effected, which, while it keeps the officials of the Pennsylvania Railroad in close touch with the enterprise in all its stages, relieves them of multiplicity of detail.

Location of Power Station.

The enormous scale of development of the large terminal system of the Pennsylvania Railroad, which is to be entirely operated by electric power, very early led to the decision that to secure reliability of service, as well as convenient power distribution, there should be two main generating stations, sites for which could be more readily obtained if they should be located one in New Jersey and the other on Long Island. The latter station would also naturally be used as the main source of power for the Long Island Railroad lines as fast as equipped, and the electrification of the Atlantic Avenue Improvement, which was impending when the general project took shape, required the early construction of the Long Island City power station.

On account of the very large amount of power that would eventually be needed by the new lines, which are to tunnel under the East River near the present terminus of the Long Island Railroad at Hunter's Point, and also by the Long Island Railroad suburban lines, which are now concentrated at this terminus, it was obviously desirable to locate the power station conveniently to the district which would eventually be the scene of such a concentration of electric-railway activity.

The great flexibility of the alternating-current system of power transmission admits of placing the generating station at whatever reasonable distance from the natural center of load may be dictated by the important considerations of condensing-water supply and cheap coal delivery; and the proximity of the East River [illegible] Both the [illegible] a [illegible] available in Long Island City [illegible] advantage of [illegible] Long Island Railroad [illegible] handling of coal [illegible] minimum [illegible] and equipment during construction. [illegible] an entire rectangular block [illegible] toward the river, extending 200 feet north and south on Front Street and on West Avenue and 500 feet in depth along Third and Fourth streets.

Station Capacity.

At the time the design was undertaken, the extent of electrification in sight was such as to [illegible] a station capacity of not less than 50,000 kilowatts and probably more. A station of such magnitude requires, for economical operation, generating units of the largest practicable size. When the decision was made, the largest size of steam turbines and generators that had been standardized was of 5,500 kilowatts, and this size, therefore, became the unit basis of the power station design. The rectangular shape of the lot, practically 200 by 500 feet, made it possible to plan a station that could readily be extended to occupy the entire block. The adopted design will permit the disposition of fourteen 5,500-kilowatt generating units in the building covering the block, or about 105,000 electrical horsepower, if such an amount of power be eventually required.

For the initial load that was to be placed upon the power station during the earlier years of the Long Island Railroad electrification, it was decided that three 5,500-kilowatt units would suffice. The building, as designed for this initial equipment, covers the full width of the block and half its length, and contains room for six 5,500-kilowatt units and two 2,500-kilowatt units of the same type to be used for lighting the tunnels.

As now built, therefore, the station can hold more than double its present equipment, and when extended in size will accommodate more than four and one-half times the original installation of electrical generating machinery.

Foundations.

The site was formerly under water and had only been filled in to an extent that brought the surface about 1½ feet above the extreme high water. The structure and equipment of a large power station involve the carrying of heavy concentrated loads upon the side walls, building columns and machinery foundations, which have to be properly distributed over the underlying soil in a manner that will secure absolute stability and uniformity of settlement. In the design of this foundation due consideration was given to several alternative methods, and its was finally decided to use a comparatively uniform spacing of piles overlaid by a monolithic concrete mass of a thickness which should take up the distance between the point at which the piles could be safely cut off and extreme high water. The total number of piles required for the foundation was 9,115.

Intake Flume.

The flume for the condenser intake and the overflow flume directly above it traverse the building foundations completely from west to east and are integral with them. Both the intake and the overflow flumes are nominally 10 feet in diameter, this large sectional area being required to provide sufficient condensing water with a low velocity of flow when the power station is extended to its maximum future length of 500 feet and filled with generating machinery. The elevation of the intake flume is such that [illegible] overflow flume with 15-inch I beams.

Excavation.

The work of excavation was begun October [illegible], 1903. The only difficulty encountered was a layer of quicksand, which made necessary the driving of six-inch sheet piling for the whole length of the site on the Third Street side and for a part of the distance on the Fourth Street side.

Piling.

Spruce piles were used, varying in length from 25 to 40 feet. They were driven practically to refusal with a 2,000-pound hammer falling 18 to 20 feet. The first pile was driven on November 16, 1903, and the last one on March 5, 1904.

Concreting.

The concrete was mixed by machine, and a special plant was installed for this purpose, with a view to securing the most economical and rapid production of concrete. As the concrete had to be placed in freezing weather, provision was made for heating the sand and stone piles by means of a hot-air furnace burning waste lumber, the heat being distributed by means of an 18-inch pipe running through each pile of material and so situated that the material shoveled into the cars was taken from a section of the pile traversed by the pipe, so that it was sure to be well thawed out. The water used for mixing the concrete was also heated with steam from a 30-horsepower steam boiler of the vertical type. The concrete was mixed in proportions of 1, 2½ and 5, very wet, and required very little ramming. Although the work was done during an unusually cold winter, the precautions taken sufficed to prevent trouble from freezing. The entire block of concrete required for the monolithic cap and the flumes was about 18,000 cubic yards.

Architectural Features.

In the case of the Long Island City power station it was decided to erect the building free from any architectural elaboration, relying entirely for expression of purpose on the outline and disposition of the masses of the structure as dictated by the engineering necessities. Fig. 1 is a general view of the structures, showing the coal tower in operation. The building design comprises three distinct features. The first is the boiler house, with its four independent stacks piercing the

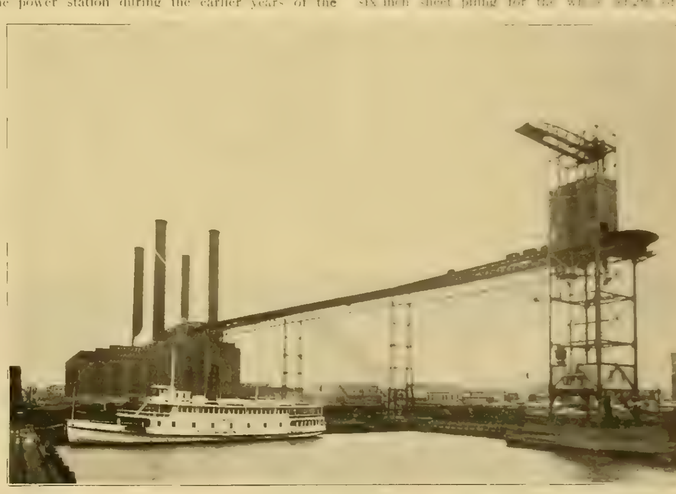


FIG. 1. LONG ISLAND CITY POWER STATION OF PENNSYLVANIA RAILROAD, SHOWING COAL TOWER IN OPERATION.

roof at regular intervals and its facade exhibiting the subdivision of the structure into a series of equal bays, each marked by a single arched window opening extending without interruption past all floors. The second feature is the separate enclosure of the coal bunker, superimposed by the boiler house longitudinally between the stacks. The third feature is the engine house, including also the electrical switching galleries and offices, which is treated as a separate wing of the entire building, connected to and parallel with the boiler house, but subordinate thereto as to its height, this being consequent upon the type of generating machinery adopted.

The only feature which could in any way be considered ornamental is the name "Pennsylvania" in neat terra-cotta capitals inscribed across the parapet of the engine house.

The frames of all doors and windows in the exterior walls are of cast-iron. The main entrance doors are of heavy oak and plate glass. All other doors are built of wood cores covered with Kalimene iron. The window sash are of cast iron glazed with rough wire-glass, the sash being pivoted at the top and arranged to swing outward by a system of operating devices specially designed for this station and believed to be a substantial improvement over previous developments.

The design of the sanitary appliances of the station received not only careful consideration with regard to the convenience of location, but with a view to securing the greatest possible perfection of material and workmanship. A liberal amount of space is given up to lavatory and locker rooms for the station force, those for the engine and fire-room forces being located in the boiler room basement, and those for the electrical staff on the gallery floor adjacent to the operating room.

The over-all dimensions of the present building are 200 by 262 feet outside measurement. The boiler house is 103 feet wide inside, the engine room 66 feet, and the electrical galleries 25 feet wide. The boiler house proper is 82 feet high to the top of the parapet. The coal-pocket enclosure, superimposed on the boiler house, is 60 feet wide, and its parapet is 118 feet high. The engine room is 70 feet high, to the top of the parapet.

The first floor of the boiler house is 16 feet above the basement, and the second floor of the boiler room is 35 feet above the first floor. In the engine house, the engine-room floor is 23 feet six inches above the basement, and thence to the supporting columns by applying a neatly finished granolithic covering of cement over the grillages of steel beams embedded in the concrete foundations. The boiler-house columns as they appear on the second floor of the boiler room are shown in Fig. 3.

General Features of Power-station Equipment.

A description of the steam plant should be prefaced by an outline of the general system on which it is laid out. The desirability of subdivision into units, or groups of units, always appeals strongly to the operating force in a large steam plant, which must always be ready for emergencies, no matter how perfect the design and construction may be. The necessity which may arise at any moment for cutting out a portion of the plant makes it desirable to design it in the first place with a view to easy and economical subdivision, so that when completed a large power plant may be regarded as a collection of self-contained individual plants, all located under one roof and under one control, but capable of being readily separated. When, as is usually the case, they are joined up and operated as one plant, the lines of separation between the sections are practically obliterated.

The unit system of design was followed in laying out the equipment of the power station. The boiler plant, of 32 boilers, is divided into eight groups of four boilers each, four of these groups being on the first floor and four directly over them on the second floor of the boiler house. The four boilers of each group stand opposite each other across an alley or firing space, and are separate as regards economizer, flue and stack connections, but their steam connections are made up so as to form them into a group for the purpose of unit subdivision. That is to say, the four boilers at the west end of the plant on the first floor, on both sides of the alley are piped to one manifold, which is connected to a vertical header, and the four boilers directly above them on the second floor are piped in the same manner to the same header, the two groups of four constituting the first unit group at the west end of the boiler room.

This group is amply sufficient to furnish steam to the two 2,500-kilowatt lighting units, which will eventually constitute the first unit subdivision at the west end of the engine room. The second groups of four boilers on the first and second floors

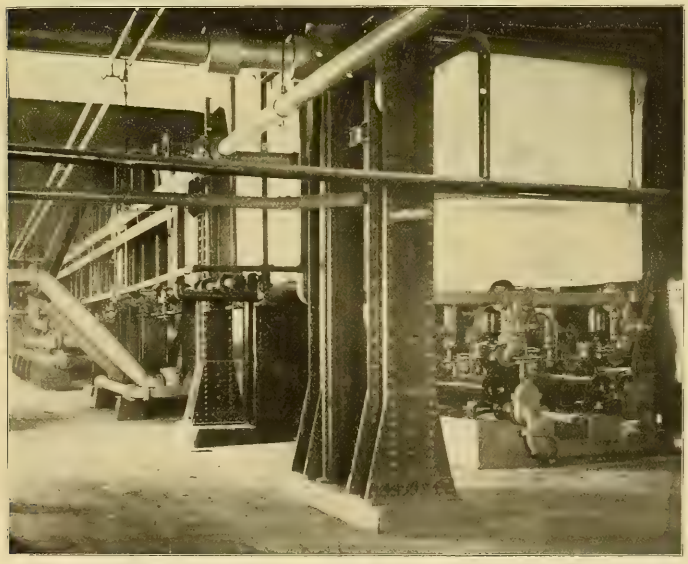


FIG. 2. BOILER-ROOM BASEMENT IN LONG ISLAND CITY POWER STATION, SHOWING FLUES AND HOT-WELL TANKS.

roof trusses the height is about 40 feet in the clear. This is a much lower engine room than is commonly met with in power stations of this size, the saving in head room being due to the adoption of the horizontal type of steam turbines, which enables economy in vertical space required as well as in the floor area.

Like all large power stations of modern construction, the superstructure of the building consists of steel framework, which carries the weight of the room and the entire contents of the building, except such portions of the machinery as may be more conveniently carried on separate foundations. The first steel was placed in position on the foundation on March 17, 1904, and the steel erection was completed about the 20th of September, 1904.

Fig. 2—a view in the boiler-room basement—shows the treatment given the bases of the steel

are piped together in like manner, so that they can, as one group, supply steam to the first 5,500-kilowatt turbo-generator. These main groups of boilers are piped together by a cross-connecting header, which is to be considered as an equalizer, rather than as a large main into which all boilers feed and from which all engines take steam, which is the most usual layout of power-station steam piping.

Although this subdivision into unit plants may or may not be availed of by the operating force, it nevertheless constitutes a systematic and uniform scheme of development, favoring the duplication of the bends, valves and other pipe details, thereby rendering construction economical.

In describing the equipment of the power station, the most logical method is to begin at the coal pile, and follow the energy from it through the steam and electrical plant to the outgoing feeders.

The equipment may be divided into several distinct sections, as follows: First, the coal-handling plant; the steam-generating plant of boilers, with the accessory water-supply system and pumps, and including furnaces, flues, economizers, stacks and ash-handling plant; then the turbine engines and their various auxiliaries in which the steam is used, and, finally, the electrical plant, which converts mechanical into electrical energy and distributes it to the outgoing feeders. First in order, therefore, comes the handling of coal.

Coal-handling Plant.

The location of the power station is such that it can receive coal either by water or by rail, but as some water transportation is necessary in order to reach the power-station site, from the New Jersey terminals of coal-carrying railroad lines, it

FIG. 3. BOILER ROOM, SECOND FLOOR, LONG ISLAND CITY POWER STATION.

becomes cheaper to carry it in barges to the power-station site. The plant was therefore designed more particularly to deal with water-borne coal, though certain provisions were made in the design of the tower that will admit of the development of the power station for handling rail-borne coal directly from the cars should it ever be required in the future.

The coal pocket is located in the top of the boiler house so that it can feed coal by gravity through suitably located spouts to the stoker hopper in front of each boiler, thus eliminating all handling of coal inside the house on the part of the fire-room force, reducing to a minimum the expense of firing the boilers. But to get the coal properly deposited and distributed in the coal pocket of 5,800 tons capacity, where the consumption is several hundred tons per day, becomes a problem of no small magnitude if, as in this case, it is desired to handle such large quantities of fuel at the lowest possible cost.

The location alongside the dock, to which barges are brought, is about 500 feet from the west front of the boiler house. A high-level cable railway was run from the coal-hoisting tower on the dock into and through the top of the boiler house, over the coal pocket, at an elevation of 107 feet above the dock level. This cable railway is in the form of a loop and is operated by an endless cable, motion being imparted to the cars by means of a simple form of cable grip. The decision to use a level coal bridge (where height is, of course, governed by the construction of the coal pocket), coupled with the desire to do all the hoisting at one time, determined the height of the coal tower, rendering advisable the construction of a higher tower than any hitherto used for this purpose. The combination of the high-level cable railway bridge and the hoisting tower of corresponding height enables all the hoisting to be done at one operation without the pulverizing of the fuel incident to passage through a succession of conveyors or elevator devices.

Subsequent to this single-hoisting operation the coal is passed along to its destination in the pocket by gravity and by transportation in cars along the level cable railway.

The hoisting tower is of the "one-man" type, having capacity for 400 long tons of run-of-mine bituminous coal in five working hours. The coal is hoisted in a two-ton Haywood bucket of the "clam-shell" type, with heavy renewable steel cutting blades. This is raised and lowered by a two-cylinder 15 by 24-inch Lidgerwood type of hoisting engine with a Stephenson link motion. The bucket is so counterweighted that when lowered its speed cannot exceed 1,000 feet per minute. It is suspended from a substantial trolley carried on a rigid boom built of steel trusses in parabolic form and projecting 43½ feet beyond the tower at a height of about 103 feet above the dock.

The operation is as follows: The bucket is low-

ered into the barge with jaws open and the sharp edges of the bucket naturally dig into the coal to a sufficient depth to allow the enclosure of a full load of it in the bucket as soon as the jaws are closed. The closing of the bucket is done by a biter engine, which operates through a series of steel ropes working around the sheaves, and brings the jaws of the bucket together without lifting it out of the barge. When the bucket is closed the hoisting engine starts automatically a continuous hoisting until the bucket reaches its predetermined maximum height about 150 feet in the air, the maximum rate of hoist being about 1,400 feet per minute. At this point the hoisting ceases and the trolley motion starts automatically, running the bucket in on the boom until it is over the receiving hopper and then automatically starting the biter mechanism in the reverse direction and dumping the load by opening the jaws of the bucket.

The machinery for hoisting and trolleying the operation of the bucket was designed and built by the Robins Conveying Belt Company.

The receiving hopper is built of steel plate and the coal passes through it by gravity onto the shaking bottom, which allows certain small bituminous or small anthracite coal to pass around the crusher to the loading hopper and delivers the large coal to the crusher. The shaking grate and the crusher are operated by the same engine, which is a 7½ by 7-inch Westinghouse standard engine.

The crusher has a capacity of 400 tons in five hours, and the coal after passing through it drops directly into the loading hoppers, which are directly above the scale platform. They are equipped with gates operated by the weigher, who loads the cable cars as they stand upon the platform. The scales have a capacity of five tons.

The cable railway is designed for a capacity in excess of the other portions of the mechanism above described. That is, it is capable of handling 150 tons per hour when operating 29 two-ton cars at a speed of 180 feet per minute around a track loop approximately 2,500 feet long.

The whole plant is designed with a minimum of machinery for the purpose intended and is expected to have an ultimate capacity of 800 tons per day. Besides obviating injury to the fuel from constant dumping from one conveyor to another, the labor, cost, interest, depreciation and repairs are reduced to a minimum.

It is estimated that the actual cost, including labor, supplies and fixed charges per ton of coal from the time it leaves the barge until it is stored in the bin, on the basis of 400 tons per day, is 9½ cents per ton, which is believed to represent the greatest economy yet obtained in any plant intended to accomplish the same purpose under similar general conditions.

The striking features of the system [illegible] of the bin and of the conveying cable [illegible] for carrying coal into the pocket.

[illegible]

Ashes are dumped through hoppers in the bottom of the boiler pit into small cars so constructed that the body is detachable from the truck. After receiving a load of ashes the car is run along a narrow gauge railway laid in the basement floor underneath the line of dumping hoppers to a turntable at the west end of the boiler house basement directly under the end of the ash bridge. A trolley hoist is provided which runs on a 10-inch I beam that runs from a point over the ash bin through the bridge and extends over the turntable. From the trolley carriage are suspended by means of wire cables two sheaves with forged steel hooks, which are inserted in the rings at each end of the car body as it stands on the turntable in the basement. The cables are then wound up on the grooved winding drums of the trolley hoist, raising the bucket to the proper height opposite the ash bridge, at which point, by the action of an automatic switch, the operation of the hoisting is stopped, the trolley motion is started and then the bucket is carried to a point over the ash bin, automatically dumped, reversed, returned again to the inner end of the trolley hoist and finally lowered to the turntable in the boiler-house basement.

WATER SUPPLY.

Water is taken from the mains of the Montauk Water Company, two of whose service mains are connected to an 18-inch main supplying the power house. In order to be sure of having a reserve on this supply there was built adjacent to the Long Island railroad yard at a distance of about 2,700 feet from the power station, the nearest available site, a standpipe 40 feet in diameter, 80 feet high, which is connected into this 18-inch main and under ordinary circumstances kept full.

One of the advantages in employing steam turbines is that the steam, if condensed in a surface condenser, is absolutely free from lubricating oil and can be used over and over again without injury to the boilers. This consideration was influential in determining the employment of surface condensers in this station, as the expense of pur[illegible] [illegible] feed water for 12,000 horsepower [illegible] from 90 to 202° F.

BOILERS.

The boiler plant for the Long Island City power station consists of 32 Babcock & Wilcox water-tube boilers set in batteries of two boilers each. Eight batteries on the first floor are [illegible] in the [illegible] floor immediately over the former. These batteries are equally distributed on each side of the boiler plant, with a firing space between boiler fronts of about 18 feet in width.

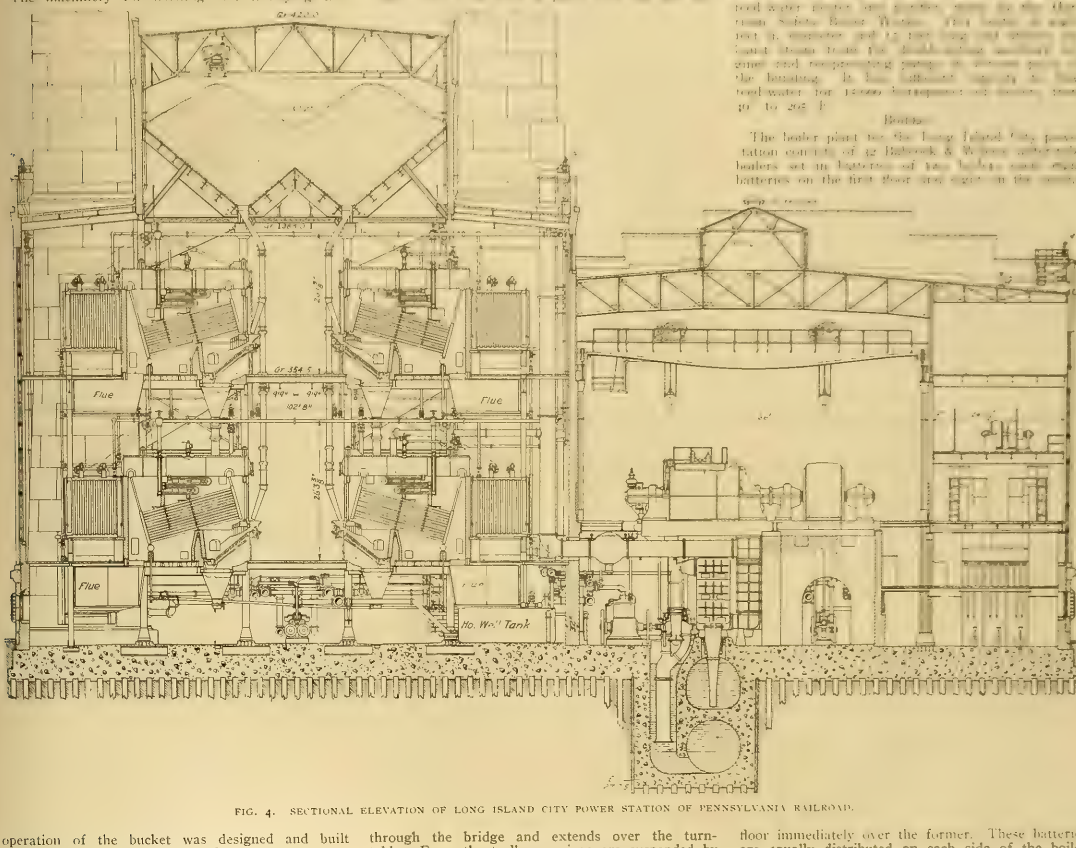


FIG. 4. SECTIONAL ELEVATION OF LONG ISLAND CITY POWER STATION OF PENNSYLVANIA RAILROAD.

The boilers are designed for a working pressure of 200 pounds per square inch, and each boiler has a total effective water-heating surface of 5,243 square feet, comprised in three steam drums 42 inches in diameter and 23 feet 10⅝ inches long, and 21 sections of four-inch tubes 18 feet long, with 12 tubes in each section. The general arrangement of the entire boiler plant and accessory apparatus is shown in the sectional elevation, Fig. 4.

Besides the water-heating surface, each boiler is supplied with an internal superheater consisting of two sections of tubing, arranged much like a letter U lying on its side. These superheaters are shown in position in the sectional view of the power station. Each superheater is capable of superheating the output of the boiler 200° F. when operating at 200 pounds pressure

The 32 boilers now installed are arranged in four groups, with eight boilers in each group, the eight boilers being those on the first and second floors directly over one another. The group nearest the west end of the plant is intended ultimately to take care of the two 2,500-kilowatt lighting units there to be installed. The other three groups are each capable of supplying one 5,500-kilowatt turbine unit. The ultimate capacity of the boiler house, when finally extended, will be 96 boilers of the type now installed.

[To be continued.]

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CONTENTS OF THIS NUMBER.

Generators of 20,000 Horsepower on Vertical and Horizontal Shafts. By Orrin E. Dunlap. Illustrated..... 271
Overhead Wiring Conditions in Grand Rapids, Wis.....271, 272
Emmet's System for Regulating Turbo-generators. Illustrated. 272
Improvement in Motor Field Commutation. Illustrated..... 272
Rebuilding San Francisco Lighting Plant..... 272
Steam-turbine Investigation..... 272
The Pennsylvania Railroad's Extension to New York City and Long Island—Long Island City Power Station. Part I. Illustrated.....273, 274, 275
Editorial..... 276
Niagara's "White Coal"..... 277
Municipal Ownership Without Municipal Operation Approved at Chicago Election..... 277
Electric-light Plant for Culebra and Empire in Panama Canal Zone. With map..... 277
Candidates for the Institute Presidency. Portraits of E. W. Rice, Jr., and Dr. Samuel Sheldon..... 278
Navy Department's Work with Space Telegraphy..... 278
The Copper Market..... 278
Largest Power Station in Japan..... 278
Large Gas-driven Alternators for Johannesburg..... 278
Lyons Domestic Electricity Exposition..... 278
Obituary.—Deaths of Carl von Siemens, J. C. Kafer, J. L. Breen, Edward Backus, G. M. Brill, J. V. Merrick, R. F. Yorke, L. H. Cooper and G. L. Bradley..... 279
Extensions of Allis-Chalmers Company's Works at West Allis, Wis. Illustrated.....279, 280
Electrolysis. By E. E. Brownell..... 281
How the Idea of the Horizontal-vertical Steam Engine Was Evolved..... 281
Prevention of Ice on Third Rail..... 281
Ohio Independent Telephone Association..... 282
Discuss Dual Telephone System for Milwaukee..... 282
Henry T. Scott, President of the Pacific States Telephone Company. Portrait..... 283
General Telephone News..... 283
Indiana Telephone Items..... 283
Michigan Telephone Matters..... 283
The Telephone on the Pacific Slope..... 283
Telephone News from the Northwest..... 283
Ohio Telephone Notes..... 283
Lower Telephone Rates for Chicago Demanded by Illinois Manufacturers' Association..... 284
The First Independent Telephone Exchange..... 284

DEPARTMENTS.

Correspondence.....284, 285, 286
Great Britain..... 284
New England..... 284
New York.....284, 285
Ohio..... 285
Indiana..... 285
Michigan.....285, 286
Central Illinois..... 286
Northwestern States..... 286
Pacific Slope..... 286
Personal..... 286
Electric Lighting.....286, 287
Electric Railways..... 287
Power Transmission..... 287
Publications..... 288
Societies and Schools..... 288
Miscellaneous..... 288
Trade News.....288, 289
Business..... 289
Illustrated Electrical Patent Record.....289, 290

DATES AHEAD.

Fond du Lac Gas and Electrical Show, Armory E, Fond du Lac, Wis., April 9th to 14th.

Iowa Electrical Association (annual convention), Kirkwood Hotel, Des Moines, April 18th and 19th.

Iowa Street and Interurban Railway Association (annual convention), Kirkwood Hotel, Des Moines, April 19th and 20th.

Texas Independent Telephone Association (annual meeting), Waco, Tex., April 25th, 26th and 27th.

American Electrochemical Society (general meeting), Ithaca Hotel, Ithaca, N. Y., May 1st to 3d.

Southwestern Electrical and Gas Association (annual convention), Galveston, Tex., May 16th, 17th and 18th.

Indiana Independent Telephone Association (annual meeting), Claypool Hotel, Indianapolis, May 17th and 18th.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

Canadian Electrical Association (annual convention), Clifton House, Niagara Falls, Ont., June 19th, 20th and 21st.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st to 23d.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

ACCORDING to what are said to be reliable figures, one out of every 500 persons employed by the railroads of this country was accidentally killed during the year 1905. One out of every 24 was injured in some degree. In view of the fact that the block system, the patent coupler, the air brake and kindred appliances have been adopted during recent years to save life and limb, the figures seem startling. Dr. M. H. Thomas of Huntington, Ind., state surgeon of the National First Aid Association, in a pamphlet sent out to steam and interurban railway managers of the state, points out certain deficiencies in railroad practice which he thinks can be readily eliminated and which would result in great saving to the operating companies. He would instruct the trainmen, motormen and shopmen in "first-aid methods" and in "accident law points" so they would be able to testify in a competent manner. He also urges the employment of a skilled surgeon to work with the legal department of the railroad. The duty of this official would be to assist and advise counsel of the road in bringing about co-operation between the legal and surgical staffs and to deal directly with the claimant. Dr. Thomas thinks that proper instruction to the trainmen in first aid to the injured and on points of accident law, and the employment by the claim department of medical men skilled in surgery and knowledge of negligence law, would result in a net saving to a railroad company of at least 20 per cent. of the amount now spent annually in payment for personal injuries and death claims.

APPLIED ELECTRICITY has many uses, and they are important, but when it comes to using the electric current as a means of hazing or as an initiatory performance at a secret-society meeting a foolish step has been taken, and it is not improbable that serious results may ensue. Among some of the more unrestrained students belonging to the upper class of one of our technical institutions recently it was felt that the old and tried methods of hazing were hardly adequate to the occasion, so several under classmen were subjected to strong electric current until they became exhausted. Such hazardous tomfoolery as this should be suppressed. Electricity is not a tangible thing; it is not to be "monkeyed" with by those who do not bring to its use a certain respect and intelligence. Like the magician's apprentice, who had sufficient skill to produce a flood but not enough to stop it, persons unversed in the art should not perform any electrical tricks or experiments, unless with three or four cells of primary battery, save under the eye of a competent instructor. Ordinarily 110 volts may be handled without serious danger, but under some circumstances a shock at this pressure may result in severe injury—possibly death. Some persons are able to stand pressures that would make nervous wrecks out of others. Then there is always uncertainty as to the exact quantity of current and the pressure of a circuit before it has been tested with ammeter and voltmeter, and even then one does not know at what moment, from some outside influence, the condition of the circuit may be entirely changed. For these reasons electricity should be let severely alone by all hazers, secret-society initiating "teams" and practical jokers. Human life should not be subjected to needless risk.

THE RESULTS of the Chicago municipal elections of April 3d are distinctly encouraging to those who believe that most public-utility undertakings are best conducted when left to private initiative and private enterprise, suitably restricted for the public good.

There are several reasons for this hopeful feeling. One is that of the three public-ownership propositions on the "little ballot," one failed of indorsement for lack of the necessary number of votes. This was the proposition empowering the city to operate street railways, which was beaten because it failed to receive three-fifths of all the votes cast on the proposal.

The second reason is that while the other two propositions carried (simple majorities only being required), the vote was close, showing a great advance in favor of private ownership when contrasted with previous votes in Chicago overwhelmingly in favor of municipal ownership. Mayor Dunne, Chicago's foremost advocate of public ownership, is reported to have boasted, before election, that the vote would be five to one in favor of his pet policies. But in reality two of the questions submitted were carried by bare majorities, and the third, which received more votes than either of the others, nevertheless failed because it did not get three-fifths of all, as required by law. This showing is certainly encouraging. It proves that the voters are studying the question; that there has been a reaction from the pell-mell shouting and voting for municipal ownership.

A third reason for gratification is the fact that a majority of the aldermen in the City Council, as it now stands, seem to be opposed to the mayor's municipalization plans.

In practical result the election bids fair further to complicate the already tangled traction situation in Chicago. The city now, apparently, may neither operate the street railways itself nor grant a franchise to any private company to do so. The issue of $75,000,000 worth of "Mueller-law certificates" is authorized, but there is grave doubt whether these certificates of indebtedness will be held to be valid by the Supreme Court of the state, and, if so, whether capitalists will care to purchase them. It is evident that the era of uncertainty and of makeshift arrangements in the street-railway service of the city will continue for some time to come. Of course, it is conceivable that the city may succeed in raising the money to purchase the roads and may then lease them to operating companies. But would not this contravene the wish of the voters that there be no "franchise" to any private company?

A FINE example of modern power-station design and construction is afforded by the Long Island City power house of the Pennsylvania, New York and Long Island Railroad Company, a comprehensive description of which is begun in this number. The company named is an organization of the Pennsylvania Railroad Company operating in New York state, and is constructing the tunnel under the Hudson River (east of the boundary between the states of New Jersey and New York), the terminal station and yards on Manhattan Island, the tunnel under the East River and the terminal, yards and connections in Long Island City. Thus the power house is interesting not alone in itself but also as a part of the Pennsylvania's elaborate terminal extension in and about New York city—one of the most important, original and carefully worked-out developments of modern railroading. The first unit to be completed in the carrying out of this great work is the electric power station in Long Island City, which is now described.

The Pennsylvania terminal system is to be entirely operated by electric power, and there will be two main generating stations—one in New Jersey and the other in Long Island City. The latter will also supply power for the Long Island Railroad lines as fast as equipped. This power house, with its initial equipment for 16,500 kilowatts (ultimate capacity, 77,000 kilowatts), was needed first, and is now in operation supplying current for the section of the Long Island Railroad between Flatbush Terminal and Rockaway Park.

Both in general conception and design, and in attention to detail to secure the greatest economy and efficiency in operation, this power station affords opportunity for careful study. Especially interesting features are the intake for condensing water, the arrangement of boiler units and steam piping, the bold methods of coal and ash handling, the means adopted to prevent the galvanic or electrolytic action of the salt water used for circulation in the condensers, the color scheme for piping, use of storage battery to provide exciting current, disposition of the current-controlling apparatus and the system of signals between engine attendant and electrical operator. But in every detail the equipment is worthy of close attention, and no apology is necessary for the amount of space which the Western Electrician is giving to this advanced specimen of power-house design.

In future articles we hope to take up other features of the Pennsylvania electric-railway extension at the New York city terminal.

Niagara's "White Coal."

The Western Electrician last week gave its readers the substance of the report of the United States section of the International Waterways Commission, which has been laid before the government in Washington, and which the president has transmitted to Congress with a favorable recommendation. In Canada there appears to be a good deal of hesitation on this important subject. The situation there seems to be that the power companies wonder what the Province of Ontario is going to do. Ontario stands in fear of the Dominion, and the Dominion hardly knows "where it is at," in the face of the report that Sir Mortimer Durand, British ambassador at Washington, and the United States are negotiating a treaty for the preservation of the Falls of Niagara. All this is topped off by many municipalities in Ontario calling upon the government to develop electric power for distribution to the municipalities, this to be accomplished by buying up one of the present Niagara plants or establishing a new plant at Canadian Niagara, which latter suggestion does not indicate much public sentiment for the preservation of Niagara Falls.

In the report of the United States section of the International Waterways Commission it was mentioned that there were some differences between the American and Canadian sections of the commission, but that these did not appear to be insuperable. The report of the Canadian section makes it look as though there might be quite a serious misunderstanding, or that at least the Canadian commissioners desire that the United States section shall come to them clothed with more authority than they now possess to treat upon the international waterways. The Canadians think there is a desire on the part of the Americans to railroad through an agreement about Niagara, but they are not in a hurry to act, and it does not appear as though public sentiment in Canada wants Niagara "saved." The fact is that public sentiment in Canada is being developed for the full utilization of the falls. The Toronto Globe preaches thus: "Why should Ontario suffer from a soft-coal strike with power enough to turn every wheel in the province going to waste at Niagara? Put enough harness on the falls and cease to depend on foreign coal for factory power."

Often in Canada, using an expressive phrase coined in France, the power of Niagara is referred to as "white coal," which, in the light of the coal-strike situation, is suggestive of independence. The United States section of the commission advises no further diversion of the waters of the Niagara, but the Canadian report, in substance, asserts that to the 415,000 horsepower to be developed by the works on the three Canadian companies, frequently mentioned, from 200,000 to 400,000 additional horsepower can be "harnessed" without in any way impairing the scenic beauty of the Falls of Niagara, and it is recommended that until the consequences of the works actually under construction are known, no arrangement whatever be made with the United States government.

It is also contended that if the Falls are impaired in beauty today, the mischief is done on the American side, as the power companies in New York state have all their intakes above the rapids at which the Falls commence. On the other hand, not one of the three Canadian companies has an intake above the rapids. One—the Ontario Power Company—takes its water at the crest, and the other two below the crest. The report further recommends that, inasmuch as the demand for power from the Canadian companies will be limited for some time, it would be good policy not to permit any other companies holding Canadian charters, which have not yet commenced operations, to proceed with their works, but that their charters be canceled, and none others be granted until the actual condition of affairs, as shown by the completed works of the present companies is known.

It is further stated in the report that, in the opinion of the commissioners, it is not advisable to make any treaty with the United States in reference to Niagara alone, but that any international arrangement must embrace all the waters adjacent to both countries, from the Atlantic to the Pacific, and that the duration of the treaty shall not exceed 25 or 30 years.

In an address before the Toronto Board of Trade, Hon. Adam Beck, chairman of the Municipal Power Commission, estimated that 500,000 people may easily be supplied with electric power from Niagara Falls if the available power is developed, and said, "Our friends in the United States need not be so concerned as they profess to be." He did not believe in prohibiting the export of power, as this would work an injustice to those who have invested between $[illegible] and $[illegible]. He said that power can be developed at Niagara for $8 per horsepower against steam at $[illegible] per horsepower, a saving of $20 per horsepower or $[illegible] to the province. It would cost $[illegible] per horsepower to transmit it from Niagara to Toronto, but, he stated, power was to be sold in Toronto for $35 per horsepower. Mr. Beck estimated the cost of developing, transmitting and distributing of [illegible] horsepower to be $[illegible], of [illegible] horsepower it would be $[illegible], and for 100,000 horsepower $11,000,000. Power for manufacturing purposes could be supplied for $17 per horsepower, some estimates making it $15 per horsepower. A reduction of 25 per cent could be made in house lighting, and the city of Toronto could reduce the cost of arc lamps from $65 to $40 a year. All told, there would be a saving of $1,850,000 to the municipal interests.

A meeting of the joint commission is to be held in Buffalo on April 20th for the purpose of attempting to adjust such differences as now exist between the two sections.

Municipal Ownership without Municipal Operation Approved at Chicago Election.

At the municipal election of April 3d the citizens of Chicago approved the ordinance authorizing the city to issue Mueller-law certificates to the amount of $75,000,000 by the narrow majority of 3,339 in a total vote of 216,677. Likewise, the proposition, "Shall the city of Chicago proceed to operate street railways?" received a majority of 10,651 votes, out of a total vote of 231,171. In this case, however, three-fifths of the votes cast were necessary to carry the measure, by law, so that the operation clause failed to reach the required number of votes by 17,792.

The third proposition on the "little ballot" related to a question of public policy, as to whether the City Council should proceed to secure municipal ownership and operation under the Mueller law rather than to grant franchise ordinances to private companies. Here, too, the municipal-ownership idea carried by a majority of 3,837.

The questions voted upon and the votes for and against are as follows:

Shall the City of Chicago proceed to operate street railways?

For	120,911
Against	110,260
Lacking 60 per cent. of votes cast, necessary to pass	17,792

Shall the ordinance entitled "An Ordinance authorizing the City of Chicago to construct, acquire, purchase, own and maintain street railways within its corporate limits and providing the means therefor" passed by the City Council of said city on the 18th day of January, A. D. 1906, making provision for the issue of Street Railway Certificates not to exceed in amount $75,000,000 be approved?

For	110,008
Against	106,669
Majority	3,339

Proposed question of public policy—Shall the City Council proceed without delay to secure Municipal Ownership and operation of all Street Railways in Chicago under the Muller Law, instead of passing the pending franchise ordinances or any other ordinances granting franchises to private companies?

For	111,862
Against	108,025
Majority	3,837

The daily papers figure that the new City Council will stand from 25 to 28 with the mayor in favor of municipal ownership, 32 to 35 against the mayor and 10 doubtful.

The city having acquired the power to own but not to operate the street railways adds another complication to the already tangled situation. What the next move of the mayor and his adherents will be remains to be seen.

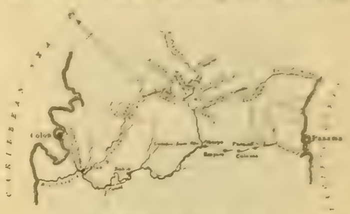
The full text of the opinion of the Supreme Court in the 99-year case has been issued. It only strengthens the impression given by the syllabus printed in the Western Electrician of March 17th, denying the claims of the Chicago Union Traction Company and the Chicago City Railway Company to long-term franchises in streets of Chicago. The companies' rights in the streets are governed exclusively by the franchises granted by the city.

The city ordinance of October, 1905, on street-car crowding has been declared invalid by Judge Mack, who granted an injunction to the City Railway Company, nullifying, for the present, about 500 pending justice-court suits against the companies. The case will be appealed by the city.

It is reported that on March 28th 572 words were sent by the DeForest space-telegraph system from Coney Island and recorded on the coast of Ireland, 3,200 miles away. A total of 1,000 words were sent, of which the above number were recorded. The messages were sent in various "tunes" to ascertain the best.

Electric-light Plant for Culebra and Empire in the Panama Canal Zone.

[illegible]



MAP OF PANAMA CANAL ZONE.

ton, D. C. The two towns are situated [illegible] together, as seen by the accompanying map of the Canal Zone, and may conveniently be supplied with current from a plant situated at either place.

Two generating sets of 100 kilowatts each will be required, the generators to be direct connected to steam engines. These are to develop two-phase 60-cycle current at 2,200 volts. Each engine will be of the vertical, single-acting automatic compound type and 13 and 22 by 13 inches in dimension. The generators shall be capable of running at an overload of 50 per cent. for two hours continuously, with a rise of themperature not greater than 55° C.

Exciting current will be obtained from either of two separate sources. One of these is a motor-generator set operating from the system. This will consist of a 15-kilowatt 125-volt compound-wound multipolar direct-current generator direct connected to a 25-horsepower two-phase 60-cycle 200-volt induction motor operating at 850 revolutions per minute. The other set will be a steam-driven one consisting of a 15-kilowatt generator similar to the one above and driven by a 7½ by seven-inch vertical steam engine.

The switchboard will include two two-phase 2,200-volt generator panels, each complete with lamp bracket and shade, 60-ampere ammeter, polyphase indicating wattmeter, field ammeter, synchronizer switches, etc.; two two-phase feeder panels; one two-phase load panel, and two exciter panels. A swinging-bracket synchroscope and swinging-bracket voltmeters will be installed.

Sixty-three transformers will be required of the following capacities: Three of 10 kilowatts; 12 of five kilowatts; 20 of three kilowatts; 22 of two kilowatts, and six of one kilowatt. They are to be oil-insulated and wound for a primary voltage of 1,050-2,100 volts and a secondary voltage of 105-210-440 volts.

Steam-generating equipment is to include three vertical tubular boilers of 120 horsepower each, designed to operate at a steam pressure of 125 pounds gauge per square inch. One boiler horsepower is here considered equivalent to the evaporation of 34.5 pounds of steam from and at 212° F. Each boiler is to have not less than 1,200 square feet of heating surface. Two duplex boiler feed pumps will be installed, one combination 350-horsepower vacuum feed-water heater, purifier, filter and receiver complete and one condenser equipment. The last-named must be capable of condensing 7,500 pounds of steam an hour, and of maintaining a vacuum of 25 inches with circulating water at 92° F.

The boiler house is to be equipped with a self-supporting steel stack 90 feet high and 54 inches in diameter.

Bids are asked also upon a considerable quantity of line material, among the most important items being the following: 95,000 feet of aluminum conductor wire; 800 feet of aluminum tie wire; 2,000 triple-petticoated 2,200-volt grooved insulators; 450 wood cross-arms; 1,800 locust cross-arm pins, etc. A large amount of interior-wiring material will also be needed, such as rosettes, key sockets, cleats, plugs, knife switches, receptacles, etc.

The Candidates for the Institute Presidency.

Two candidates for the office of president of the American Institute of Electrical Engineers have been nominated by the directors of that organization. They are E. W. Rice, Jr., of Schenectady, and Dr. Samuel Sheldon of Brooklyn. The election will be by letter ballot and will be announced at the annual meeting on May 15th. Portraits and brief biographical data of the candidates are here presented.

Edwin Wilbur Rice, Jr., is third vice-president and technical director of the General Electric Company. He was born in 1862 and graduated from the Central High School of Philadelphia in 1880. He associated himself with his former teacher, Prof. Elihu Thomson, in electrical investigations, and a few years later became superintend-

E. W. RICE, JR.

ent of the Thomson-Houston works at Lynn. In 1893 he was made chief engineer of the then recently organized General Electric Company. Three years later he became third vice-president of the company. Mr. Rice has been associated with electric-railway and lighting development almost from the beginning. He was the first to advocate flexible motor suspension for electric-railway cars. He has had much to do with the development of devices and methods for handling and controlling high-tension currents. More than 100 patents have been issued to him in the United States. He is a member of several scientific and technical societies. After the Paris Exposition of 1900 he was created a chevalier of the (French) Legion of Honor, and in 1903 Harvard conferred on him the honorary degree of master of arts.

Samuel Sheldon, A. M., Ph. D., was born in Middlebury, Conn., in 1862 and graduated from Middlebury College in 1883. He received his master's degree from his alma mater in 1886. He

DR. SAMUEL SHELDON.

went to Germany and was assistant to Prof. Kohlrausch at Würzburg in the historic determination of the value of the ohm. The University of Würzburg conferred the degree of Ph. D. on him in 1888. He was assistant in physics at Harvard in 1888 and 1889. Since the latter year he has been professor of physics and electrical engineering in the Polytechnic Institute of Brooklyn. Since 1903 he has been retained as a consulting expert in the United States by the Swiss government. Dr. Sheldon is a member of several scientific societies and was a member of the international electrical jury of awards at the St. Louis Exposition. He is author of "Dynamo-electric Machinery" (1900) and joint author of "Alternating-current Machines" (1902). He is also a well-known member of the D. K. E. college fraternity.

It is reported that in the nominations for the presidency Mr. Rice received the support of 551 members and Dr. Sheldon of 408.

Milwaukee has been selected as the location for the annual convention.

Navy Department's Work with Space Telegraphy.

A large number of the members of the Washington Society of Engineers at a recent meeting were the witnesses of various demonstrations of space-telegraph apparatus by experimenters from the army and navy departments of the government.

Lieutenant-commander S. S. Robison, United States Navy, told of the work of the Navy Department in wireless telegraphy. The department now has about 35 land stations working, and about 50 stations aboard ships. Plans are being made for still more. Several years ago, he said, a board was appointed to consider the question, and gave its development to the Navy Department, with an order to construct a chain of stations along the Atlantic and Pacific coasts of the United States, in the canal zone and the Philippine Islands, and providing ships with the apparatus. That work has been partially accomplished. On the Atlantic coast there are stations at Portland, Me.; Portsmouth, Boston, Cape Cod, Newport, Montauk, New York navy yard, Navesink, Annapolis, Washington, Cape Henry, Norfolk, Diamond Shoals Point, Charlestown, St. Augustine, Key West, Pensacola, Cuba, Porto Rico, New Orleans and Colon. On the Pacific coast there are stations at San Diego, near Santa Barbara, Farallone Islands, off the Golden Gate; Goat Island, in San Francisco Bay; Mare Island. Three or four others are to be built farther north. There is one at Honolulu, one on the island of Guam, and another at Cavite, in the Philippines. Others are designed, so that the commander of the Pacific squadron can always be in touch with his ships on the ocean.

Tests made by the department so far demonstrate several things of a peculiar nature. Messages can be transmitted better at night than in the daytime; better over water than over land, and better over land with long waves than with short waves. In tests made between Key West and Colon, about 1,060 miles, communications were carried on at night, but not in the daytime, and the same results were obtained between Key West and San Juan. The longest distance over which ships have communicated at night is 1,200 miles. The present aim, he said, is reliable communication, night or day, at 200 miles.

Lieutenant-commander L. A. Kaiser, United States Navy, gave a description of the wireless-telegraph station at the Washington navy yard. Many changes are being made there all the time, and better results are being obtained as the experiments continue. He gave a description of the possibilities of space telegraphy in time of war. With scout ships fitted with the apparatus, the American fleet and Washington could be kept in touch with the whereabouts of the enemy all the time, through messages sent from the scout ships. The question of secrecy is not serious, as a code can always be used. The greatest danger is from interference with the enemy through the medium of their wireless apparatus.

Major Edward Russell, United States Army, told of the work done by the Signal Corps. The corps made its first experiments in 1899, and sent messages from the War Department here to Fort Meyer, three miles. In 1902 the Signal Corps used instruments in the maneuvers between the land and sea forces, and a scout boat sent out to sea for 20 or 30 miles from Fort Mansfield, where a wireless station was established, gave notice of the approach of the enemy's fleet.

One of the best tests of the system has been between St. Michael and Nome, in Alaska. Communication was first established there in 1904, and since then, on account of the breaking of the cable, the wireless has been carrying all messages between those two points.

The Copper Market.

A heavy business was transacted in copper during the month of March. The last days of the month saw the prices practically constant at 18.62 to 18.75 cents a pound for Lake and 18.25 to 18.50 for electrolytic. It is said that consumers have booked unusually large orders and have consequently entered the market and bought heavily. The prevailing high prices are believed to be stable and the result of legitimate demand. Not only is copper in increasing demand for electrical purposes but the demand in other directions is great, notably in shipbuilding. Exports for the month were unusually small, being only 13,936 tons. From present indications it would not be surprising to see prices reach a still higher figure.

Largest Power Station in Japan.

Electrical activity in Japan is again demonstrated, by the installation of the largest electrical generating station in the empire, which the Tokio Electric Light Company now has under construction. This company already operates a steam-driven plant in the city of Tokio, and the new plant will meet the increasing demand for power. The new plant, contracts for which have been recently closed, is located on the Tamagawa River, about 25 miles from Tokio, with which it will be connected by high-tension transmission lines, operating at a higher voltage than has been attempted, heretofore, in Japan.

At the station the main generating apparatus will consist of five 3,000-kilowatt Siemens-Halske machines, direct connected to waterwheels made by Escher-Wyss & Co. The generators will deliver 50-cycle current at 6,600 volts. All high-tension switches are of the General Electric H3 oil type, motor-operated and electrically controlled from a separate five-panel bench board. This system of remote control is also carried out for the rheostats and circuit-breakers, which are also operated from the bench board. This switchboard will be furnished by the General Electric Company, and is similar to one used in the New York Interborough Station. The transformer equipment at the generating end of the line consists of nine 2,000-kilowatt General Electric transformers, arranged for stepping up the voltage to 35,000 for transmission when connected in delta or 57,000 when Y connected. For the present the current will be transmitted at about 40,000 volts, but eventually 60,000-volt transmission is planned.

The receiving station will be located just outside the city and will contain the main step-down transformers, which are also furnished by the General Electric Company. The initial installation for the sub-station will consist of nine 1,800-kilowatt units, adapted to step down the voltages from either 33,000 or 57,000 to 11,000 volts. The arrangement is thus suitable for the transmission voltage which is at present planned, and likewise will meet future needs when the transmission voltage is increased to 60,000. In the sub-station, as in the main generating plant, the switchboard will be furnished by the General Electric Company. From this station on the outskirts of the city, all wires will be laid underground to various small distributing stations located about the city, transmission being at 11,000 volts. As in the case of all electrical installations in Japan, the work is subject to a rigid government inspection both before and after construction. Governmental approval having been obtained on the plans, and the station built, another careful inspection must be passed before the plant can be operated commercially. This rule is an interesting one and covers all work of this character, whether it is fostered by private companies or the Japanese government.

Large Gas-driven Alternators for Johannesburg.

One of the notable features of the light and power plant now being built at Johannesburg, S. A., is the use of unusually large two-phase alternators, which are being built at the Stafford works of Siemens Bros. & Co. in England. Two of these machines have just been completed, and they form good examples of slow-speed alternating-current practice. These alternators are to be driven directly by Oechelhäuser gas engines. They are designed for an output of 1,800 kilovolt-amperes at 3,300 volts, two-phase, 50 periods, with a speed of 100 revolutions a minute. They are to work on a power factor of 0.75, with 275 amperes to each phase. In testing these two machines the Hopkinson method was used, and it is said that this was the first time the method has ever been applied to such large units. One machine was run as a generator, delivering current to the second as a motor, which was in turn belted to the first. To make up the losses a 150-horsepower motor was also belted to the generator.

Lyons Domestic Electricity Exposition.

During the months of July and August, 1906, there will be held in Lyons, France, a general exposition of all electrical devices that can be applied to domestic uses. It will be conducted under the auspices of the Agricultural and Scientific Association of Lyons, and no motor will be accepted for exhibition which is over one horsepower. The object of the exhibition is to bring cheap electrical appliances nearer to the people in order that the great mass may derive some benefit from them—motors that may be used on embroidery, sewing and knitting machines, ventilators, vacuum carpet and rug cleaners, house-cleaning machines, floor polishers, carts for transporting objects, turning spits in cooking, etc. Motors for weaving are excluded. They have been in use in and around Lyons for the last three years, and it is deemed advisable to have an exhibition at an early day expressly for such motors. Americans wishing information may apply directly to J. C. Covert, United States consul at Lyons.

OBITUARY.

Carl von Siemens.

Carl von Siemens, brother of the late Sir William Siemens and Dr. E. Werner von Siemens, died in Mentone, France, on March 21st of inflammation of the lungs. He was born in 1829 at Menzendorf, in Mecklenburg, Germany, and his brothers owe much to him for the energy with which he helped to further the practical application of their inventions, especially in Russia. The business of Messrs. Siemens in St. Petersburg, Russia, has been conducted by him since 1854, with the exception of 11 years, when he assisted in directing affairs at the London establishment. He was chairman of Messrs. Siemens Brothers & Co. at the time of his death. The network of telegraph lines which covers Russia was laid by Carl Siemens for the Russian government. He was personally in charge of the laying of the direct United States cable, the first one contracted for by the firm of Siemens Brothers, and also was the first to succeed in fishing up the broken end of this same cable from the greatest depth of the north Atlantic. At the time of his death he was a partner in the firm of Siemens & Halske of Berlin, St. Petersburg and Vienna. Hereditary rank of nobility was conferred on him in Russia in 1895.

John C. Kafer.

John Christian Kafer, a naval and mechanical engineer and a past-president of the Engineers' Club in New York city, died at Trenton, N. J., on March 30th. His death was unexpected, though his health had been poor for two or three years. Mr. Kafer was born at Trenton, N. J., on December 27, 1842. He was a past assistant engineer of the United States Navy and a member of the American Society of Mechanical Engineers, of which he was vice-president in 1897-1899. He had lately formed the consulting firm of Kafer, Mattice & Warren. He was greatly interested in the new United Engineering Building.

Joseph L. Breen.

Joseph L. Breen, general manager of the People's Railway Company of Dayton, Ohio, was accidentally killed on March 29th while riding on the platform of one of his own cars. Crossing the Miami River on a temporary bridge at Washington Street, he leaned out to look forward and was struck by a post. He was knocked from the car and into the river. Mr. Breen was about 40 years old and a Virginian by birth. He entered the street-railway service in Philadelphia and went from there to Chicago. Several years ago he went to Dayton to take charge of the People's line as general manager.

Edward Backus.

Edward Backus, commissioner of electric lights and lines in Somerville, Mass., died at his home in that city on March 26th. He was born in Cambridgport, Mass., August 9, 1849. Mr. Backus began work as an electrician in 1874. He was employed by the Bell Telephone Company for 12 years. In 1889 he was appointed superintendent of the Somerville fire-alarm telegraphs, serving for three years, when he accepted a like position in Cambridge. He was appointed commissioner of the Somerville electric lights and lines in 1895. His wife, a son and a daughter survive him.

G. Martin Brill.

G. Martin Brill, president of the J. G. Brill Company of Philadelphia, builder of street-railway cars and trucks, died on March 31st at the age of 62 years. Mr. Brill was the son of J. G. Brill and was one of the founders of the company which bears his father's name. Mr. Brill was stricken suddenly with heart disease the day before his death and remained unconscious to the end. Surviving him are his wife, one son, Herman Brill, and three daughters.

J. V. Merrick.

J. Vaughn Merrick, who had charge of the designing of machinery and marine engines used in the government vessels during the Civil War, and was appointed in 1862 to the board of experts of the Navy Department to report on naval machinery, died in Philadelphia on March 28th. He was 78 years old and was a member of the Franklin Institute and the American Society of Mechanical Engineers, having been vice-president of the latter in 1883.

Reginald F. Yorke.

Reginald F. Yorke died recently in England. He was the son of Admiral Reginald Yorke and was born in 1862. He early became interested in telegraphic work and was at one time employed by the Eastern Telegraph Company at Porthcurnow, and subsequently in the "Mallard" [illegible] Company's telegraphic department. He devised [illegible] improvement in [illegible] and [illegible] in many [illegible].

Leon H. Cooper.

Leon H. Cooper, secretary of the Cooper [illegible] Company of Louisville, Ky., was found dead in his office on March 27th. Mr. Cooper [illegible] suffered from heart trouble and had [illegible] a severe attack which led him to end his life with poison. He was [illegible] years of age, a graduate of the University of Michigan and of the Massachusetts Institute of Technology, and was an expert electrician.

George L. Bradley.

George Lothrop Bradley, said to have been the organizer of the American Bell Telephone Company and to have one time owned a majority of the stock, died in Washington, D. C., on March 20th. He was 60 years of age and at the time of his death a director of the American Telephone and Telegraph Company.

Extensions of Allis-Chalmers Company's Works at West Allis, Wis.

New extensions to the West Allis, Milwaukee, Works of the Allis-Chalmers Company, which, when completed, will add 861,000 square feet to the plant's present floor area of 652,000 square feet and make the entire plant capable of affording employment to 11,000 persons, will place the West Allis Works among the large industrial plants of the country. The extensions built are as follows:

Fig. 1. View in Erecting Shop.

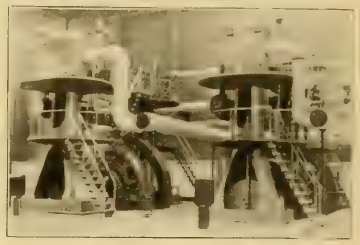


Fig. 2. Generating Units in Power Plant

NEW WEST ALLIS SHOPS OF ALLIS-CHALMERS COMPANY.

Three machine shops running east and west, parallel to the existing units Nos. 1, 2 and 3. Each of the new shops is 575 feet long, two of them 145 feet, and the third 168 feet wide; an erecting shop, 1,136 by 113 feet, running north and south as an extension of the existing erecting shop and adjoining the six machine-shop units opening out into it; the extension of the existing foundry, north and south, which has a total length of 994 feet over all and a width of 222 feet, and the extension of the pattern and pattern-storage building, which also has a length of 994 feet over all and a width of 119 feet.

The work of constructing these extensions involves an expenditure of over $3,000,000. Two buildings, the extensions to the erecting shop and the pattern shop, have been practically completed, while substantial progress has been made on the remaining buildings.

The West Allis site, situated in the town of West Allis, on the outskirts of Milwaukee, has a frontage of 1,575 feet and runs back 2,696 feet, or more than half a mile, giving nearly 4,250,000 square feet of ground space, or about 100 acres, adjoining the tracks of the Chicago, Milwaukee and St. Paul railway.

The general plan of the West Allis Works provides for two sets of building units, one composed of those in which the work is common to every class of product, like the pattern shops, erecting shops and foundry; the other group comprising the machine-shop units, where the work is specialized for various machine operations. The two groups of buildings lie at right angles to each other; those of general utility lengthwise of the plat, north and south. The machine shops, six units in all, run crosswise of the plat, adjoining the erecting shop at the east end. Facing the ends of the machine-shop units Nos. 1 to 6 stands the foundry with its extensions, extending north and south. The pattern storage and shops stand farthest westward in the group and parallel to the foundry, with a span of 98 feet between them. The extensions to the erecting shop, foundry and pattern shops are duplications of the existing units in practically every detail of construction.

The original erecting shop had 24 bays, each 23 feet wide, with a total length of 566 feet. The principal [illegible] 7[illegible] feet [illegible]

[illegible]

The new equipment for [illegible] power [illegible] works [illegible] 42-inch Reynolds vertical [illegible] direct connected to a 1,000-[illegible] direct-current generator and an Allis-Chalmers [illegible] compound air compressor.

In the boiler house five Edgemoor [illegible] tube boilers with a total aggregate horsepower of [illegible] and a heating surface of 6,586 square feet each, will replace five Reynolds [illegible]-inch vertical tubular boilers aggregating 876 horsepower, which will be installed at the Reliance works. The new boilers will be operated in connection with Jones under-feed stokers. A stack 175 feet high and eight feet inside drain furnishes natural draft.

The heavy machine tools of various kinds installed in units Nos. 1, 2 and 3 will be duplicated for units Nos. 4, 5 and 6 and supplemented by tools suitable for specific service, as, for example, the building of steam turbines and turbo-generators, gas engines, etc. One order recently placed covered 42 machine tools of extra heavy pattern, involving an expenditure of $550,000. These tools were all designed especially for use with high-speed steels and driven by Allis-Chalmers motors. The combined weight of these tools within the motors used for driving them aggregate 2,141 tons. Fourteen of the new machines are vertical boring and turning mills from eight to 16 feet and extra heavy in design. There are five standard shaft lathes and two crank-shaft lathes with a swing of from 60 to 125 inches and 30 feet between centers; eight planers of various sizes, all of which are the spiral-geared type; a 260-ton armature press, also several drilling and boring machines, slotters, etc. Over 1,200 horsepower in Allis-Chalmers motors will be required to drive the new equipment described. In addition to the machine tools, 34 electric traveling cranes have been ordered for sizes and capacities ranging from 2½-ton wall jib cranes to 60-ton 78-foot span cranes, with 10-foot auxiliary hoist for the foundry extension.

Direct current at 250 volts is distributed throughout the building for operation of motors used for machine-tool drive. These motors are largely operated on the Ward-Leonard multiple-voltage five-wire system (Allis-Chalmers system of control for variable-speed motors), making 27 different speeds possible for each machine.

The heating system utilizes exhaust steam passed through a closed heater, corresponding to the primary heater in a condensing system. An auxiliary live-steam heater is provided to operate in connection with the exhaust steam heater for cold weather. The hot water thus obtained is circulated through the works by means of two centrifugal pumps electrically driven. The total space to be heated is 26,000,000 cubic feet traversed by 500,000 feet of 1¼-inch hot-water pipes. Water for all purposes is obtained from four artesian wells located on the property, pumped automatically by

motor-driven deep-well pumps through eight-inch pipes to cisterns near the power house. These cisterns are of concrete construction, each of 100,000 gallons capacity, with steel-concrete roofs; a pressure of 100 pounds is kept on the mains at all times, which can be raised to 140 pounds.

Electrolysis.[1]

By E. E. Brownell.

The fundamental principle and primary source of electrolytic corrosion of metallic structures is, that when a current of electricity leaves the unprotected surface of any metallic subterranean construction to pass from it into the earth, the current will electrically disintegrate the metal of the structure. Electrolytic corrosion is an electrochemical effect, for if the electrolytes were not present in the soil adjacent to the pipes, the electric currents could not injure the mains in the least. It is the combination of the electric earth currents acting upon the electrolytes, that is wholly accountable for the ravages of electrolytic deterioration upon the various sub-surface metallic structures, by liberating upon their metallic surfaces the dissociated electrolytes comprising acid-forming radicals and nascent gases.

During the summer of 1904, in the city of Detroit, Mich., I conducted many experimental tests, in order to demonstrate how near the law [of electrochemical equivalents] was correct when applied to the electrodes and from a practical standpoint as well, receiving the following results: For 500 hours there was passed from the surface of bare wrought-iron structures buried in the natural earth a direct current flow of 5.9 amperes, and since there are 453.6 grams in one pound, the following equation was received: $1.04 \times 500 \times 5.9 \div 453.6 = 6.79$ pounds of iron lost. The loss of 6.79 pounds of iron is the calculated deterioration, according to the law of electrochemical equivalents, after being multiplied by the ampere-hours. But the actual loss in pounds of iron after weighing, was found to be 6.75 pounds of iron, so that the difference of 0.04 pound of iron proved conclusively and decisively that the practical test was correct within 0.016 per cent. of the law. Practical experiences, in thousands of cases, have proven to my entire satisfaction that a current flow of one ampere, passing from the unprotected surface of an iron structure will remove about 20 pounds of iron per year from it, or about 72 pounds if the structure be lead. Naked cast-iron obeys the same law within a few per cent. of wrought and steel structures, the retardation being due to the electronegative elements of carbon, silica, etc., so commonly found in cast-iron.

The chemical by-products of the electrochemical changes from electrolytic dissociation upon iron and lead sub-surface structures invariably increase the deteriorating effect, producing further and greater injury than the primary evil of electrolysis alone could accomplish.

Another peculiar chemical condition which possibly has never been brought to your attention, is that, when uncoated iron pipes are highly negative to earth, an alkaline substance forms upon their surfaces which, electrolytically, is uninjurious so long as the current remains of the same electrical polarity.

If two dissimilar metallic bodies were buried within a few feet of each other, and then only separated by the earth, they would tend to establish a galvanic battery within themselves, corroding the surface of either one or the other. But when the unlike metals form a part of any piping system, such as lead calking, lead service pipes, brass cocks and the like, in a cast-iron piping line, no ill results could possibly occur. The electrical condition caused by two unlike metals, which are separated by the earth, for example, or any other partial solution containing an electrolyte, is termed the counter-electromotive force of electrical polarization. But since the tracks, and practically all piping lines, as a whole, are iron in some composite state, the current flow from the rails to the pipes has no electrical impediment to overcome, so that the most minute current flow will produce an appreciable damage.

The statement has been repeatedly made that it requires a difference of electrical potential of 1.5 volts between pipe and earth to produce electrolytic corrosion upon the pipes. The writer has personally taken up at least 60 miles of cast-iron mains and tens of thousands of wrought-iron service pipes, which were completely destroyed by electrolysis when the iron pipes were less than 0.2 of a volt electrically positive to the surrounding earth.

It might be well to herein note, that the practice of electric street-railway companies during the winter months, of using large quantities of salt upon their tracks to prevent the accumulation of ice, also increases electrolytic action upon the divers sub-surface metallic structures.

Electrolytic deterioration upon bare sub-surface metallic structures is generally more uniformly distributed than upon those having painted or coated surfaces. The pitting effect so universally found upon the exterior surface of all classes of deteriorated lead and iron piping lines, is the contributory damage resulting directly from a greater current density or flow of electricity from the pipes at these specific places or spots. The pits occur by reason of the surface of the metallic body having an ununiform electrical contact with the immediate and surrounding soil, thus establishing many paths of egress for the current. By the excess of current leaving at these exits it electrolytically takes the metal from the pipes and leaves a pit in its wake.

It has been thoroughly known for many years that certain surface waters, especially the surface waters which flow from wooded districts, have a slight chemical acid reaction, and if wrought-iron, steel and many times cast-iron, are not protected by some indissociable paint or covering, tuberculization of the metal will take place.

Cast-iron, when corroded by electrolysis, leaves a light concrete formation as a residual, that has no tensile strength, and which often deceives the observer, since the pits and holes are left well filled with a soft carboniferous matter. All other things remaining equal, cast-iron will withstand a less amount of electrolytic deterioration per given area and cross-section than steel or wrought iron.

Shunting of the current over the calked pipe joints, as it flows along the line of main, is many times a serious electrical condition, but the extent of the injury is local and distinct, and exceptionally so where the current volume is normal and not augmented by connecting to it negative return-pipe feeders. When the current flow is abruptly broken, or the electrical continuity of the mains seriously intercepted by the occasional or random installation of insulated pipe joints, cement joints or defective electrical calking, then the damage can be and has been acute, by shunting the accumulated current from the mains to the earth.

Having seen possibly several hundred cases of this character, which is comparatively a small per cent. of the great deterioration from electrolytic corrosion, I recall vividly many serious instances. Three insulated pipe joints of the Dresser pattern, were inserted in electrical series upon a 10-inch wrought-iron high-pressure gas main, with the respective electrical drops over each insulated joint of 0.8, 1.0 and 1.2 volts. It required between three and four years to completely destroy the mains on the electrically positive side of each pipe joint. Notably in all cases of electrolytic corrosion at the joints of lead-calked pipe lines, the mains were invariably exposed to great temperature ranges, and the coefficient of expansion and contraction very high, thus loosening the lead in the joint and making a poor electrical union or contact between the bell and spigot ends. When large negative copper feeders are metallicly connected to the lead-calked cast-iron mains, which necessarily tremendously increases the current flowing over them, the damage to the pipes at the calked joints is then very liable to become menacing.

The gas companies of Greater New York and Chicago, with others in most of the large American cities, use lead for calking purposes, while others use insulated joints, which may give excellent satisfaction from a mechanical standpoint, but electrolytically they are all a complete failure.

The following illustration will possibly explain one of the principal causes which produce electrolysis upon sub-surface metallic structures. Around any power house using the single-trolley system of traction, with the positive terminal of the dynamos connected to the trolley, and where the station is located in a city with piping lines, circumscribe around the power house an electrical contour line at any given distance. It is preferable, though not absolutely necessary, however, that the contour line be along the region where the pipes and rails tend to be nearly electrically neutral, or where the minimum difference of electrical pressure exists, since the current flow over the pipes in this district is generally greater than elsewhere, thus giving higher and better results. By making suitable excavations over all the pipe lines which cross at right angles with the given contour line, the current flow can be ascertained reasonably correct by noting the electrical drop with a millivoltmeter over the pipe for a stated number of lineal feet through the calculated known resistance of that particular main. If the test is to be made strictly accurate, the use of a microohmeter should be employed, which will readily establish the proper contacts upon the mains, so that the electrical drops will be read directly in amperes, and the lead brought to a convenient place at the surface of the street. The total current found to be passing over the pipes where intersected by the electrical contour line will give a certain amount.

Now observe the difference in electrical pressure between the pipes and rails and the electrical resistance of the intervening earth, which, according to Ohm's law, gives a certain current flow passing from the pipes to the rails. Therefore, the difference between the amount of current crossing the electrical contour line by way of the pipes and the amount leaving the pipes, according to Ohm's law, is the volume of earth current proper which is passing to, over and from the piping system, irrespective of its relative conductivity. It is generally found that these earth currents proper are the source of certain electrical conditions which make them the prime destroyer and the principal base of electrolytic corrosion of sub-surface structures. The chief object of this illustration is to prove conclusively that the conductivity of the piping lines, or the amount or percentage of return current which they shunt in practice, especially lead-calked cast-iron pipe lines, do not necessarily govern the damage.

There are, to my knowledge, 30 small cities throughout the country where the circumscribed positive area or zone of the earth around the power house of the electric street railway envelopes the earth of the entire city or cities. This is a characteristic electrical condition where long lines of interurban electric street railways are supplied with direct current from a power house located in the small city. The mains and services in these small cities suffer very seriously from electrolysis, with great injury to them, yet they convey no return current from the rails directly, with little or no current passing along them from one consecutive pipe length to the other.

The rate of depreciation upon sub-surface metallic structures is generally somewhat greater during the wet seasons, due to the decreased electrical resistance between the rails and the contiguous earth. The damage from electrolysis is not always the greatest nearest the power house. Topographical conditions and the location of the tracks are responsible for the exceptions in most of the cases. The currents of electricity that are traversing through the earth and also along the various piping systems from a given source, many times encounter other earth currents from different power houses. When both of the currents are flowing in the same direction, along the same electrical conductor, they are in electrical series, and the volumes of each are added, but when currents of electricity are found to be flowing in opposite directions, or crossing the paths in common, then one source of earth currents tends to neutralize the effect of the other. This reduces at times what would be serious electrical conditions of the pipes were it not for the counteracting result thus produced. Earth currents of electricity being a certain stressed condition of the ether, and not a constituted molecular substance of matter, the direct currents intermingle, and the identity of each is forever lost. But every ampere of current put in circulation by a dynamo must return to it to be reimbued with the necessary electrical pressure, called volts. The identity may be lost, but the exact equivalent amount of current, in amperes, returns unquestionably to each power house that is sending it out.

Incidentally, in making "electrolytic surveys," and correcting serious electrolytic conditions, the care and preservation of sub-structures constructed of steel have been repeatedly called to my attention, for in these days of progression, where steel is used in enormous amounts underground, we have little knowledge whether electrolysis is seriously at work, or not, but arrangements have been made in the city of Chicago for a thorough investigation upon the opening of the coming season. The damage to underground steel structures of buildings is very difficult to discover, on account of the inaccessibility of the sub-structure. It would seem that there is certainly a great possibility of electrolysis, with results too awful to foretell. The writer knows of one building where electrolysis has attacked the sub-steel work. The building in question is in the city of Chicago, and should the tenants ever suspect such a condition, which is, to a more or less degree, serious, there would be plenty of office space rentable within 24 hours, and which at the present time contains enough people to populate a small city, being filled from cellar to roof, with the best class of occupants. It may be, after a great calamity, or the rebuilding of some of the earlier unprotected steel sub-structures, that some very valuable data will be obtained therefrom.

It might be well to note that the gas leakage, especially natural gas, from a piping system into the surrounding earth, has a wonderful influence in decreasing the electrical resistance of the soil, consequently propagating more serious chemical and electrochemical dissociation of the different pipes.

It has been stated and commented upon that, if alternating currents of electricity could be satisfactorily used in electric street-railway traction, the dangers from electrolysis would be a thing of the past. But iron-piping lines, buried experimentally in the ground and subjected to the passage of alternating currents from them, prove this statement to be incorrect, as they suffer from electrolysis, though to what extent or given rate I am now unable to report, since tests are now under way for demonstrating the rate of electrolytic depreciation under all conditions. Iron sheets buried in the ground for about 1,000 hours, between which was passed an alternating current of about 10 amperes at a pressure of five volts, showed the deterioration to be very apparent under 25 cycles, while a similar iron sheet, buried in the same class of soil several hundred feet distant, showed no appreciable disintegration whatsoever.

In this crude, but practical, test I was thoroughly convinced of certain results in three different respects. First, that an alternating current

1. Abstract of a paper read before the Pittsburg branch of the American Institute of Electrical Engineers on December 12, 1905.

of 25 cycles will produce more or less corrosion upon iron electrodes; second, that the rate of depreciation is about equal upon both iron electrodes, though the rate is unquestionably far below one-half that of direct current, when calculated for the time that the current was found to be flowing from the electrodes; third, that the dissociation of the electrolytes produces certain chemical substances of mixed acid and alkaline reactions, which were possibly more injurious to the iron electrodes than the electrolytic action or the electrochemical effect alone could have produced, since one iron electrode which was left in the ground by mistake for 30 days longer than the first showed greater deterioration, naturally the result of purely chemical action.

REMEDY AND MITIGATION.

An absolutely infallible remedy for preventing the evils of electrolytic corrosion upon all subsurface metallic structures is an electric street-railway system of ungrounded circuits. The Cincinnati Traction Company of the city of Cincinnati, Ohio, the Metropolitan railway of Manhattan Island, New York, and part of the electric street railway of Washington, D. C., have insulated circuits, which perfectly prevent electrolytic corrosion. The Metropolitan Railway Company of Manhattan Island, New York, has possibly the most complete system of electric surface traction in the world. In the city of Havana, Cuba, the double trolley is now being installed, the street-railway owners having been forced to do so by the United States military engineers, to prevent electrolysis.

The writer has been, and always will be, in favor of the electrical principle of the double-trolley system, but only so far as it affects the forestalling of electrolytic deterioration. It would not cost less than the sum of $200,000,000 to reconstruct every single-trolley electric street railway throughout the United States into the double-trolley system of equal electrical efficiency upon the negative side of the circuit. (Double trolley in principle, not necessarily in construction.)

The vital question would then arise, in view of the enormous cost and difficulty of operation, Will the protection against electrolysis warrant such an expenditure when applied to all electric street railways in general? In cities of the first class, with heavy populative densities, all other things being equal, the advantage gained would possibly be worth the amount invested in the insulated conduit system of electric street-railway traction. But in some cities of the second class and under it would be very impractical and unwarranted, when viewed from a non-partisan engineer's standpoint, when taking everything in proper consideration. Now to admit that there can be no reasonable and effective plan of mitigation would be equivalent to acknowledging the limited resourcefulness of our engineering capacity. It is the chief duty of any engineer to obtain the best practical results, with the least possible expenditure, all other things of a contributory nature remaining equal.

The following is the list of the plans of mitigation in the inverse order of their efficiency:

1. Insulated pipe joints, installed upon a piping line, are practically worthless and have been known to be the means of greater damage than the normal electrolytic condition could have produced.

2. To coat all of the piping lines which are now laid in the ground with a non-ionizable material would be inconsistent and of an enormous cost.

3. Negative boosters, which are used for the sole purpose of sending counter earth currents against the natural shunted flow of earth currents to neutralize them and destroy their effect, are expensive to operate and the adjustment very difficult to properly and effectually maintain.

The cost of equipment and operation of the negative-booster plan is a dead loss to the electric street railways, merely tending to cover up certain serious defined electrical conditions in the earth and upon the piping systems, while local critical electrolytic conditions are left unmitigated by this plan.

4. Reversing the electrical polarity at regular or irregular intervals is only a mere makeshift, and is a very impractical scheme, for it scatters the destruction everywhere over the piping lines, instead of allowing the damage to develop locally in well-defined districts, where it can be taken care of.

5. To force the electric street-railway companies to decrease the electrical drop to seven volts between any two given points along the track construction would be exceedingly expensive, yet at the same time it would vastly increase the electrical efficiency of their return circuit and consequently decrease correspondingly the current leakage from the rails to the earth.

This plan is known as the "seven-volt British Board of Trade rule." Not a single trolley electric street railway in the United States is so operating in my opinion to comply with such a high rate of electrical efficiency. Even with the application of the "seven-volt rule" the earth would shunt a sufficient amount of return current to cause serious electrolytic corrosion. If the "seven-volt rule" was enforced, say in the city of Pittsburg, it would require not less than $2,000,000 for copper, labor and material. The application of this rule does not strike directly at the seat of the evil, being analogous in form to the action of a gas or water company which decreases the gas or water pressure in order to diminish the [illegible] leakage, instead of repairing or removing the primary source of the evil in the leaky pipe.

6. Make all subsurface metallic structures negative to earth, which will require the [illegible] of the following rule:

The rail bonding should be standard, uniform throughout, and maintained so that the electrical drop over the track construction is reduced to a practical operative limit. The drop over the rail joint should invariably be equal to the drop over any given number of lineal feet of the rail, not including the rail joint. There should be well known the districts and sections fed by each respective power house, the load at the station, the drop over the rail, the drop over the pipes, the drop over the earth and the electrical resistance of the earth between pipes and rails, the resistance of the tracks from the affected area to the power house, and numerous other electrical and practical features, which all go to vitally govern the success of the proposed plan of mitigation.

I have been able to reduce the serious electrical condition of 53 miles of piping lines in one of the most stubborn cases of electrolytic deterioration, so that no pipe was electrically positive to earth or the drop over any calked joint in excess of 10 millivolts. I do not believe better results should be asked of the "double-trolley" installation, when considering that the piping system comprised 280 miles of mains and 60,000 service pipes. The calking in the entire piping system should be thoroughly tested and in the affected districts bonded over with a suitable screw plug bond, which is absolutely necessary to prevent electrolysis at the calked pipe joints. From the negative bus-bar in the power house there should be extended a large copper return-feeder system, connected to the bonded mains at numerous places, so as to reduce the current flow over the mains to a minimum at any given point. Unless great care is taken as to the number and the places of making the pipe connections, and the size of the return feeders, danger districts are sure to develop elsewhere upon the pipes, with damaging results to them. Unless this work is done properly it should never be attempted, for great care should also be used not to have the negative copper wires too large or connected to the bonded mains at too limited a number of places. If this is done, the bonded mains will unnecessarily shunt an enormous amount of return current from the track construction, thus creating danger districts elsewhere, with critical results.

The two most perplexing electrical problems of this entire plan of mitigation are: First, to prevent positive or danger areas from shifting elsewhere upon the pipes, which previously were electrolytically unaffected; second, to prevnt the back shunt of earth currents from a foreign source. The back shunt of current is due to the passage of currents in the opposite direction and foreign to the origin of current returning over the proposed return-pipe-feeder system into the power house. The back shunt of current enters the pipes by way of the return copper wire pipe feeders and propagates serious positive or danger areas upon the pipes after the two currents separate or emerge from the common electrical zone. There are times when no successful plan of mitigation can be applied, when two or more electric street-railway companies using grounded currents jointly maintain the same return circuit (rails), with their power houses remote from each other in the same city, due to this ever-present back shunt, for then when you decrease the current leakage from the mains into the earth it equally increases the current leakage from them into the earth elsewhere, and the plan is then a complete failure. Again, unless the negative return-pipe-feeder system is properly laid out, the current will shunt over the copper wires from one locality of higher electrical pressure into the earth, and upon pipes of lower electrical pressure, making the pipes electrically positive to earth in the locality of lowest electrical potential, with serious results.

The return current will shunt crosslots many times, with serious results. This can only be avoided by properly locating the places of connections, so that the current will not leave dead pipe ends or the pipes at right angles through the earth to reach by the shortest route any pipe station. If an arterial piping system is protected by this plan of mitigation, serious local electrolytic corrosion will occur throughout upon other piping lines not electrically connected in common. For this reason all parties directly or indirectly interested in any city should work in perfect harmony, if the best results are to be accomplished with the least possible cost. I have applied this plan of mitigation of electrolysis during the last 10 years in many of the large cities of the country, with uniformly successful results.

The use of the streets for pipes is lawful and is authorized by statute. Such a use is not an additional burden, and must be held as one of the uses contemplated when the streets were dedicated. The streets are the only available places in which to lay the pipes, and the sub-surface of the streets is by law and necessity set aside for public-service pipes and the like. The extent of the easement in the streets is to be measured by the wants and necessities of the public. Nevertheless, the primary use of the streets is for foot and other passengers, [illegible]

How the Idea of the Horizontal-vertical Steam Engine was Evolved.

[illegible] Patent Office January [illegible] Reynolds [illegible] Chalmers Company [illegible] of the combined vertical and horizontal engine in the [illegible] power house, New York [illegible] an incident characteristic of Mr. Reynolds related by those who were [illegible] time when this type of engine was first [illegible] nearly seven years ago, when the [illegible] filed for the patent only recently granted.

The incident referred to occurred [illegible] when the Allis-Chalmers Company was asked [illegible] for advice as to the type of engines to be used in the new power house then being planned by the Manhattan Railway Company, New York city. It was the intention of the railway company's engineers to install units of 5000 kilowatts capacity. The first type of engine considered was the cross-compound, vertical machine similar to those furnished for the Metropolitan street railway. [illegible] some correspondence passed between Mr. Reynolds and the engineers of the Manhattan Railway Company on the subject, so that finally Mr. Reynolds was invited to come to New York and discuss the matter in detail. Mr. Reynolds left Milwaukee, with the question of the type of engine still unsettled, but with the understanding that the straight, cross-compound, vertical unit would be used if it were found practicable. On the train, en route for New York, however, Mr. Reynolds evolved in his mind the possibility of using a combined vertical and horizontal engine, allowing four cylinders to be connected to the one shaft, and before reaching New York he was prepared to offer to the engineers in charge a definite proposition, covering a combined vertical and horizontal four-cylinder engine, now generally known as the "Manhattan" type, and, furthermore, he submitted to them the size of cylinders which he would recommend, the size of crank pin and cross-head pin and the size of main journals, with rough sketches of the proposed unit as he had planned it in his mind's eye. As a result of that conversation the Allis-Chalmers Company received orders for eight pairs of such machines.

On Mr. Reynold's return to Milwaukee work was at once begun on the design of the new engines in accordance with the data used by him in his New York proposition. When the complete designs were ready it was found, by comparison, that in the rough notes made by Mr. Reynolds while on his way East, he had arrived at identically the same dimensions of various parts as those obtained from the carefully worked out designs.

It is said that this incident is only one of a great many which have occurred during Mr. Reynold's long service with the old E. P. Allis Company and later with the Allis-Chalmers Company, which display his wonderful engineering ability and his promptness in making decisions.

Prevention of Ice on Third Rail.

Accumulation of snow and ice on the third rail is the source of much annoyance and sometimes delay in traffic on electric railways employing this method of current collection. Of the various methods devised for the prevention of the trouble none has proved entirely satisfactory. Another contribution to the list of preventives is a system devised by Jeremiah D. Burns of Washington, D. C., and which was recently patented. The system embodies the use of a resistance wire insulated with a material which is a good conductor of heat, carried adjacent the web of the rail just under the flange. The insulator should consist of a pipe of iron containing the wire and an insulating filling such as clay, cement or any silica composition. The tube is held in place against the rail by hooks so constructed as to clamp it in place. Current, when passed through the wire, will warm the tube sufficiently to keep the rail at a temperature high enough to prevent the collection of ice. The device may also be used on the traffic rails at points where trains or cars are to be brought to a stop, and where ice on the rails is a severe menace to the safety of operation.

Ohio Independent Telephone Association.

The third annual convention and banquet of the Ohio Independent Telephone Association took place at the Hotel Hartman, Columbus, on March 29th and was interesting and successful. The meeting was opened at 10 o'clock with an address of welcome by Mayor D. C. Badger. The response was made by J. C. F. Hull of Bucyrus.

In his address President Frank L. Beam acknowledged in appreciative words the assistance which has been given the Independent movement by the executive committee of the state organization, the district vice-presidents, the manufacturers and supply houses, the electrical journals and the daily press. The annual conventions are the keystone to the success of the Independents, he said. Before this organization was established each local company had to shift for itself. Twelve years ago, Mr. Beam, said, the Bell company had less than 50,000 telephones in service in Ohio. Up to that time only a limited number of people had been educated to know the great value of telephone service either in business or social life. A great many important towns and villages were without telephone connection. Then the Independent companies were organized. Progress was slow at first because of obstructions from patent litigation and because of inducements offered small companies to keep out of the Independent organization. But the public, he said, encouraged competition, both in the way of subscribing for service and investing in securities of Independent companies.

Today, said Mr. Beam, the Independents have approximately 250,000 telephones in service in the state, a gain of about 60,000 in the last year. There are 367 incorporated companies doing business in the state with an investment of over $30,000,000. This, he said, proves that the association has joined the several companies in a union that is invincible; it has brought the local companies to see that the support of neighboring companies is necessary to their progress; it has eliminated any feeling of jealousy in regard to the division of territory; it has done a great deal in the way of establishing uniform rates, and it has brought together influential men and stockholders representing every line of industry.

The report of Secretary Ralph Reamer showed that the financial end of the work had been kept up fairly well, but that more money is needed to successfully carry on the work. For this reason he urged that all companies become members. Out of 325 companies in the state the association has a membership of 135. The expressions on the floor showed that a good increase in membership is likely to follow this meeting. The appointment of committees followed the report.

James B. Hoge, president of the National-Interstate Telephone Association, read a paper on "National Development and Progress of the National-Interstate Telephone Association." He used a number of maps to show the location of lines and the thoroughness with which some of the territory has been developed. Trunk lines, he said, now extend from Albany to Kansas City and along the Lakes to a point near Chicago. Work is being pushed west of the Rocky Mountains, and within a short time all the exchanges in that portion of the country will be connected. In all, about 3,200,000 Independent telephones are in operation now and $300,000,000 has been expended to make the service as nearly perfect as possible. New Hampshire, Vermont, Oregon, Arkansas, Oklahoma and the Indian Territory have been organized. Franchises have been secured in New York city, Detroit, Spokane and Portland, and applications are pending in Cincinnati, San Francisco, Evansville, Ind., Nashville, Tenn., and a number of other towns, including the New England states. In the large cities the companies are increasing their business at the rate of from 500 to 1,000 telephones a month. Development on the Pacific Coast, about Minneapolis and Duluth and in the New England states is going on at a rapid rate. Many places now desire exchanges and are only waiting for some one to build them, the money being ready for investment. Mr. Hoge then recounted the advantages that come from the development of country business. It enables the farmers to be in close and constant communication with the markets, brings the city and country people closer together and makes business better and easier to do. The address was full of interest all through.

The roll call of counties was not completed, but progress was reported by E. G. Miller of Warren, district No. 1; J. B. Rhodes of Zanesville, district No. 9, and G. P. Thorp of Hamilton, district No. 4.

A committee was appointed to visit the state Senate and work against the passage of the Howe tax bill. The committee, composed of G. P. Thorp, James S. Brailey, Jr., J. C. F. Hull, B. C. Hendrickson, C. D. Juvenal, W. H. Baum, W. F. Laubach, J. W. Devore and W. W. Fisher, went at once to the Senate chamber and the next morning the bill was defeated.

A resolution was adopted relative to Cincinnati especially, to the effect that where towns or cities are opposed to the Independent movement, and so manifest it by persistently refusing to grant franchises, they must be considered as enemies, and telephone men should act accordingly. A short address by Mr. Hurtford of the Charleston Home Telephone Company, Charleston, W. Va., completed the work of the forenoon.

In the afternoon W. B. Woodbury of Detroit told about the situation in that city and in Michigan. He said that everything looked encouraging there and that his company would have one of the best systems in the country when it is completed. Ed. L. Barber spoke of the work in the South. The first long-distance line through to the gulf will be completed in about four months. Another line is now completed to Birmingham and will be built to the coast. The Central Home Telephone Company is prepared to take care of smaller exchanges in Kentucky as a holding company. While opposition is being encountered on all sides the Independent system is being firmly planted.

The question box brought out some interesting discussions. The first question read was: "Are telephone securities a better investment today than they were two years ago? If so, why?" W. Gilbert Thompson of Hamilton opened the discussion and was followed by D. E. Sapp of Mt. Vernon, James S. Brailey, Jr., of Toledo, and Jay Secore of Toledo. The trend of the remarks were to the effect that confidence has been established in the securities and that the investing public looks at them as good and making a remunerative investment.

"What benefit, if any, has been derived by members of the association from the papers read a year ago on standardization of equipment, uniform accounting, toll signs, etc?" O. F. French opened the discussion on this question by saying that much good could have come from the study of these subjects, but they had not been taken up to as great an extent as might have been. However, much progress has been made in the way of standardizing equipment. All equipment should be made so that exchanges may operate together. Mr. Peters of Athens, A. C. Davis of the West Virginia Association and others also discussed the question.

At this point the matter of disputed territory came up and there was a disposition on the part of some to have legislation on the matter, owing to experiences that they had had. But it was finally left to the executive committee to devise plans for taking care of this trouble.

Other questions were as follows: "Is it advisable where more than one company is operating in a county to consolidate and have all companies under one management?" "What has the United States Long-distance Company done during the last year, and what are its plans for the coming year?" "Has the Ohio Independent Telephone Association benefited the companies throughout the state?"

Late in the afternoon the nominating committee reported the following-named as officers who were elected for the ensuing year:

President—Frank L. Beam.
Secretary—Otto C. Weisheimer of Columbus.
Treasurer—Ralph Reamer of Columbus.

Delegates to the National convention—E. L. Barber and James S. Brailey, Jr., Toledo; Judge Louis Brucker, Mansfield; I. H. Thiedieck, Sidney; J. C. F. Hull, Bucyrus; W. G. Thompson, Hamilton; G. H. Metheany, Lima; W. W. Morrison, J. B. Rhodes, Zanesville; G. F. Thorpe, Wilmington; J. B. Hoge, Cleveland; D. E. Sapp, Mt. Vernon; F. L. Beam, Cyrus Huling, C. F. French, G. R. Johnson, Columbus; C. Y. McVey, Cleveland; W. F. Laubach, Akron; E. C. Coen, Vermillion; Leo Fleisch, L. H. Beatty, Washington C. H.; Washington Hyde, H. F. Folsom, J. C. Reber and J. M. Saltzgaber.

The banquet in the large dining hall of the hotel of the hotel in the evening was a pretty affair, the greater number of the delegates and visitors having remained for it. Hon. Harry M. Daugherty presided as toastmaster and performed his duties well. He introduced Hon. Walter B. Ritchie of Lima, who predicted some great things for the state and for the Independent telephone movement.

Judge C. B. Matthews of Cincinnati spoke on "The Cincinnati Situation." By every method that can be employed, he said, the Cincinnati people have been educated to believe they do not want two telephone systems. They do not understand the good that is to come from the additional service. Cincinnati has lost because of the improved business policies of St. Louis, and she is losing because of the old idea regarding the two systems. Public sentiment must be created for the good of the people as well as the Independent interests. "Why We Should Maintain a State Association" was the subject taken by Frank A. Davis of Columbus. Colonel J. D. Powers of the Louisville Home Telephone Company closed the addresses with a most interesting talk on "The General Telephone Situation as Viewed from a Neighboring State."

Convention Notes.

The North Electric Company showed a line of 100 and 50-line magneto boards, hotel-type instruments and the new iron box and small branch exchange equipment. The full line of magneto work was shown and attracted much attention. George P. Pratt, Ohio representative, was in charge, but Engineer E. T. King and General Sales Agent J. F. Engle were on the ground to aid in meeting the delegates.

Red and black wire was shown by the Erner & Hopkins Company.

A. B. Crawford had a line of the Stromberg-Carlson Telephone Manufacturing Company's product.

The United States Coin Register Company had a sample of its pay-stations for the inspection of the delegates.

H. L. Grant, state representative of the Century Telephone Construction Company, was on hand with his line, as usual.

F. B. Miller represented the Miller Anchor Company with a line of anchors that have become well known to the trade.

The Leeds & Northrup Company showed a line of electric measuring instruments, testing sets and other things of the kind.

C. M. Hamilton, sales manager, and F. M. Knierim showed a line of security specialties for the F. Bissell Company of Toledo.

The W. G. Nagel Electric Company of Toledo had a line of pay stations, anchors, tools and specialties. Ernest J. Paradis was in charge.

Baird's lockout system for pay stations was shown by the Baird Manufacturing Company. J. W. Harris was in charge of the display.

The Mountain State Electric Company had a display of Hall specialties, party-line lockouts and material. John F. Frasher was in charge.

Double galvanized-iron telephone wire was shown and its qualities demonstrated by the Indiana Steel and Wire Company, which was represented by Robert Miller.

R. E. McDuff, Jr., representing Frank B. Cook, was unfortunate in not receiving his goods in time to show them, although they had been shipped 10 days previously.

The Select Telephone Manufacturing Company had its line of lockout telephones, central-energy and farmers' line instruments at the meeting, with representatives in charge.

V. A. Chapman had charge of the display of the Michigan Electric Specialty Company, which consisted of two-group party-line selectors and other apparatus for farmer lines.

Switchboards, protectors, telephones, pole houses and cable-protection supplies were shown by the Sterling Electric Company, represented by Evan Shelby, G. W. Metcalf and C. L. Carr.

The display of the American Electric Fuse Company was in charge of J. A. Kenny. Can-top terminals, wire-joint fuse protectors and all accessories relating to protection were shown.

J. V. Latham, representing the Cadiz Electric Company, manufacturer of Star telephones, switchboards, protectors and accessories, was among the delegates and gave a good idea of his goods.

Lamps, boxes and switchboards were shown by the Kellogg Switchboard and Supply Company. R. S. Mueller was in charge of the display and with him were Chief Engineer C. S. Winston, J. C. Kelsey, O. T. Kimmel and R. W. Pillars.

Discuss Dual Telephone System in Milwaukee.

The Merchants and Manufacturers' Association of Milwaukee, Wis., has been hearing arguments for and against the admission of the West Shore Telephone Company to Milwaukee, a matter that is now before the City Council. The association is now taking a postal-card vote to ascertain the views of the members on the question. There were present at a recent hearing to speak for the West Shore Company Don Farnsworth of New York; Richard Valentine, president of the Rock County Telephone Company, Janesville, and J. B. Doe of Milwaukee. L. A. Olwell also spoke in its behalf. Among those who opposed it were President Alonzo Burt of the Wisconsin Telephone Company, Vice-president J. D. McLeod and Captain I. M. Bean of the special committee appointed by the merchants.

President Burt argued that an additional system would mean but additional expense, as the user would have to have two telephones instead of one, and that as a matter of fact the Wisconsin Telephone Company's system covered the territory thoroughly. F. L. Bills, construction agent of the West Shore Company, in a letter said that 20,000 residents of Milwaukee were prevented by present rates from the use of the telephone; that his company would spend $5,000,000 for a local system and exchange, and thus aid in making Milwaukee a greater jobbing center because of the added connections for country merchants.

On the whole, I think our telephone system is superior to that of any foreign cities. Our telephone girls have larger vocabularies, for one thing. In England the "hello" is never used. When an Englishman gathers up the ponderous contrivance and fits it against his head he asks, "Are you there?" If the other man answers, "No," that stops the whole conversation.—George Ade.

H. T. Scott, President of the Pacific States Telephone Company.

Henry T. Scott, who was elected a director and president of the Pacific States Telephone and Telegraph Company at the annual meeting this year, has long been identified with the heavy manufacturing and financial interests of California. He came from Philadelphia to San Francisco in the late '70's, taking a clerical position with the Donohue Iron Works, in which his brother, Irving M. Scott, was employed as a draftsman and engineer. The enterprise and ability of the Scott brothers became an important factor in the subsequent growth of engineering works in the city. The firm of Prescott, Scott & Co. was organized with their assistance and succeeded to the business established by the Donohue interests. The new firm was very successful, and later the Union Iron Works was organized, with Henry T. Scott as president, which position he continued to hold until the recent sale of the company to eastern capitalists. This company soon acquired a reputation for marine work, secured government contracts, and became famous as the builder of the battleship Oregon, which was followed by a number of other warships, including the Ohio. A great deal of Henry T. Scott's time was spent in Washington, D. C., and the East in connection with the work on these contracts.

HENRY T. SCOTT.

After disposing of his shipbuilding interests profitably, Mr. Scott continued to reside at his country place at Burlingame and to be identified with the business interests of San Francisco. He was president of the Pacific Mutual Life Insurance Company during the period while the merger was being arranged with the Conservative Life, under the name of the Pacific-Conservative Life Insurance Company.

When the Home Telephone Company of San Francisco, which has just been granted a franchise, was organized, Mr. Scott became one of its directors. Last year, for some months, no apparent headway was made toward the consummation of its plans. In the meantime John I. Sabin, president of the Pacific States Telephone and Telegraph Company, died late last year, and shortly thereafter Mr. Scott was offered the presidency. He now devotes the greater portion of his time to his duties, with offices in the new building of the company on New Montgomery Street.

Mr. Scott entered the presidency at an auspicious time when the new plant in San Francisco was nearly completed and when the long-distance lines had reached a high degree of efficiency. He has already made an inspection of the lines along the coast, and his known executive ability is expected to make itself felt in various places shortly.

GENERAL TELEPHONE NEWS.

T. M. Kay will install a local telephone system in Irene, Tex., with connections to Emmet and Mertens.

The Whitesboro Telephone Company of Whitesboro, Texas, has sold out to the North Texas Telephone Company.

Secretary J. B. Earle of the Texas Independent Telephone Association has issued a call for the annual meeting to be held in Waco, Tex., April 25th to 27th.

The Central Union Telephone Company has made a report for the year 1905, showing 152,928 subscribers at the close of the year. The total number of sub-licensed subscribers was 50,900, making the total number of stations connected with the Bell system in the Central Union's territory 203,228. The net increase in the company's stations for the year was 23,233, in new sub-licensed stations 11,830, the total increase being 35,063. No report of earnings has been issued.

The Pennsylvania Telephone Company has opened the new operating room in the new building in York, Pa. It is one of the finest telephone office and exchange buildings in the state. The building is a two-story brick structure, and the telephone plant is of the central-energy system. The switchboard is in five sections, capable of accommodating 1,100 lines. The ultimate capacity of the board will be 10,000. The present equipment will accommodate 14 operators.

Indiana Telephone Items.

The Indianapolis Telephone Company [illegible] application before the Board of [illegible] permission to [illegible] Indianapolis. The company [illegible] gument that [illegible] tially increase the cost [illegible] phone service.

The Dubois County Telephone Company of Huntingburg and the Pike County Telephone Company of Petersburg have each increased the capital stock to make extensions and improvements.

A. P. Hanna, Charles Patton and others of Waveland have organized a new telephone company. They propose to establish a plant at Waveland and connect with the country line adjoining and to give free service in and out to any point reached by a free system. The stockholders are to furnish their own telephones and bear the cost of wiring and switchboard. They also guarantee service to those who do not wish to take stock at $12 a year.

The City Council of Richmond has ordered the city engineer to prepare plans for a conduit system for all low tension wires.

At a meeting of the board of directors of the United Telephone Company of Marion held in Indianapolis last week the taking over of the company by the Bell company was completed. All connections will be made from one station instead of from two as heretofore.

The Peaceable Telephone Company of Jackson Township, Hancock County, has been incorporated to build and operate a telephone system in that community. Fred E. Williams and associates of Greenfield are the incorporators.

The Farmers' Mutual Telephone Exchange Company of East Enterprise has been incorporated with a capital of $1,000. The company will operate in East Enterprise and in Switzerland and Ohio counties. Harvey Sedan is among the incorporators.

The Eleventh District of the Indiana Independent Telephone Association, in convention assembled, petitioned the City Council of Cincinnati, Ohio, to grant to an Independent telephone company a franchise to establish a telephone system in Cincinnati. The district represents 10 counties, 25 companies, 15,455 subscribers and 12,000 stockholders in all lines of business. It is said that the pressure now being brought from all directions is likely to influence the council to grant the Independents a foothold in Cincinnati.

The New Long-distance Telephone Company of Indianapolis has begun the installation of circuits from Indianapolis to Ft. Wayne, South Bend, Logansport, Muncie, Winchester, Anderson, Kokomo, Lebanon, Thorntown, Spencer, Bloomington, Bedford, Washington, Vincennes and other points.

The Town Council of Oakland City has granted a franchise to a telephone company represented by C. F. Stevens. The city is to receive one per cent. of the gross earnings of the local system after it has been in operation 10 years. The rates will be $1 for residences and $2 for business houses until 500 telephones are in use, and then an advance of 25 cents will be added. The new company will have long-distance connection with the New Long-distance company. S.

Michigan Telephone Matters.

The report of the Union Telephone Company, read at a stockholders' meeting at Alma, shows that the company operates 40 exchanges in Central Michigan, with 6,500 subscribers. It has also more than 800 miles of long-distance lines service. Officers elected included Tod Kincaid, Owosso, president, and W. A. Melchers of Alma, manager.

The Springport Mutual Telephone Company stockholders rejected a proposition from the Michigan State Telephone Company, to have the mutual lines centering there go into the Michigan State exchange. The local Independent exchange signed a contract with the Citizens' company of Grand Rapids, whereby the Citizens' company will build a line to give service between that place and Jackson. The farmers on the Cook lines recently sold to the Michigan State company have decided to build Independent lines of their own to connect with Springport, Eaton Rapids, Onondaga, Rives and Jackson.

The Cassopolis Telephone Company held its first annual meeting on March 21st. These officers were elected: President, Harsen D. Smith; vice-president, H. W. Crook; manager, W. W. Reynolds; secretary and treasurer, William Jones. A dividend of seven per cent. was declared.

Twenty miles of conduit will be built at once by the Michigan State Telephone Company in Detroit. Five contracts for conduits were awarded to the contracting firm of John A. Mercie & Co., and the aggregate cost of the work will be close to $100,000. B.

The Telephone on the Pacific Coast.

The Sunset Telephone Company is preparing to rebuild the Yreka telephone plant and will expend about $5,000. Another $5,000 will be spent in the building of a new line from Yreka, Cal., to Hamburg.

A telephone exchange will be installed at the [illegible]

[illegible] Oakland. S.

Telephone News from the Northwest.

Arrangements have been completed for the construction of a telephone line from [illegible] ton, S. D.

The Northwestern Telephone Exchange Company is about to erect a new exchange building at Crookston, Minn.

Hughes & Deter of [illegible], N. D., propose to build a telephone line to [illegible], Minn.

Business men of [illegible], Minn., are working to secure the establishment of a [illegible] exchange.

The new directory of the Northwestern Telephone Exchange Company in Minneapolis includes calls on a new exchange, that of [illegible] division of the downtown district.

The Mesaba Telephone Company has completed a new switchboard at Virginia, Minn., and has cut it over on a central-energy system.

The Minnesota Central Telephone Company has agreed to rebuild completely its local exchange at Lamberton, Minn., in consideration of the project of forming a new company and putting in a second exchange being abandoned.

The Great Western Telephone Company will build an extension from Fort Pierre, S. D., to Rapid City, following the extension of the Chicago and Northwestern Railway.

The Nimrod Rural Telephone Company has been formed to build a line from Nimrod, Minn., to Sebeka.

The telephone exchange at Ackley, Iowa, has been sold by Bruening & Symington to a stock company of which E. B. Smith of Waterloo is president, and F. J. Martin of Ackley, secretary.

The New State Telephone Company has secured a site at Cherokee, Iowa, on which it is proposed to erect an exchange and office building. R.

Ohio Telephone Notes.

General Manager Bayard Kilgour of the City and Suburban Bell Telephone Company of Cincinnati asserted before the Council committee on telephones a few days ago that he could present the protests of 10,000 business men and citizens against granting the Queen City Home Telephone Company or any other company a franchise, if given a week's time. The Queen City had received letters from many other cities in the state attesting to the advantages of having an Independent system in the city, but Mr. Kilgour said he could also prove that they are wrong.

Telephone men, as well as those interested in other semi-public corporations, are pleased because of the failure of the Howe bill to pass the Senate. The assertion has been made that the bill, if made a law, would have added a yearly expense of $1 per telephone in this state. A like expense would have been added to all other corporations that operate for the public convenience, such as street and electric railroads, light plants, waterworks and others of the kind.

The Townsend Telephone Company of East Townsend has been incorporated with a capital stock of $10,000 by C. B. Canfield and others.

Talk continues as to the purchase of the Federal properties by James S. Brailey, Jr., and his associates. It is probable that negotiations are being pushed forward as rapidly as possible, but it is not known when they will be closed or whether they will be closed at all. However, it is believed that some arrangement will be made whereby they may be operated either in a group to themselves or grouped with others. This is in line with the general plan of the National-Interstate Telephone Association.

A meeting of the First District of the Illinois Independent Telephone Association is called to be held in Joliet, Ill., on April 10th at the office of the secretary of the state association, suite 225 Barber Building. The meeting will be called to order at 11 a. m. The district consists of Henry, Lake, De Kalb, Kane, Dupage, Kendall, Cook, Will, Grundy and Kankakee counties. A. J. Vernier of Kankakee is vice-president of the district.

Lower Telephone Rates for Chicago Demanded by Illinois Manufacturers' Association.

An influential factor in the present telephone rate-reducing campaign in Chicago is the Illinois Manufacturers' Association. This association has for a number of years disputed the right of the Chicago Telephone Company to charge more than $125 for the most improved service, and it believes that the rates can be considerably reduced all along the line with profit to the telephone company. To prove its sincerity in the matter the Illinois Manufacturers' Association has offered to install a complete telephone system in Chicago. It asks only a return of six per cent. on its investment, the remaining profits to be set aside to form a sinking fund for repairs and extensions, and a fund for purchase of the system by the city at any time within the term of a definite franchise grant.

The details as to rates, etc., to be inaugurated by the company which the manufacturers would organize have not been fully worked out. The association, however, has had the advice of experts, and as proof of its intention, if given a franchise, to lower existing rates, the company's attorney appeared before the City Council committee which is considering the subject and offered a certified check for $100,000 to vouch for its sincerity.

John M. Glenn, secretary of the manufacturers' association, in an interview with a representative of the Western Electrician, said that the association was not at all anxious to go into the telephone business, but with information at its command it is satisfied the rates can be reduced from 10 to 30 per cent. from the latest offer of the existing company. Mr. Glenn said the association had plenty of money, and the raising of funds to install a telephone system would be an easy matter. However, if rates considered fair by the manufacturers' association are embodied in a franchise-extension ordinance for the Chicago Telephone Company, it is not likely that the Illinois Manufacturers' Association will make any further effort for a franchise.

At the last meeting of the Council committee on gas, oil and electric light the Chicago Telephone Company presented a schedule of proposed changes and reductions in addition to those previously made. As soon as it is physically possible the company will abolish the 10-party line residence service and substitute therefor the four-party-line service, charging for the four-party-line service the same rate which is now charged for the 10-party-line service.

It will reduce the cost of residence telephones, unlimited service, single-party line, from $100 a year to $75 a year; two-party lines from $75 a year to $60 a year, and change all four-party residence lines to two-party residence lines. This will involve a reduction in the company's revenue of $59,838.

A reduction is to be made in the rate of desk telephones to $1 a month. The present rate for business extensions is $30 a year; residence, $15 a year. It will make the charge uniform at $1 a month, making an annual reduction in revenue of $58,029.

These changes by the schedules as now proposed will change 24,440 residences from 10 to four-party lines, 9,138 10-party business telephones will be changed to two-party lines, 16,188 four-party telephones will be advanced to two-party service, and the rates for 6,675 extension telephones will be reduced to $12 per annum.

Mayor Dunne sent a letter to the mayors of Philadelphia, Denver, St. Paul, Omaha and Cincinnati, in which he asked for data on telephone rates.

The First Independent Telephone Exchange.

It may be of interest to note that Indiana was the birthplace of the Independent telephone system. Thirteen years ago the first Independent telephone plant was installed at Noblesville, Ind. Albert Church, a banker, and P. C. Burns, then a manufacturer, in a small way, of dry batteries, but now president of the American Electric Telephone Company of Chicago, organized the first Independent company. The new company started with 75 subscribers, and the first year cleared 30 per cent. on the capital of $10,000, notwithstanding the fact that it had cut the Bell rates in half. Thus the great Independent telephone movement of the country was started on its career in March, 1893.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having just closed a contract with the Kinloch Long-distance Telephone Company of St. Louis, Mo., for 10,000 central-energy telephones. This is the first order the Kinloch company placed for new telephones to be used in conjunction with the 17,000-line switchboard now being installed by the Stromberg-Carlson company.

CORRESPONDENCE.

Great Britain.

London, March 21.—It is now officially announced that the Hull Corporation has received offers, both from the postmaster-general and the National Telephone Company, for the purchase of its municipal telephone system. Apparently terms were not reached with the postmaster-general, but matters reached a much finer point with the company. The terms practically asked by the telephone committee of the corporation were that the corporation should be reimbursed every sovereign of its capital expenditure and that the existing low subscriptions should remain undisturbed for three years. The company agreed to these terms and also promised to take over the staff. The telephone committee reported to the corporation in favor of the acceptance of these terms, but at a special meeting, after discussion, the report of the telephone committee was rejected. Better terms can hardly be expected from the company, while, if the system is maintained by the corporation until the expiry of its license in 1911, the postmaster-general is not expected to renew the license and will not be bound to purchase any more of the system than he thinks will be necessary for his purpose.

While on the question of telephony, it may be interesting to point out that the National Telephone Company has been held to be a landowner in respect of any land upon which its poles are placed, so long as its structures remain. A decision was given the other day to this effect, enabling the company to oppose in Parliament a bill which sought to acquire compulsorily land holding telephone poles.

The government is being pressed as to its intentions regarding the report of the Royal Commission on London Traffic, and the recommendations contained in it. While acknowledging the advantage of certain of the recommendations, it is now pointed out that the government has not been in office long enough to thoroughly investigate them, and that it is hopeless to anticipate any legislation this year.

The London electric power bills still remain in a state of animated suspension; apparently there is being experienced in ministerial quarters some difficulty in arriving at a decision as to the best manner in which to deal with them.

A number of breakdowns have been occurring of late upon the District Railway, chiefly through the breaking of the axles on the American rolling stock. The matter has been the subject of considerable press comment, and some questions have been put to the parliamentary officials of the Board of Trade. Obviously it is without their province to interfere, and little satisfaction has been received from these quarters. It is a matter in which the ingenuity and tact of Sir George Gibb will no doubt be exercised.

The London County Council has three bills in Paliament this year, viz., its tramway bill, its general-powers bill (which includes powers to enter into the business of wiring and fitting premises for electric supply) and its electric power bill. There are a very large number of opponents, and every effort is made to eliminate as many as possible if there are any technical grounds for so doing. Some work of this character has been carried out this week, but the council got the worst of the fight. A combination of electric-light companies has been granted the right to oppose the wiring and fitting clauses, on the ground that a new competition is being set up; and the 'bus companies have been given a right to appear against the tramways bill on the same ground.

The Bristol Corporation was the first authority owning electricity works of any magnitude to be compulsorily included within the sphere of operations of an electric power company. Naturally, with a go-a-head engineer and committee, there has been considerable resentment since 1903, when the event took place. The power company in question has, however, not made any steps toward putting its act of Parliament into force, and Bristol is not being slow in taking advantage of the fact, for at a meeting of the corporation last week it was decided to petition the Board of Trade to exercise its powers and strike Bristol out of the company's area. Should the case come on for hearing at the Board of Trade it will be an interesting one, and the first of its kind.

The Lancashire and Yorkshire Railway Company is contemplating the conversion of others of its steam lines to electric traction.

The London County Council is equipping a very large number of its tram cars with electromagnetic brakes, at a cost of nearly $60,000.

The annual return concerning the telegraph system of Great Britain shows an adverse balance of nearly $5,000,000.

Rapid progress is now being made with another of the Yerkes group of tube railways in London, viz., the Great Northern, Piccadilly and Brompton Railway, which will connect up the Southwest of London with the North. A station shaft has just been sunk in the courtyard of the Charing Cross station, and for the privilege of doing this from the surface, instead of from below, it is stated no less than $400,000 has been paid to the company owning Charing Cross station. G.

New England.

Boston, Mass., March 31.—Next Monday night the Newton aldermen will hold a public hearing on the Boston and Worcester Street Railway Company's petition for authority to carry express matter over its road in that city. The Boston and Suburban Electric Companies also desire similar authority, but the corporation has not presented a petition. Newton is the only municipality that has not granted this permission to the Boston and Worcester company.

The Old Colony Street Railway Company will soon begin carrying express over a section of its electric railway, which connects with a line to Providence, R. I.

The Worcester Light and Equipment Company of Worcester, Mass., has been incorporated. It has a capital of $10,000, and was incorporated by Albert M. Thompson, William J. Hall and associates.

The Norwich and Westerly Street Railway Company's stockholders have authorized an issue of bonds amounting to $750,000, the proceeds to be used for the construction of the company's electric railway between Norwich, Conn., and the Rhode Island state line in Westerly. The company has completed six miles of track and expects to have its road in operation by July 1st.

The New York, New Haven and Hartford Railroad Company has sent representatives of its operating department to Pittsburg, Pa., to inspect the new electric locomotive built for the company by the Westinghouse company. The locomotive will be run on the newly electrified section of the company's road between Stamford, Conn., and New York. The company intimates that the division between New Haven, Conn., and New York will be electrically equipped during the next year.

The city of Boston is preparing to build a group of buildings for the Girls' Latin School and the Boston Normal School, in which it will install apparatus for the generation of direct current of low voltage, for the purpose of instruction in electrical work; also apparatus for controlling and measuring current, and a motor for operating machine tools in the handicraft department of the Normal School.

Owners of 500 of the 555 shares of the Brattleboro Street Railway Company's stock have assented to the acceptance of a New York syndicate's offer for the company's property in Brattleboro, Vt. The syndicate offered to pay the company's bonds in full and to pay 25 per cent. of its face value for the stock, the offer amounting to about $35,000. The plant cost $80,000.

The Shaw syndicate has formally transferred the control of the Hartford, Manchester and Rockville Tramway Company to the Consolidated Railway Company. J. L. Adams, who has been superintendent for the Hartford, Manchester and Rockville company for eight years, has resigned that position and accepted the general managership of a chain of Ohio electric railways, covering 145 miles of road.

A petition to the Connecticut Railway and Lighting and the Consolidated Railway Companies, asking them to construct an additional electric railway between New Britain and Hartford, Conn., has been signed by 400 persons, representing the larger business firms of New Britain.

The Massachusetts Senate has reconsidered its acceptance of the street-railway committee's adverse report on E. Moody Boynton's petition for a revival of the Quincy and Fall River Bicycle Railway Company's charter, and has substituted the bill for the report. B.

New York.

New York city, March 31.—The Assembly at Albany, on Wednesday, threw out a bill promoted by Assemblyman Shanahan, designed to prevent the formation of holding companies on the consolidation of public-service corporations. In the arguments against the bill a merger was foreshadowed between the Consolidated Gas and the Brooklyn Union Gas companies. On the same day the state Senate passed Senator Elsberg's rapid-transit bill, after striking out a clause which would have permitted separate contracts being made for the construction, equipment and operation of subways in New York city. The measure, if finally approved, will not interfere with pending subway plans in New York city.

Bids for some of these new lines will shortly be advertised and will be returnable on June 1st. The contemplated routes are along Third, Seventh, Eighth and Lexington avenues, and on Fourteenth and Thirty-fourth streets, with branch lines in Brooklyn and the Bronx.

The New York Central Railroad has informed the State Railroad Board that it will reduce suburban fares when the electric traction is introduced.

Governor Higgins has signed a bill calling for the removal of the New York Central tracks from the surface of Eleventh Avenue, and giving authority for the construction of a subway on that thoroughfare. Governor Higgins says the company may take its tracks entirely out of the avenue, if it elects to do so, in which case it will receive compensation for all lawfully existing privileges which are thereby taken from it.

Official discussion over the terms of the Connecting Railroad Company's franchise has been con-

tinued and an aldermanic committee has inspected the route. The Board of Aldermen has demanded that detailed plans of the road shall be included in the franchise contract when it is drawn up. This connecting railroad is designed to form a link by means of a bridge over the East River between the New Haven, Long Island and Pennsylvania Lines, and there are plans on paper, but not officially authenticated, for through traction by steam and electricity between Boston, New York and Chicago.

The wooden covering over the third rail at the Columbus Circle subway station caught fire at a late hour last Saturday night. The resulting smoke filled the station and the power had to be shut off for 15 minutes.

The Assembly at Albany has passed a bill to compel the New York City Railway to sell tickets at the rate of six for 25 cents. This company is the first to announce the arrival of spring by putting on open cars on the East Side routes.

The State Railroad Commission has received a deputation urging the installation of trolley traction in place of the existing horse cars on Canal, Madison, Spring, Delancy and other important East Side routes.

Bids will be advertised in a few days for the contracts for the construction of the Manhattan Bridge between New York city and Brooklyn, known to the bridge department as "Bridge No. 3."

Brooklyn residents are asking the fire department to replace the old-fashioned fire-alarm boxes with new boxes of the keyless kind. Under present conditions the box keys are in charge of an adjacent householder.

Edwin E. Ross and associates of Camden, N. J., have incorporated the Electric Service Supply Company with capital of $450,000.

The State Civil Service Commission advertises examinations for inspectors of gas and electricity with salaries ranging from $1,200 to $2,000. Applications must be made at Albany, N. Y., by April 9th. Candidates must possess ample technical qualifications as to lighting methods and photometrical tests.

The State Board of Railroad Commissioners has issued a compilation of statistics showing the transportation and operation of the surface, elevated and subway lines of New York city for the years 1904 and 1905. The total number of fares paid in all the boroughs in 1904 was 1,077,658,247, and in 1905 1,171,151,698, an increase of 93,493,451. The car mileage for all the boroughs in 1904 aggregated 201,584,912 and in 1905 230,249,455, an increase in the latter year of 28,664,543. The Metropolitan street railway, Manhattan system, received 379,721,637 cash fares in 1905, a decrease of 1,027,954 over the preceding year, and transferred 166,125,412, a decrease of 12,625,978. The elevated carried 249,955,166 passengers during 1905, a decrease of 42,691,508. The subway carried 116,209,313, compared with 16,241,369 in 1904. The net increase on all the lines of this company of passengers carried was 57,285,936. On the roads of the Brooklyn Rapid Transit system 337,678,930 cash fares were received in 1905, an increase of 33,762,390, and 78,923,328 transfers were made, an increase of 15,375,164.

Commissioner Ellison has announced that he had declined to grant the New York Central railroad a permit to place its 11,000-volt transmission line overhead in carrying out its plans to electrify the line from Grand Central Station to Peekskill. The road has ordered hundreds of heavy steel poles to be placed along its tracks and has caused hundreds of pits to be dug and concreted, so that they would be ready for the poles when they arrive. They will be useless under the present ruling for that part of the road between the Grand Central Station and the city line. Commissioner Ellison thinks the danger to life from the high-voltage wires in case of a break is too great to place the line overhead. D. W. W.

Ohio.

Cleveland, March 31.—Considerable speculation has been caused by the report that W. Kelsey Schoepf and his associates have purchased the Columbus and Lake Michigan steam road, operating a line 42 miles long between Lima and Defiance. A route is now being located from Lima to Bellefontaine, where the original Appleyard lines will be joined. It is said the syndicate is also planning to build a line directly from Bellefontaine to Columbus over the right-of-way of the Columbus and Lake Michigan. From Defiance north a road may be built to reach Bryan in Williams County. These roads will connect up the Schoepf interests in northern and southern Ohio and Indiana and make Lima the hub of the system in that part of the state.

In the House of Representatives a few days ago the Stockwell bill providing for the submission of franchises to the vote of the people, if five per cent. of the voters demanded it, has been killed. Mr. Stockwell said the bill is not what he wanted, but that it is an improvement over the present method of granting franchises.

The Appleyard securities given the German Bank of Buffalo, amounting to not less than $1,400,000, have been sold to Walter P. Cooke of Buffalo for $43,100.

It is said the confiscation of coal shipped to the Appleyards roads at Springfield by a steam road may [illegible] the traction [illegible] the present [illegible] It [illegible] traction road would [illegible] in the [illegible]

What is known as the [illegible] has been selected by the Northern Ohio Traction and Light Company for its new extension from [illegible] to Wadsworth. This route [illegible] fewer curves and grades than the northern route. Later on the company may build on to [illegible] and connect with the Cleveland and Southeastern.

A. E. Smith of Harland, Wis., has devised a plan for a through route from Green Bay, Wis., to Cleveland by way of Toledo, and to Louisville by way of Cincinnati and Indianapolis. Mr. Smith represents the Chicago, Kenosha and Milwaukee Electric Railway Company, and the plan embraces a freight as well as passenger service.

General Manager W. H. Wyke of the Lima and Eastern Interurban Railway Company has been quoted as saying that construction work on the road would be commenced next month.

The bonds of the Columbus, Delaware and Marion Electric Railroad Company, aggregating $1,000,000, have been approved in Maine, where the company is incorporated.

Health authorities at Akron have begun to make war upon the interurban roads, charging that some of them do not keep their cars in a sanitary condition.

At the annual meeting of the stockholders of the Columbus, Delaware and Marion Railway Company and its subsidiary corporations a few days ago, President J. G. Webb submitted a report showing that the gain in earnings for the year had been 30 per cent. The sum of $300,000 was authorized for betterments. These include the completion of the extension to Greencamp and Richwood, the purchase of seven new cars and 31 miles of new steel rails, another 2,000-kilowatt generator for the Stratford power house and the Bucyrus extension.

Nineteen bids have been received for preparing plans for the municipal light plant at Covington, Ky.

The Electric Construction Supply Company of Springfield has been incorporated with a capital stock of $10,000 by William W. Rodgers and others.

An increase of capital stock from $25,000 to $100,000 has been made by the Blakeslee Electric Auto Company of Cleveland. O. M. C.

Indiana.

Indianapolis, March 31.—The mayor and city attorney of Bluffton hold that the ordinance granting a franchise to the Marion, Bluffton and Eastern Traction Company to enter that city is invalid because the Board of Public Works failed to act in harmony with the council. The company has concluded to build into the city and permit the question to be raised by an injunction.

The Vincennes Traction and Light Company has filed articles of incorporation, capitalized at $200,000. The company proposes to build street railways in Vincennes, Bruceville, Bicknell, Oaktown, Decker, Monroe City, Princeton, Washington, Carlisle and Sullivan. It is proposed to connect the cities named with an interurban road and and to supply electricity and steam for light, heat and power. Benjamin G. Hudnot and C. A. Gordon of Terre Haute, William Folley of St. Louis and George E. Henry of Vincennes are the incorporators.

By ordering a reduction of 30 cents a ton in the coal rate between the Linton coal fields and Stinesville the Indiana Railroad Commission this week decided one of the most important cases that has come before it. The rate has been 80 cents for a haulage of 59 miles. It is said the commission will soon take up the question of exchange of freight between interurban and steam roads.

The city councils of Noblesville, Greenfield and other cities have granted franchises to the Capital City Circuit Traction Company. This company will build a line around Indianapolis at a radius of 25 miles.

A. E. Smith of Kenosha, Wis., representing a syndicate owning gas and electric plants and electric railways operating in Wisconsin, has, it is announced, purchased the Michigan City electric-railway lines. It is through that, perhaps, these interests are identical with those of the Chicago Air Line Company now building from South Bend to Chicago.

The Indiana Union Traction Company has stored 800 tons of coal for its central power station at Anderson, which operates the 300-mile system of electric lines. Other traction lines are storing coal, and the steam lines are confiscating coal in transit, all preparatory to the anticipated strike. The electric-light plants through the state will likely be closed down in case the suspension of mining continues long. As a rule they carry a small supply of coal.

A suit to determine the rightful owners of a site near Shoals on the White River for a water power has been decided in favor of the Peru company, headed by Jerome Serff of Peru. A large power plant to generate electricity will be built this summer. It is said 4,000 horsepower is available.

Interline tickets good over all connecting Indiana and Ohio electric lines have been issued and are [illegible]

[illegible] to improve the service by [illegible] additional lines, so as to compete [illegible] the municipal plant.

The Fairmount Light and Power Company of Fairmount proposes to install meters [illegible] consumers, and to give a continuous [illegible] an American Diesel engine. Paul Lak[illegible] general manager. S. S.

Michigan.

Grand Rapids, March 31.—The Pere Marquette Light and Power Company has offered to supply the village of Shelby with electricity for lighting and power purposes at the switchboard at the rate of three cents a kilowatt. The company is building a dam on the south branch of the Pere Marquette River which will give a 35-foot head and will develop about 1,200 horsepower.

A new alternating generator, a new switchboard and 150 new enclosed arc lamps have been put in operation by the Pontiac Standard Lighting Company at Pontiac. The control of the company has passed out of the hands of George E. Fisher of Detroit, who for the last 14 years has been actively identified with street-lighting contracts in Pontiac. Following the sale of Mr. Fisher's interest Charles A. Ward of Ann Arbor appeared as active head of the new company. Mr. Ward has now been succeeded by Glenn D. Smith of Jackson.

During the last five months a Detroit and Adrian syndicate has been working so quietly on a project to build an electric railway between the two cities that the purpose was not generally known before the filing of articles of the Detroit and Adrian Traction Company. Mason L. Brown of Detroit, who is one of the incorporators and in charge of the survey, said that the survey had been about completed and a private right-of-way to the River Rouge and franchises in Adrian and Tecumseh secured. The route is about 60 miles long.

The street-car system between South Bend and St. Joseph will be in operation by June 1st. Contractor George Townsend will turn the road over on May 1st. Fare for the round trip from Niles to St. Joseph will be 80 cents. The fare for the round trip from St. Joseph to South Bend will be $1.10. The roadbed between St. Joseph and South Bend covers a distance of 35 miles. Ten elegant new compartment cars will go on at the opening, while six freight and baggage cars will handle the fruit business. The traction company has arranged to handle fruit for the Graham & Morton steamers.

The Co-operative Construction Company, whose purpose it is to build an electric railroad from Grand Rapids to Ludington through Hesperia, Hart and Pentwater, has been incorporated with $10,000 capital, $6,000 of which is paid in. George E. Milton is president.

The changes incident to the acquisition of the Detroit, Monroe and Toledo Short Line by the Detroit United Railway will be one of the latest improved turbine engines and dynamos, which will have the capacity of the three electrical units now installed in the power house at Monroe. This improvement will necessitate the abandonment of the general offices of the company in the power house proper. General Manager Tarkington will be quartered in the building occupied by the despatcher. The proposed change will necessitate an expenditure of $100,000. Under the new regime the freight trains will start from Detroit and Toledo each morning instead of Monroe.

The Grand Rapids, Grand Haven and Muskegon Railway Company last Wednesday for the first time received power furnished by the Grand Rapids-Muskegon Waterpower Electric Company. It is said that the regular power house at Fruitport will be turned over to the new power company to be used as an emergency station. The interurban company is now commanding a motive power of 1,000 horsepower. The new power arrangements will allow the interurban railway company to reduce its working force considerably. L. W. B.

Central Illinois.

Peoria, March 31.—The Illinois Traction Company has decided that the route of the line between here and Bloomington shall follow the Big Four steam road. The company is also considering building a branch of the Springfield and Northwestern from Lincoln to Peoria, via Minier and Pekin.

The McKinley syndicate has surveyors in the field, running a line from Pekin to Jacksonville, to connect with the Peoria-Bloomington line at East Peoria.

Owing to the fact that the lowest bidders on the bridge to be built across the Illinois River in Peoria by the Illinois Traction Company, wanted more time than the company would allow, the contract has not as yet been let. The bids for the substructure are about to be opened.

The Illinois Independent Telephone Association has issued an open letter to the people of the state asking them to do what they can to induce the Chicago City Council to grant a franchise in that city to some Independent company.

A municipal-ownership league was formed at Bloomington. Rev. H. O. Hoffman was chosen president and Julius Freeman secretary.

The McKinley syndicate has purchased a tract of 27 acres on the east side of the river at Peoria, on which the new bridge approach will be built, and it is also reported that it intends to build extensive shops on this property soon. The Federal government has approved the plans of the bascule bridge to be erected by the McKinley syndicate.

The indications are that the Illinois Central electric-railway line from Lewiston to Canton will be built this year. The Cleveland syndicate will furnish $235,000, and the amount to be subscribed by Canton and Lewiston persons is nearly all subscribed.

The surveys for the Peoria, Streator and Ottawa railway are being pushed north from Streator and as soon as finished to Ottawa the surveyors will start this way. According to the terms of the ordinances granted this road may be operated by electricity or any other motive power except steam.

Grading on the Peoria-Bloomington line is progressing rapidly. Three miles has been finished east of East Peoria, which is ahead of contract time. The entire road is to be graded by June 1st.

A license to incorporate the Springfield and Southeastern Traction Company has been issued. The principal office will be in Springfield, Ill., and the capital stock will be $250,000. It is proposed to construct an electric railroad from Springfield in a southerly direction, taking in Pana, Vandalia and Decatur. The incorporators and first board of directors are L. A. Shadburne, P. Chase, T. J. Finn, James J. Finn and M. P. Vale, all of Chicago. V. N.

Northwestern States.

Minneapolis, March 31.—The Iowa Gas and Electric Company has been organized for the purpose of constructing an interurban line from Adair to Corning. J. H. Simmons of Corning is president and C. E. Barry of Casey, secretary.

There is considerable talk of building an electric railway from Corydon, Iowa, to Sewal, connecting the Chicago, Burlington and Quincy and the Chicago, Milwaukee and St. Paul railroads at those towns.

The Jamestown (N. D.) Traction Company has been incorporated by Morris Beck and others with a capitalization of $150,000, and it is proposed to build an electric railway from Jamestown to Courtenay and another to either Oakes or Edgeley.

A. T. LeVesconte has purchased the electric-light plant at Langdon, N. D. He has resigned as manager of the electric-light system at Glencoe, Minn., and Mr. Cummings of Webster City, Iowa, has been elected as his successor.

The Roberts & Abbott Company, consulting engineers of Cleveland, Ohio, is preparing specifications for a concrete dam and power house, to be constructed at Decorah, Iowa, by Burtis & Howard.

The LaCrosse (Wis.) City Railway Company and the LaCrosse Gas and Electric Company may both be sold to Chicago interests who have taken options on the properties which run to June 1st.

An electric-light system is a possibility at Tyler, Minn. R.

Pacific Slope.

San Francisco, March 30.—The Del Monte Hotel at Monterey, Cal., will have a complete electric power plant installed at once. The new equipment will include three 125-kilowatt two-phase belted-type generators, each driven by a Harrisburg four-valve engine. New boilers will be installed of sufficient capacity to supply the electric plant, which will drive a laundry and do pumping, in addition to supplying lights for the large hotel buildings. Oil fuel can be obtained very cheaply from a pipe line at Monterey.

The directors of the Citizens' Light and Traction Company of Salem, Ore., held a meeting last week, and reorganization was effected. H. W. Goode of Portland was elected president, F. G. Sykes of Portland vice-president, Sam Reed of Portland secretary and treasurer, and Rollin K. Page of Portland manager. Mr. Page has moved to Salem and will take charge of the railway, light, power and gas systems of that city and the electric plants at Woodburn, Mount Angel and Silverton.

Articles of incorporation of the Ygnacio Valley Railway have been filed in Alameda County, and a series of condemnation suits have been brought against a number of defendants in Oakland and Fruitvale, Cal. The company has a capital stock of $2,000,000, and it is its intention to build a railway from Oakland to Antioch, with two branch lines, having a total mileage of 55. A. Bishop, L. F. Winchell and W. Murphy are the incorporators.

The Fairmont Hotel management has closed contracts for a complete three-wire 110 and 220-volt electric-light and power plant in the new building, which is the largest and finest of its kind in San Francisco. Three 150-kilowatt Westinghouse generators will be direct connected to three Harrisburg four-valve engines, and one 75-kilowatt generator will be direct connected to an Ideal engine. Three double-throw panel switchboards will be installed and the entire plant will be fitted up in handsome style. At least 1,200 rooms are to be lighted, and laundry, etc., operated.

The Western Power Company, which has been doing preliminary work for several years on a very large electric power project, which contemplates the development of power at the Big Bend of the Feather River in Plumas County, California, has its engineers completing the revised plans in New York. They will probably resume operations at the power site during April, and will lose no time in constructing the transmission system that is to be eventually extended to San Francisco, a distance of about 150 miles.

The San Francisco, Vallejo and Vaca Valley Railway and Steamship Company will soon begin work on its electric road from Vallejo to Benicia.

Articles of incorporation have been filed for the Oroville Townsite Company with a capital stock of $400,000. The incorporators of the company are M. J. Gordan, Fred B. Grinnell and Charles A. Dibble of St. Paul, Minn., and Frank C. Paine of Whitefish, Mont. The company proposes to install an electric-light plant and a system of street and suburban railways in Oroville or the City of Oro.

A six-stamp mill is to be erected at Blewett, Wash., and operated by electricity. A six-stamp battery is on the ground now. Power will be taken from the Peshastin Creek, and operations will commence about April.

The Valley Electric Company of Santa Maria, Cal., is contemplating extensive improvements to enlarge its plant and lighting capacity. A new building, boilers and machinery will be added.

The Pacific Wireless Telegraph Company has leased 12 acres of land on the summit of Mt. Tamalpais, California, where the company has established a station and erected a tower 300 feet high.

The Napa and Lakeport Railroad Company has been granted a franchise to operate an electric railway on the streets of Napa, Cal. The new company is to operate a ferry system from San Francisco to the Marin County shore.

It is reported that M. R. Jones and his associates in the newly incorporated Martinez and Contra Costa Railroad Company intend to build an electric road from Martinez to Antioch, Byron Springs, and through the San Ramon Valley, to a connection with the Key Route line at Berkeley.

F. M. Greenwood and his associates of San Francisco have been granted a 50-year franchise by the city trustees of Alameda, Cal., for a competing electric-railway and ferry system.

One million dollars of the Los Angeles Pacific Company's bonds, at 100¼ and accrued interest, recently placed on the market, were oversubscribed $90,000. They were placed by Sutro & Co. of San Francisco, who are understood to have bought the entire issue at something less than par. The eagerness with which the bonds were taken may be accounted for by the published statement that Mr Harriman has acquired control of the property.

Jay P. Graves has bought the franchise held by the Spokane Light and Power Company, at Spokane, Wash., carrying the right and privilege to build and operate a light and power plant in Spokane. Mr. Graves has also secured waterpower and privileges at falls in the Spokane River, and it is understood that it is his intention to bring the power to Spokane, where a commercial lighting plant will be installed.

The Starr-King Building on Geary Street, San Francisco, is to be equipped with an isolated electric-lighting plant, which will furnish lights also for several adjoining buildings.

The new Fairmont Hotel, in San Francisco, which was about completed, but is to be considerably enlarged by its new owners, Hartland Law and H. E. Law, will be equipped with an isolated electric-light and power plant, steam-driven.

W. D. Crawford and A. D. Ridson, representing the Pacific Wireless Telegraph Company of Los Angeles, are in Bellingham, Wash., and will install a space-telegraph station there this summer. The system owned by this company is used by the United States government in the northwestern part of Washington. A.

PERSONAL.

F. R. Glover, manager of the British Columbia Electric Railway at Vancouver, B. C., will leave soon for the Okanagan country, where he intends residing in future.

J. G. Forsthove, superintendent of the McKinley syndicate interests at Galesburg, Ill., has resigned his position. About May 1st he will engage in business in St. Louis.

John T. Huntington, for the last three years general manager of the Elgin, Aurora and Southern Traction Company, resigned his position in Aurora, Ill., and has gone to Topeka, Kan.

Alex Dow, vice-president and general manager of the Edison Illuminating Company of Detroit, has gone abroad for a vacation. He will spend the time principally in England and expects to return next month.

Samuel L. Black, manager of the New England Telephone and Telegraph Company's office at Calais, Maine, died on March 23d. He was 73 years old. Mr. Black was a telegraph operator for 51 years, having been employed by the Western Union Telegraph Company for 48 years.

George R. Metcalfe, editor of the Technical World Magazine and also of the text-book department of the American School of Correspondence, Chicago, has resigned to accept the position of editor of the publication department of the Westinghouse Electric and Manufacturing Company at East Pittsburg. Mr. Metcalfe is an experienced and capable technical writer, and he will make a valuable addition to the Westinghouse forces.

H. N. Morris, president of the Shreveport (La.) Gas, Electric Light and Power Company and of the Texarkana Lighting Company, will leave in a short time for North Carolina, where he will spend several months. Mr. Morris will give up the active management of the local lighting company, and will turn its affairs over to A. G. Curtis, formerly of Chicago. He will retain the presidency of the two concerns. This action is taken by Mr. Morris on account of ill health.

David H. Wilson has been appointed to the position of electrical engineer of the Erie Railroad. The new office has just been created by the Erie in recognition of the increasing importance of the electrification work which is being furthered on sections of the system in New York state. Mr. Wilson, who is a graduate of Purdue, comes to the road from the American Locomotive Company. He will devote himself at first to the work of equipping the Erie's big power house at Hornellsville.

William S. Hine has many friends who will be pleased to know that he has again entered the electrical business and has this time joined the forces of the Fort Wayne Electric Works. Mr. Hine was for years connected with the Stanley interests, and his excellent work in marketing alternating-current apparatus while he was with the Western Electric Company is well known. Of late Mr. Hine has been identified with the life-insurance business. He will operate from the Chicago office and be, so to speak, the "right bower" to Manager Goll in charge of this branch of the Fort Wayne business. Mr. Hine is a brother of Henry Hine, also well known among electrical men. His pleasant personality no less than his business ability has made him a favorite among electrical men in Chicago and the West.

WILLIAM S. HINE.

ELECTRIC LIGHTING.

The council of Hanover, Mich., will install a $20,000 light and water plant at Hanover.

The Minden (Neb.) Edison Light and Power Company has been incorporated with a capital of $20,000.

The Eldorado (Kan.) Light, Heat, Ice and Power Company has been incorporated with a capital stock of $50,000.

The Ellendale (N. D.) Light and Power Company has been incorporated with a capital stock of $25,000.

Ed. Sawyer of Rushton, Iowa, has been granted a franchise to put in an electric-light system in Homer, La.

V. A. Decker, F. C. White and Lewis P. Cooke have purchased the plant of the Hawley (Pa.) Electric Light Company. About $20,000 will be expended in improvements.

The frequency of passenger wrecks recently throughout the country, in which passengers were burned to death by reason of fire breaking out in the debris, has caused a renewal of the agitation

among many newspapers in favor of electric lights for all classes of passenger equipment.

Oberlin, Kan., has voted to issue bonds to the amount of $10,000 for the construction of an electric-light plant.

The Pell City (Ala.) Manufacturing Company has petitioned for a franchise to furnish electric light for the city.

Citizens of Aberdeen, S. D., will vote on April 17th on a proposition to issue $35,000 in bonds for an electric light plant.

A recent fire in Fordyce, Ark., damaged the electric light plant to the extent of $1,500. The loss is partly covered by insurance.

The council of Covington, Ky., has adopted a resolution providing for the appointment of an engineer to prepare plans and specifications for an electric-light plant for Covington.

The Seward Light and Power Company of Seward, Alaska, will soon install a 225-kilowatt Allis-Chalmers waterwheel-type generator, a nine-kilowatt belted exciter and a new switchboard. The new equipment will be for furnishing light and power in Seward.

F. J. Combe and S. C. Tucker of Brownsville, Tex., are preparing to install an electric-light and power plant at Brownsville. The proposed plant will probably be used to provide lighting and power service also for Matamoros, Mexico, situated opposite Brownsville.

The Gray's Harbor Lighting Company of Aberdeen, Wash., has been reorganized under the name of the Gray's Harbor Railway and Lighting Company. George F. Sonte of Seattle, and others, are the incorporators. The capital stock of the company is $500,000.

At Stillwater, Minn., complaint has been made that the rules contained in the National Electrical Code are too strict for a city of its size. This statement has been denied before the City Council by an underwriters' inspector from St. Paul, who was called in for consultation on the subject. An ordinance designating the code as the standard for wiring will probably be adopted soon.

Municipal authorities of Syracuse, N. Y., are engaged in a controversy with the Syracuse Lighting Company. It is understood that the mayor holds out for street arc lights at $70 each and commercial lighting at six or eight cents a kilowatt-hour. Street lighting now costs $85.55 a lamp, and the private users of electric light are charged 10 cents a kilowatt. Some of the citizens advocate a municipal plant.

At Minneapolis, Minn., an outside wiring inspector has been appointed and an ordinance drawn defining his duties. The lighting company proposes to expend about $600,000 during the next six years in perfecting and enlarging the underground systems in the business district, and in the meantime various minor extensions to the conduit system will be made as the service requires. Nothing will be done, however, until the City Council formally approves the ordinance covering outside work.

The De Queen Light, Ice and Cold Storage Company of De Queen, Ark., recently purchased a small lighting plant to serve its own needs and also to furnish lighting current to the town. The main unit will consist of an 85-kilowatt belted generator, wound for 60-cycle single-phase current at 1,100 volts. There will also be a 35-kilowatt direct-current exciter. Both of these generators are to be driven by a 14 by 24-inch Reliance engine. The equipment was ordered from the Allis-Chalmers Company's St. Louis office.

At St. Paul, Minn., the newly adopted ordinance requiring concealed electric-light and power wires to be enclosed in iron conduit where placed in buildings used for public gatherings and in all basements is being rigidly enforced. The electrical inspector has been furnished an assistant which permits more time being given to old and defective equipments. State licenses will be required of all contractors and journeymen electricians. This will affect St. Paul, Minneapolis and Duluth. Some progress is being made by the street railroad company in removing feeders from the main business district.

ELECTRIC RAILWAYS

The Norfolk (Va.) Street Railway Company proposes to expend $3,000,000 in improving the street-railway system.

Street-car barns, to cost $30,000, will be erected in the near future by the Shreveport (La.) Traction Company on its property at the foot of Market Street. Plans will soon be completed, when bids for construction will be asked.

It is reported that the Erie Railroad management, in making plans for increasing interurban traffic on its branch lines in New York state, has ordered surveys and estimates for the electrification of the Rochester Division, from Corning to Rochester. A power house is being constructed at Hornellsville for the easterly interurban lines. For the Rochester extension, it is said the company will get power over transmission lines from Niagara Falls.

The Ogden Rapid Transit Company of Ogden, Utah, proposes to extend its line to the mouth of Ogden Canyon. The city is being petitioned for a franchise.

A company has been incorporated at Gallatin, Tenn., for the construction of an electric line from Stanford to Gallatin. The capital is $50,000. W. G. Schandergen of Gallatin is one of the incorporators.

The Central Pennsylvania Traction Company has taken out a building permit for the erection of a power house on South Cameron Street, Harrisburg, adjoining the present plant. The new house is to be 100 by 172 feet, and will be erected entirely of steel and concrete.

Manager W. S. Dimmock of the Lancaster (Pa.) Railway and Power Company, who has returned from his trip to Boston, announces that the company will spend nearly $1,000,000 in extensions, double tracking, new cars and other improvements during the coming summer.

The Southeastern Kansas Railway, Light and Power Company is being incorporated with a capital of $4,000,000 by L. Rosenthal, J. J. Jones and Frank Dixon of Chanute, Kan. The company is organized to build extensive systems of interurban railway lines in the southeastern part of Kansas.

The Steubensville and East Liverpool Railway and Light Company of Wheeling, W. Va., has been incorporated to build an electric railway between Pittsburg and Wheeling, W. Va. VanHorn Ely, president of the East Liverpool Traction and Light Company, is one of the incorporators.

Large increases in traffic for the month of March, 1906, are reported by the Chicago elevated railways. The Metropolitan reports the heaviest for a single month in its history, being a daily average of 138,169. The daily average on the Northwestern for March was 85,154, and on the South Side 95,466.

The Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., has run the first car over its new private right-of-way into Oshkosh. Heretofore the company's interurban cars gained entrance into Oshkosh over other tracks. Its new right-of-way extends to the new Main Street Bridge and will cut about 10 minutes from the 20-mile run between the two cities.

Negotiations are to be opened with the Winnipeg Electric Street Railway Company by the city of Winnipeg, Man., with a view to having an agreement drawn up between the city and the company on the question of running Sunday street cars. If an agreement can be reached a by-law will be drawn up embodying the agreement and submitted to the people for their approval.

The Aurora, Elgin and Southern Traction Company was recently merged with the Elgin, Aurora and Chicago road. It is understood that the entire business of the roads will be transacted from Wheaton, where the general office will be located. The clerical force will be moved from Aurora and Elgin and only a superintendent of transportation will be left in each of the cities.

A charter has been granted for a trolley line to connect Ocean City, N. J., with Somers Point, the company being authorized to issue $25,000 of capital stock. The proposed line is to run directly across Great Egg Harbor Bay, and will have to be built almost wholly upon trestle for about two miles. It is said that the road is designed to connect at Somers Point with the cars from Atlantic City.

Work has been started on the construction of an electric railway between Scranton and Lake Winola, Pa., a distance of 22 miles. The line is being built jointly by the Northern Electric Street Railway and the Dalton Street Railway companies. A traffic agreement is likely to be effected with the Scranton Railways Company, controlled by the American Railways Company, whereby the cars of the new line will be able to reach the heart of Scranton.

The annual meeting of the Denver Tramway Company was held a few days ago, and the old officers were re-elected. The company is not prepared to make a statement concerning its extension and improvement plans, in which, it is said, $3,000,000 will be expended. A new line will be built to Argo and a line will be extended to Fort Logan and Loretto Heights. The gross earnings of the company last year were almost $2,400,000. The surplus, after charges, is said to be $750,000. It was the best year in the history of the company.

Service of the Philadelphia Rapid Transit Company was severely crippled last week by a fire which destroyed the Wyoming Avenue power plant. The fire was caused by an explosion of unknown origin in the room containing the gas-generating machinery. The Wyoming Avenue plant was the largest power plant of the company, and the only one supplying an alternating current. There are 10 direct-current plants in the city, and the Beech

[redacted]

POWER TRANSMISSION.

The Stave Lake Power Company of New Westminster, B. C., is preparing to put in a Stone dam on the Stave River and erect a power [redacted] supply power for the railroad and for lighting purposes.

A. H. DeLong of Forest City, Minn., expects to organize a company to utilize the waterpower of Crow River for the generation of electricity, to be supplied to Litchfield, Minn., and neighboring towns. Mr. DeLong already has a dam erected at Forest City, which has developed 300 horsepower.

The Inland Power and Electric Company of Spokane, Wash., has acquired 20,000 horsepower at Albany Falls, Idaho, and 20,000 horsepower at Hell Gate in the Columbia River, and an additional power at Metaline Falls on the Pend d'Oreille River in Stevens County, Washington. The company is incorporated for $1,000,000.

The borough of Steelton, Pa., was on March 30th for the first time lighted by power supplied from the York Haven power plant. More than 100 arc lights and nearly 8,000 incandescents were lighted with power received from this source. The power is brought across the Susquehanna River near Middletown on cables and strung on poles from Middletown to Steelton. Twenty-four thousand volts is carried from the power plant to Steelton.

The Traders' Paper Company of Lockport, N. Y., will soon install electricity for power purposes in place of steam. About 2,500 horsepower will be used. The decision was reached after some months' investigation by Superintendent Joseph H. Eilers of the relative cost of steam and electric power. The Lockport Gas and Electric Light Company will build a transmission line to the several large East Lockport mills from the Niagara, Lockport and Ontario Power Company's transformer station on the Ernest farm, west of the city. A petition for the same is now before the Common Council. It is believed that all the East Lockport mills will be using electrical power within a few months.

Plans are being made by a number of Pittsburg capitalists for the construction of a large power plant near Springdale for the generation of electricity, which is to be used for heat and light, and for the operation of car lines in the Allegheny Valley. H. P. Dilworth of Pittsburg, one of the local promoters, has secured from the secretary of war the rights to construct a plant on the banks of the Allegheny River and to make use of the Springdale dam for waterpower. The plan, as outlined in the application for a charter for the East Deer Light and Power Company, includes the building of a trolley line from Pittsburg to Apollo and other Upper Allegheny towns. The work will be carried on in conjunction with that of the Allegheny Valley Street Railway Company, which is now building lines near New Kensington, and with the newly organized Harmar Light and Power Company.

It is said to be the intention of the Baden Aniline and Soda Manufacturing Company of Mannheim, Germany, to obtain powers to erect a large generating station in the Bavarian Alps, in order to carry on the manufacture of nitric acid, and to produce by electric agency (Bierkeland process) nitrate of potash, suitable for the preparation of gunpowder. Power will be obtained from the River Alz, which flows out of the Chiemsee. This river, which discharges into the Inn, passes at one point in its course within 3.72 miles of the River Salzach, forming the Austrian boundary, which river is likewise tributary of the Inn and flows at a much lower level. It becomes possible by

means of a tunnel 3.72 miles in length to divert the Alz into the Salzach, and thus to obtain a constant volume of water with an available head of 164 feet..

Arrangements for the longest hydro-electric power-transmission system in Pennsylvania are being carried out by Hollidaysburg and Altoona men, who have organized the Bedford Waterpower and Electric Company. The power houses will be located at the headwaters of Yellow Creek, 30 miles from Altoona, the cost of the plant being estimated at $150,000. The intention of the promoters is to deliver electric power to Martinsburg, Roaring Spring and Hollidaysburg, selling it on the way for light and power. Numerous grist mills are located along the line, and other industrial plants, which will need the power.

PUBLICATIONS.

The Allis-Chalmers Company has issued a bulletin devoted to transfer machinery used in sawmills.

A new bulletin descriptive of various types of sawmill machinery, such as trimmers, slashers and cutting-off saws, has been issued by the Allis-Chalmers Company of Milwaukee.

The Power and Mining Machinery Company of Cudahy, Wis., is mailing a comprehensive catalogue on machinery for rock-crushing plants. The principal machine described is the McCully gyratory rock crusher, designed by the late Robert McCully of Philadelphia.

Compressed Air announces that, with its issue of May, it will appear in enlarged form and under new management. Hereafter it will be published by the Kobbe Company, 90-92 West Broadway, New York. W. L. Saunders will remain as editor-in-chief, W. R. Hulbert will be managing editor, and P. F. Kobbe, Jr., will be business manager.

A dainty desk calendar for April, May and June is distributed with the compliments of the Northern Electrical Company of Duluth, Minn. It is adorned with a beautiful female figure representing "Spring," from the original painting by Philip Boileau, reproduced and copyrighted by the Osborne Company of New York city. The calendar is graceful enough to adorn a lady's boudoir, and those who receive it will be grateful to the Northern company for it.

Merits of electric motors for power purposes are well set forth in a circular from the Westinghouse Electric and Manufacturing Company and devoted to type DA motors. These motors are especially adapted for small power consumers in driving ice-cream freezers, coffee grinders, copying machines, etc., several examples being illustrated in the circular. These motors follow closely the design of Westinghouse fan motors, but are provided with a base which enables them to be mounted on the floor, wall or ceiling.

"The Preservation of Ships," a pamphlet issued by the "Long-arm" System Company of Cleveland, Ohio, represents a distinct departure in trade literature. The company manufactures electrically operated bulkhead doors and hatch plates for ships, its system being in use on new vessels of the navy. Instead of the customary catalogue the company is putting out a series of "short talks" on the principles of safety at sea and the conditions under which safety can best be procured, with special reference, of course, to the important part of watertight bulkheads and their doors in producing an unsinkable ship.

What first catches the eye upon taking up the Westinghouse Electric and Manufacturing Company's new fan-motor catalogue is the beautiful design of the front cover. It is done in colors of delicate tint and represents a picturesque landscape set off in an unobtrusive manner by a few designs in fan motors indicative of the contents of the pamphlet. The inside is no less attractive, and fine half-tone cuts depicting various forms of fan motors and numerous adaptations for various interiors are a pleasing adjunct to the well-written descriptive matter accompanying them. A few pages are also devoted to Westinghouse small-power motors.

SOCIETIES AND SCHOOLS.

At a meeting at Lake Forest College, Lake Forest, Ill., a few days ago, it was announced that Andrew Carnegie had offered to erect a new science building if the college would raise an amount equal to his gift as an endowment for a science department.

The April meeting of the Illuminating Engineering Society will be held in the Edison Auditorium, 44 West Twenty-seventh Street, New York, on the evening of Thursday, April 12th. The programme of the evening is a discussion of the subject of "Interior Illumination." Three short introductory papers will be presented by a gas engineer, an electrical engineer and an acetylene engineer, respectively. Invitations will be issued to gentlemen representing the several interests among the membership of the society, to take part in the discussion, which will then be made general. The membership of the society is growing rapidly, the total enrollment to date being 320.

It was announced in Pittsburg a few days ago that Andrew Carnegie had given $2,000,000, in addition to previous gifts, for the maintenance of the Carnegie Technical Schools. It is expected the technical schools will have cost about $5,000,000 when completed.

Proceedings of Ohio Electric Light Association for 1905, substantially bound, are now ready for distribution. The volume contains a report of the convention proceedings at Put-in-Bay, Lake Erie, Ohio, August 16, to 18, 1905. The president of the association is F. E. Valentine of Piqua, vice-president, W. E. Russell of Massillon, and secretary-treasurer, D. L. Gaskill, Greenville.

Purdue University's department of telephonic engineering, now four years old, is to be enlarged and made a more prominent factor in the curriculum of the institution. Every member of the class to graduate this year has already a position. The Western Electric Company has contracted to give employment to 15 telephone students, and other concerns want more. The electrical building is being enlarged to accommodate this growing department.

MISCELLANEOUS.

The seats to be occupied by members of the National Assembly in the Tauride Palace in St. Petersburg, Russia, have been equipped with electrical apparatus similar to the system proposed several years ago for use in the House of Representatives at Washington, by which the members press buttons and register their votes at the clerk's desk, thus avoiding the delays of rollcalls.

The Delmarvia Telephone Company has consolidated with the Wilmington (Del.) Electric Light and Power Company under the corporate title of the Wilmington Light, Power and Telephone Company, with a capital of $1,250,000. The Delmarvia Telephone Company has installed an automatic system and the electric-light company was recently given a city franchise to compete with the old electric company. Charles C. Kurtz is president of the new company.

Pettibone, Mulliken & Co. of Chicago, whose new power plant was described in the Western Electrician of June 18, 1904, will add very materially to the equipment first installed. At the time the description of the plant appeared there was one generating unit installed, consisting of a 24 and 40 by 48-inch cross-compound Allis-Chalmers engine driving a 600-kilowatt Crocker-Wheeler generator. The company has now ordered two new engines of the Allis-Chalmers Company, one an 18 and 36 by 42-inch and the other 24 and 48 by 48-inch; both are of the heavy-duty cross-compound Corliss type.

The Chicago Underwriters' Laboratories recently established a wire-inspection bureau to make factory tests of all rubber-covered wire, with stamp-inspection tags certifying its approval. This has been found to work so successfully that the laboratories have just begun the inspecting and testing at the factories of rigid conduits, both lined and unlined. A similar service and factory inspection is to be begun soon of flexible tubing, and the work will be extended to other material and devices. The expense of this work is defrayed by the fees charged for the stamps and tags attesting inspection and approval.

In addressing the Glasgow University Engineering Society a few days ago, President G. T. Beilby is quoted as saying that there are in Great Britain steam engines and boilers with a yearly output of at least 5,000,000 horsepower. The coal consumed by these is not less than five pounds per indicated horsepower-hour. By the use of gas engines and steam turbines the coal consumption might be reduced to 1½ pounds per indicated horsepower-hour. The saving in coal, therefore, would be equal to 28,000,000 tons, valued at £9,800,000. The cost of making the change need not exceed £50,000,000, or, if the power is to be delivered as electricity, £60,000,000.

The United States Civil Service Commission announces an examination on May 2, 1906, at prominent cities in each state, to secure eligibles from which to make certification to fill six vacancies in the position of electrical assistant, at $900 per annum each, in the Signal Service at large, and vacancies as they may occur in any branch of the service requiring similar qualifications. Also an examination on May 3-4, 1906, to secure eligibles from which to make certification to fill a vacancy in the position of assistant electrical engineer, Signal Service at large, for duty in the Department of California, at $1,400 per annum, and vacancies as they may occur in any branch of the service requiring similar qualifications. Applicants should at once apply to the United States Civil Service Commission, Washington, D. C., for application form 1312. No application will be accepted unless properly executed and filed with the commission at Washington. In applying for the examinations the exact title of the position for which the applicant wishes to try—either "electrical assistant" or "assistant electrical engineer" should be used in the application.

The Western Canada Cement and Coal Company recently purchased three Allis-Chalmers steam turbines and generators of 1,000 kilowatts capacity each, which will be installed on the company's properties located 57 miles west of Calgary, Canada, on the Canadian Pacific Railway. The new units will generate current of 60 cycles, three-phase, at 600 volts, and the coal to be used for the operation of the plant will be from the Bankhead mines of the Canadian Pacific Railway and delivered at the mills. The current generated from the turbo-generator units will be devoted entirely to power purposes. The lighting load, consisting of some 40 arcs and 400 incandescent lamps, will be carried by the exciters.

Both branches of Councils of Philadelphia have passed the ordinance to reduce the price of gas to consumers after January 1, 1907, to the actual figures received by the United Gas Improvement Company under the lease, which drops by a sliding scale to 75 cents per 1,000 feet by 1918. This simply turns over to the consumers the profits which the city has been getting out of the sale of gas. Councils also authorized the appointment of a commission to audit the accounts of the United Gas Improvement Company, so that the city will get an idea of the amount to be paid to recover the works at the expiration of the first 10 years of the lease. By the provisions of the ordinance the price of gas will be reduced to 90 cents on January 1, 1907; to 85 cents on January 1, 1908; to 80 cents on January 1, 1913, and to 75 cents on January 1, 1918.

Particulars of an accident in which 110-volt current caused the death of a man come from East London, South Africa. The wire was carrying 110-volt 50-cycle alternating current for arc-light purposes. It had been burned through by contact with a wire carrying a heavier voltage and had fallen to the ground. At the time of the accident it was not in contact with the 500-volt wire, but it was subsequently found that there was a ground on the other main of the 110-volt circuit. The man who was killed was crossing the lot in the night and took hold of the wire to push it aside. It was raining and the ground was wet, as was also the man's clothing and body. He received a shock which caused him to fall but not to release the wire. When he was finally cleared from the wire he was dead, and a post-mortem examination showed that the current had passed transversely across the body through the heart and lungs.

Harvard University, taking the side of municipal ownership, won the debate with Yale on the question, "Resolved, that it would be for the best interest of New York city to own its street-railway system, including surface, elevated and subways." Harvard claimed gross overcapitalization by private companies, bad service, corruption, unhealthy cars and immoral overcrowding, and that New York was in the grasp of a "gigantic monopoly." Municipal ownership was urged as the only reform. Yale admitted some of the defects, but claimed that worse corruption would follow public ownership; that it would cost $500,000,000 to buy the properties and $20,000,000 loss each year to run them, and that proper regulation of private owners was the best way to meet the problem. Colonel N. G. Osborne of New Haven presided, and the Rev. Dr. James M. Buckley, the Rev. Dr. Robert Stuart MacArthur and Melville E. Stone, all of New York, were the judges.

An English journal relates the unusual result of a recent short-circuit. The trouble occurred on the distributing cables of the East Ham (London) Corporation network in front of a house in Green Street. The fault extended from the positive to the negative cable, and as the current was well within the capacity of the machines, the fault was allowed to burn out, and the section was then cut out. About an hour after this, however, it was found that a number of people in an adjoining house were in a state of partial suffocation, some of whom were promptly taken to the hospital, but soon recovered. On taking up the footpath to repair the fault it was found that a gas pipe crossing over the cable troughing was leaking badly. The fumes from the burning fault, mixed with the escaping gas, had found a way into the cellar through a hollow which had been left by a disused gas service, and, ascending to the top of the house, had overcome the persons sleeping in the attics.

TRADE NEWS.

Trade of the United States with Mexico in the fiscal year 1905 aggregated in value $92,000,000. In 1895, only a decade earlier, it was but $31,000,000, and in 1885, $18,000,000, thus practically doubling in the decade, ending with 1895, and trebling in the decade ending with 1905.

Sealed proposals are being invited until April 20th for furnishing the various branches of the government of the District of Columbia with electrical supplies during the next fiscal year. Specifications and full information will be furnished upon

application to the property clerk, Denrike Building, Washington, D. C.

Swift & Co. of Chicago will add to their power plant equipment two 800-kilowatt, 250-volt Allis-Chalmers generators.

The United States Circuit Court for the Northern District of New York, a few days ago, filed a decree enjoining the defendant in the case of the General Electric Company against the Madison County Gas and Electric Company, from using alternating-current integrating wattmeters or other motor devices embodying a provision for securing an approximate 90-degree phase adjustment by induced circuit. The infringement, which forms the basis of thi[illegible]

[illegible] the Diamond [illegible]

The Navy Department [illegible] Supplies and Accounts [illegible] until April 17th [illegible] with the following [illegible] electrical wire [illegible] circuit breakers, [illegible] switches and [illegible] schedule 144, electrical [illegible] conductors, carbon brushes [illegible] etc. Proposal blanks and [illegible] tained at the Navy Pay Office in New York or upon application to the bureau at Washington.

BUSINESS

[illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 27, 1906.

815,945. Coin Attachment for Prepayment Meters. John Doyle and Charles F. Averill, New York, N. Y. Application filed March 31, 1903.

Mechanical features embodied in the coin actuating mechanism of the meter are described.

815,961. Electrical Device and Circuit. William H. Lane, Westfield, N. J., assignor to the Hall Signal Company. Application filed June 2, 1905.

Two magnet coils in multiple are associated with a circuit changer connected with one of the coils and so arranged that when it is in one position it excludes the coil, and when in its other position it connects the coil in multiple with the other coil. The movement of the circuit changer to the position which excludes one coil is initiated when both of the coils are energized in multiple.

815,964. Electric Fuse. Benjamin S. Luther, Boston, Mass., assignor to the Chase-Shawmut Company, Newburyport, Mass. Application filed April 24, 1905.

The fuse is encased in a shell along with non-inflammable material.

815,991. Trolley Pole. Andrus S. Weaver, Sodus, N. Y. Application filed January 7, 1905.

A tube with bifurcated end forming arms comprises the trolley pole, which is mounted on a base and held up by a spring on the base.

815,993. Transfer Switch for Testing Circuits. John S. Whitaker, Portsmouth, N. H., and Harry P. Wood, Brooklyn, N. Y., assignors to the Consolidated Engine Stop Company, New York, N. Y. Application filed July 24, 1905.

In combination with a circuit are testing device and test-responding signal, two sources of current supply, an automatic switch, a resistance in the path of the responding signal and contacts for the switch adapted to supply current from one source through the resistance in one position, and from the other source with the resistance shunted in the other.

815,996. Rheostat. Charles Wirt, Germantown, Pa., assignor to the Wirt Electric Company, Incorporated. Application filed January 10, 1905.

In a rheostat is a removable resistance element composed of a helical coil of wire bent into a circular form and having a core of plastic material which has the property of becoming hard. (See cut on next page.)

816,000. Combined Telephone and Watchman's Alarm System. John J. Berry, Indianapolis, Ind., assignor to the Indianapolis Watchman Clock Company, Indianapolis, Ind. Application filed January 3, 1905.

The watchman's reporting means are normally electrically connected to the service circuit, a central recording means being electrically connected to the service circuit. An alarm signal and means controlled by the central recording means automatically intermittently operate the alarm signal.

816,014. Safety System for Electric-road Crossings. Arthur H. Johnson, Rahway, N. J., assignor to Harvey J. Donaldson, trustee, Ballston Spa, N. Y. Application filed December 5, 1892. Renewed February 8, 1906.

Safety mechanism for electric-road crossings embodies a conductor for supplying current to operate a car of the railway, a signal therefor and means outside of the car for cutting off the current to check the progress of the car over a portion of the railway in proximity to the crossing and simultaneously operating the signal.

816,028. Electrical Switch. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed April 30, 1903.

A swiveled bar having a pair of spring contacts, the faces of which are adapted to yield in a direction substantially transverse to the plane of oscillation of the bar, a coacting pair of contacts and means for moving one set of contacts toward and from the other make up the apparatus.

816,033. Rosette for Electric-light Wires. John H. Parker, Saugus, Mass. Application filed February 20, 1905.

An arch with a cord hole in the center extends completely over the base and forms a chamber for the reception of the lamp cords.

816,042. Gas Calorimeter. Charles E. Sargent, Chicago, Ill. Application filed September 8, 1905.

Combined with a heater are a fuel meter and a source of water supply connected with the heater. A water receptacle is arranged to receive the flow from the heater, and electromagnetic means under the control of the meter direct the flow from the receptacle to a reservoir and deflect it therefrom.

816,052. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed December 3, 1903.

A common source of current at the exchange supplies talking and signaling currents to the cord circuit and telephone line. A supervisory lamp circuit extends between one pole of the source and one cord strand, and a winding of high impedance is included in the supervisory circuit.

816,055. Centrifugal Melting Device. Theodore J. Zoeller, Nashville, Tenn., assignor to the Electric Candy Machine Company, Nashville, Tenn. Application filed October 11, 1904.

A centrifugal device for melting and mixing candy ingredients contains electrical heating means within the revolving vessel, current being transmitted to the means through a slip ring device.

816,078. Telephone-exchange System. William M. Davis, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed August 5, 1901.

Actuation of the substation apparatus causes energization of the line relay independently of the cut-off relay winding. Upon connection of the cord circuit with one of the multiple sections a local circuit containing the cut-off relay winding is closed. Means connect the spring-jack contacts with the line limbs, the local circuit including one of the cord circuit conductors and one limb of the telephone circuit.

816,083. Current Controller for Igniting Devices for Hydrocarbon Engines. Fay O. Farwell, Dubuque, Iowa, assignor of one-half to the Adams Company, Dubuque, Iowa. Application filed October 21, 1904.

Details are described.

816,100. Electric Switch. Montgomery H. Johnson, Utica, N. Y. Application filed April 20, 1903.

In an electric switch are a contact post, a double switch blade engaging the post on each side, springs on opposite sides of the post secured to the base of the post and pressing the blade parts against the sides of the post, and pivot studs or projections on the springs entering openings in the blade.

816,111. Reverse-relay Device. Ralph D. Mershon, New York, N. Y. Application filed November 4, 1904.

Co-operating with a source of current connected with one or more other sources of current are a circuit-controlling device acutated by force proportional to the vectorial product of components dependent upon current and electromotive force, respectively, and means for adjusting the magnitude and phase relation of the components.

816,112. Circuit-controlling Apparatus. Ralph D. Mershon, New York, N. Y. Application filed December 27, 1904.

Combined with a circuit are co-operating contacts and electroresponsive means for actuating them. Electromagnetic means in the circuit are arranged to become operative upon an actuation of the contacts, and then control the circuit independently of the electroresponsive means.

816,131. Transfer Circuit for Telephone-exchange Systems. Charles A. Simpson, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed October 27, 1904.

Means at each section connect the subscribers' lines with a transfer circuit to establish a complete talking circuit between the subscribers. A signal is associated with each end of the transfer circuit, a differential relay controlling the operating circuits of the signals. Means actuated in making and unmaking connections with the transfer circuit control the operation of the relay to suitably control the operation of the signals.

816,132. Telephone System. Charles B. Smith, New York, N. Y. Application filed November 28, 1898. Renewed October 22, 1902.

A continuous metallic line extends from the central station, a second metallic line extending therefrom and broken at a series of stations. A third line is arranged to complete the circuit from each station to the central, and switch mechanism at each station is arranged to successively and automatically break the third circuit connection from each station to central and build up the broken line through each station.

816,135. Telephone-exchange System. Harold B. Stroud, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed March 25, 1901.

In a trunking cord connection are the strands of the trunk cord, an indicator and one terminal of the trunking connection having a controlling electromagnet provided with differentially wound coils, means at the other terminal of the trunking connection for closing circuit through one of the coils to effect an operation of the indicator and means at the first terminal of the trunking connection for nullifying the magnetizing effect of the winding.

816,148. Trolley Shield. John W. Brown and Charles W. Jenkins, Washington, D. C. Application filed April 20, 1905.

A trolley shield comprises a main body which, when secured to the trolley, rests under the wheel, and means adapted to [illegible] the ends of the trolley wheel [illegible]

816,172. Electric Heater. [illegible] Joseph C. W. [illegible] of [illegible] Md. Application filed April [illegible]

[illegible]

816,192. Electrical Generator. William Stanley, Great Barrington, Mass. Application filed February 17, 1904. Renewed [illegible] 1904.

In an electrical generator [illegible] inducing member, an induced member, means for causing one of the members [illegible] for deriving from the induced member alternating current having a frequency [illegible] for deriving from the induced member [illegible] current dependent upon the predetermined [illegible] having a frequency different from that of the [illegible] current. (See cut on next page.)

816,205. Wireless-telegraph Receiving Apparatus. Alessandro Artom, Turin, Italy. Application filed September 7, 1905.

In a receiver for circularly or elliptically polarized electromagnetic waves are a pair of [illegible] aerials angularly disposed to each other, a primary coil inserted between each aerial and the ground and a secondary coil in inductive relation to the primary coils and all of the coils in axial alinement, the secondary coil forming part of a suitable electric circuit controlling a receiving instrument. (See cut on next page.)

816,230. Trolley Harp. Isaac H. Lunt, Barre, Vt. Application filed September 6, 1905.

Combined with a trolley pole are a [illegible] housing secured to the pole and formed of side walls spaced apart by lateral projections, a harp pivotally mounted between the side walls of the housings and springs disposed on each side of the harp for supporting the latter in alinement with the trolley pole.

816,259. Automatic Gearing Device. Judson Shoecraft, Eskridge, Kan. Application filed November 9, 1905.

An electromagnetic device brings the motor shaft into operative relation to the gearing driving the work.

816,270. Refractory Material for Electric Insulation and Other Purposes. Demetrius M. Steward, Chattanooga, Tenn. Application filed February 25, 1903.

An insulating and refractory material comprises the combination of water glass and steatite or their substantial equivalents, chemically converted practically to a complete extent by heat.

816,307. Engraving Machine. William S. Eaton, Sag Harbor, N. Y. Application filed August 23, 1905.

An annunciator and circuit are the only electrical features.

816,316. Shade. Louis W. Haight, White Plains, and William E. Chapman, New York, N. Y. Application filed March 7, 1905.

Several electric lamps are associated with an electric cable connected with and sustaining each lamp, all of the cables emanating from a single point. Spreaders are supplied extending from one cable to the other and causing the cables to diverge from the single point to separate the lamps.

816,330. Frictionless Bearing for Electric Meters. Thomas J. Johnston, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 28, 1901.

In a meter are a movable element, a vertical shaft therefor, the end of which is tapered, and means for applying air under pressure to the tapered end to support the shaft free from the means.

816,355. Apparatus for Decomposing Water by Electrolysis. William F. M. McCarty, Rocky Ridge, Md., assignor to Thomas A. Darby, trustee, New York, N. Y. Application filed November 8, 1904. Renewed September 25, 1905.

A pair of tanks communicating through the medium of a conduit contain each a spiral electrode suitably connected with a source of electricity and having at its lower end a radially projecting point located directly opposite one end of the conduit.

816,365. Vibrator for Massage Treatment. William Olson, Mount Vernon, N. Y. Application filed October 6, 1904. Renewed June 10, 1905.

A vibrator for massage purposes is driven by a small electric motor operated from dry batteries.

816,375. Electric Meter. William H. Pratt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 25, 1904.

Combined with a four-wire three-phase system are two [illegible] connected respectively between two phases and [illegible] windings connected in series with [illegible] respectively, and [illegible] windings [illegible] in series with the third [illegible]

816,383. Motor Starter. Ernest Schattner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 20, 1905.

In a motor circuit are a starting switch, comprising a magnetically suspended switch arm mounted to establish the running connections of the motor when released, and means dependent upon the speed of the motor for releasing the arm.

816,384. Battery. Eugene W. Schneider, New York, N. Y., assignor to the Mears Ear Phone Company, New York, N. Y. Application filed August 11, 1905.

A battery composed of cells has means whereby one of the cells, by an end-to-end reversal, may be thrown into or out of the generating circuit of the battery.

816,395. Alternating-current Generator. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 25, 1904.

A field structure provided with a distributed winding and a many-part commutator, brushes bearing on the commutator, means for supplying direct current to the field to magnetize the field structure on a line fixed relatively thereto and means for supplying to the brushes a current varying in magnitude and phase with the armature current are the essential features.

816,406. Fuse Plug. August Weber, Sr., and August Weber, Jr., Schenectady, N. Y.; said Weber, Jr., assignor to said Weber, Sr. Application filed March 8, 1904.

Details are described.

816,407. Electric Pressure Indicator. Joseph E. Wertz, New Haven, Pa., assignor of one-half to W. E. Day, Connellsville, Pa. Application filed March 21, 1905.

A pressure gage contains a movable conducting material, a high-pressure conductor, a low-pressure conductor and an intermediate conductor located in the gauge. An electromagnetic signaling device is arranged in a circuit normally closed between the high-pressure conductor and a battery. A circuit extends from the low-pressure conductor to the battery and is normally closed between the low-pressure conductor and the battery.

816,415. Trolley. Henry Zander and Gustav Hahn, Wilmerding, Pa. Application filed September 25, 1905.

A trolley mounted in the trolley harp is protected by a pair of guard fingers mounted upon the harp. A pair of bolts pass through the guard fingers in the harp, the harp being formed with curved inclined sides and one of the bolts being passed therethrough at a point along the curved sides.

816,428. Electric Cable. Harold W. Buck, Niagara Falls, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 27, 1904.

The method of fireproofing electric cables consists in placing the cables in their final position, treating a fireproof material with a fireproof self-hardening liquid and applying the treated material while wet to the cables so as to completely enclose them.

816,429. Device for Supporting Cables of Electric Lamps. James F. Burns, Albany, N. Y. Application filed July 12, 1905.

The parts of the device are a frame, a reel mounted therein, means for rotating the reel, a ratchet connected with the reel, a dog adapted to engage the ratchet, a magnet in operative connection with the dog, a lamp cable, a lamp attached to the cable and means for connecting the magnet and the cable with an electric circuit.

816,436. Electric-light Socket and Key. Owen C. Cover, Goshen, Ind. Application filed November 12, 1904.

A socket for electric-lighting systems comprises a body having oppositely disposed spaced contacts, spring contact members arranged within the body and respectively connected at opposite ends to one of each of the pair of spaced contacts, the remaining ends of each of the contact members being free. Means operate the contact members to include all of the spaced contacts in the circuit or but one of each of the pairs of contacts.

816,442. System of Electrical Regulation. William L. R. Emmet, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 1, 1904.

Several alternating-current dynamo-electric machines have a common source of exciting current and a regulating source of voltage interposed between the source of exciting current and one or more of the machines.

816,443. Expulsion Fuse. Charles E. Eveleth, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 14, 1904.

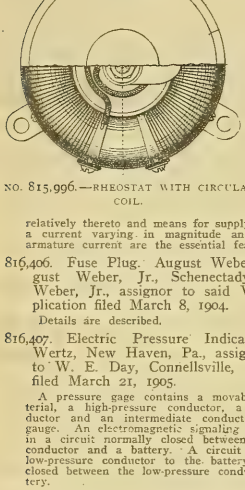
A thermal cut-out or fuse comprises an enclosing envelop consisting of an open-ended non-conducting tube and an enlarged portion or chamber, the chamber being composed of pressure-resisting material and having unyielding walls throughout. The fuse is placed in the chamber.

816,444. Electric Switch. August R. Everest and Ralph E. Barker, Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Application filed September 14, 1903.

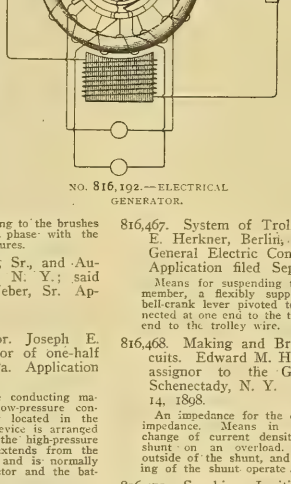
An insulating base has several stationary contacts mounted thereon. A metallic bush is secured to the base and electrically connected to one of the contacts, a shaft is journaled in the bush and a switch blade is loosely mounted upon the shaft and connected thereto by a spring and adapted to make electrical connection between the bush and the respective stationary contacts.

816,456. Time Register for Telephones. Gustav Fürst, Pozsony, Austria-Hungary. Application filed January 29, 1904.

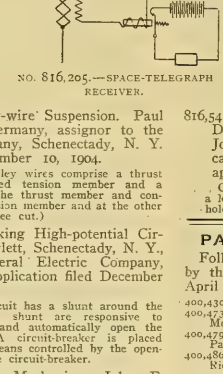
A time register for telephones comprises a motor train mechanism, a transmitter, means to permit both to act together and a receiver adapted to be used independently of the mechanism and transmitter.



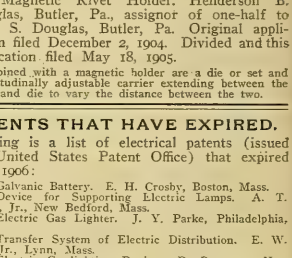
NO. 815,996.—RHEOSTAT WITH CIRCULAR COIL.



NO. 816,192.—ELECTRICAL GENERATOR.



NO. 816,205.—SPACE-TELEGRAPH RECEIVER.



NO. 816,540.—MAGNETIC RIVET HOLDER

816,467. System of Trolley-wire Suspension. Paul E. Herkner, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed September 10, 1904.

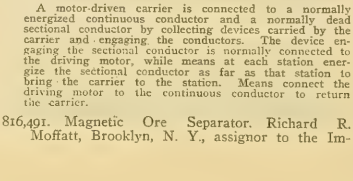
Means for suspending trolley wires comprise a thrust member, a flexibly supported tension member and a bell-crank lever pivoted to the thrust member and connected at one end to the tension member and at the other end to the trolley wire. (See cut.)

816,468. Making and Breaking High-potential Circuits. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 14, 1898.

An impedance for the circuit has a shunt around the impedance. Means in the shunt are responsive to change of current density and automatically open the shunt on an overload. A circuit-breaker is placed outside of the shunt, and means controlled by the opening of the shunt operate the circuit-breaker.

816,472. Sparking Ignition Mechanism. John F. Johnson, Chester, Pa. Application filed October 19, 1904.

Details are described.



NO. 816,467.—SYSTEM OF TROLLEY SUSPENSION.

816,483. Holder for Electric Incandescent Lamps. Peter Leonard and Charles H. Jones, Great Crosby, near Liverpool, England. Application filed February 17, 1904.

An electric incandescent-lamp holder has a shell, a plug which fits water tight into the shell, spring plungers carried by the plug, leading-in wires, a ring in the shell exterior to the plug and embracing the wires and insulating material which fills the ring about the wires, the ring being disposed between the plug and the attaching end of the shell.

816,484. Automatic Carrier. Sam H. Libby, East Orange, N. J., assignor to the Sprague Electric Company. Application filed September 1, 1904.

A motor-driven carrier is connected to a normally energized continuous conductor and a normally dead sectional conductor by collecting devices carried by the carrier and engaging the conductors. The device engaging the sectional conductor is normally connected to the driving motor, while means at each station energize the sectional conductor as far as that station to bring the carrier to the station. Means connect the driving motor to the continuous conductor to return the carrier.

816,491. Magnetic Ore Separator. Richard R. Moffatt, Brooklyn, N. Y., assignor to the Imperial Ore Separator Company. Original application filed July 19, 1904. Divided and this application filed October 6, 1904.

In a magnetic ore separator are a feed conveyor and two separating conveyers, a magnet comprising two sets of opposed poles producing two fields of different intensity, two cores each connecting one pole of one set in magnetic circuit with one pole of the other set and side frames connecting the poles of the same set in magnetic circuit with each other.

816,506. Massage Instrument. William G. Shelton, Chicago, Ill. Application filed April 3, 1905.

The massage device is driven by a small motor in the body of the instrument.

816,511. Dynamo-electric Machine. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 28, 1905.

An electrical machine is provided with a core having concentric sets of slots, those of one set being adjacent to the surface and of the proper number, form and dimensions to contain armature coils, and those of the other set being of the proper number, form and dimensions to contain resistance leads for connection to the armature coils.

816,540. Magnetic Rivet Holder. Henderson B. Douglas, Butler, Pa., assignor of one-half to John S. Douglas, Butler, Pa. Original application filed December 2, 1904. Divided and this application filed May 18, 1905.

In combination with a magnetic holder, having a hollow handle, are a die or set, a wedge block for adjusting the die, a solenoid carried by the handle and a solenoid core having a flexible connection with the wedge block. (See cut.)

816,541. Magnetic Rivet Holder. Henderson B. Douglas, Butler, Pa., assignor of one-half to John S. Douglas, Butler, Pa. Original application filed December 2, 1904. Divided and this application filed May 18, 1905.

Combined with a magnetic holder are a die or set and a longitudinally adjustable carrier extending between the holder and die to vary the distance between the two.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 2, 1906:

400,430. Galvanic Battery. E. H. Crosby, Boston, Mass.
400,473. Device for Supporting Electric Lamps. A. T. Moore, Jr., New Bedford, Mass.
400,479. Electric Gas Lighter. J. Y. Parke, Philadelphia, Pa.
400,486. Transfer System of Electric Distribution. E. W. Rice, Jr., Lynn, Mass.
400,492. Electric Gas-lighting Device. D. Rousseau, New York, N. Y.
400,515. Apparatus for Regulating Current or Potential in Secondary of Transformers. E. Thomson, Lynn, Mass.
400,516. Method of Regulating Current or Potential in Secondary of Transformers. E. Thomson, Lynn, Mass.
400,552. Telegraph-wire Carrier. R. S. Donaldson, Wilkinsburg, Pa.
400,591. Telephone Transmitter. W. J. Morton, New York, N. Y.
400,658. Electric-lamp Attachment for Gas Fixtures. E. F. Gennert, Brooklyn, N. Y.
400,661. Apparatus for Determining Electric or Magnetic Forces. A. Gipperich, Richmond, Va.
400,662. Art of Determining the Value of Electric, Magnetic or Electromagnetic Forces by Weight. A. Gipperich, Richmond, Va.
400,663. Apparatus for Determining the Value of Electromagnetic Forces by Weight. A. Gipperich, Richmond, Va.
400,664. Process of Reducing Aluminum from Its Fluoride Salts by Electrolysis. C. M. Hall, Oberlin, Ohio.
400,665. Manufacture of Aluminum. C. M. Hall, Oberlin, Ohio.
400,666. Process of Electrolyzing Crude Salts of Aluminum. C. M. Hall, Oberlin, Ohio.
400,667. Process of Electrolyzing Fused Salts of Aluminum. C. M. Hall, Oberlin, Ohio.
400,669. Safety Device for Electric Circuits. W. J. Hammer, Boston, Mass.
400,682. Prevention of Sparking in Electric Motors and Generators. D. Higham, Philadelphia, Pa.
400,724. Trolley for Electrical Railways. D. A. Ainslie, Richmond, Va.
400,725. Trolley for Electric Railways. D. A. Ainslie, Richmond, Va.
400,726. Method of Regulating Electric Currents. J. W. Balet, New York, N. Y.
400,732. Electric Switch. S. Bergmann, New York, N. Y.
400,733. Switch for Electric Circuits. S. Bergmann, New York, N. Y.
400,766. Process of Reducing Aluminum by Electrolysis. C. M. Hall, Oberlin, Ohio.
400,808. Switch Device for Electric Currents. J. A Turner, St. Louis, Mo.
400,809. Alternating-current Electric Reciprocating Engine. C. Vandepoele, Lynn, Mass.
400,830. Electric Car. G. H. Condict and V. Angerer, Philadelphia, Pa.
400,838. Dynamo-electric Machine. J. B. Entz, New York, N. Y.
400,842. Secondary Battery. W. W. Griscom, Haverford College, Pa.
400,843. Distribution of Electricity by Secondary Batteries. W. W. Griscom, Haverford College, Pa.
400,862. Secondary Generator for the Conversion of Electrical Energy by Induction. W. Lowrie and C. J. Hall, London, England.
400,866. Electric Condenser. William Marshall, New York, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

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The Bille Central Station at Hamburg, Germany.

By Frank C. Perkins.

The city of Hamburg, Germany, has a population of about 750,000. Electric current for light and power is supplied from four principal stations by the Hamburger Elektricitatswerke Aktiengesellschaft. One of these stations at Barmbeck is being equipped with 2,000-kilowatt three-phase alternators supplying a current of 5,000 volts pressure to sub-stations about the city provided with storage-battery plants and transforming devices. These sub-stations, located at Eildeck, Uhlenhorst and Uppendorf, distribute direct current to an incandescent lighting load of 58,295 50-watt lamps, several hundred arc lamps and electric motors of 1,160 horsepower capacity.

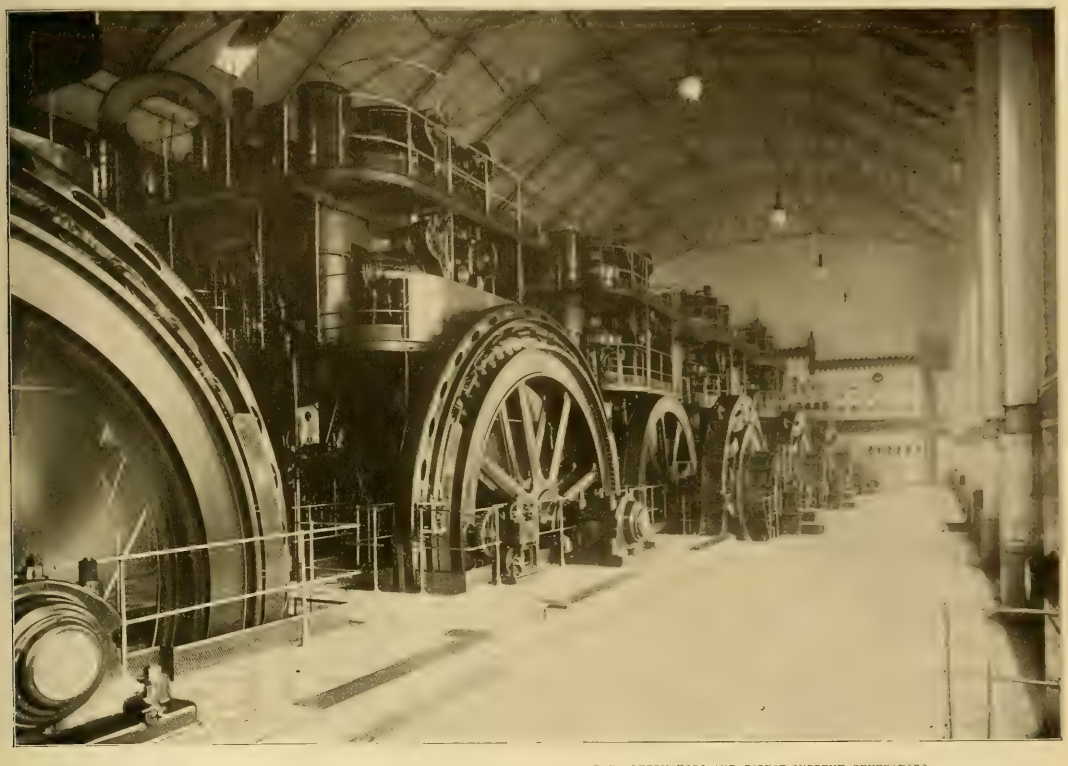

FIG. 1. INTERIOR OF BILLE CENTRAL STATION, SHOWING DIRECT-CONNECTED ALTERNATORS AND DIRECT-CURRENT GENERATORS.

The accompanying illustration (Fig. 1) shows the arrangement and design of the electrical equipment of the Bille central station in Hamburg, which supplies current to storage-battery sub-stations at St. Georg, Gross Newmarkt and Pferdmarkt. The station has a total output of 8,550 kilowatts normal capacity, with storage-battery installation of 3,441 kilowatts. This station serves a lighting load of 78,407 incandescent lamps and 1,794 arc lights and furnishes besides electric power for commercial service to the extent of 6,987 horsepower. Fig. 1 shows the interior of the generator room and Fig. 2 is a view of the electrically operated pumps, the latter being an example of a very well-arranged pumping plant.

Direct current at 600 volts is generated for railway service and for commercial light and power distribution by the three direct-connected units farthest from the observer, looking at Fig. 1. The 600-volt current is also utilized by transformation at the sub-station in the plant, using a storage battery between the neutral and outside wires of the three-wire circuit. Current is also generated in this power station by two alternators shown in the foreground, supplying a current at 5,000 volts pressure for distribution to the sub-stations located at a distance, where it is transformed to a direct current at 250 volts for distribution in connection with a storage battery equipment.

Transformer stations are of 550-kilowatt capacity each and contain motor-generator groups operated by alternating current motors.

In the central station there are also motor-generator sets of from 144 to 272-kilowatt capacity. These machines are supplied with a direct current at 600 volts, the motors operating at this pressure driving direct-current generators of 250 volts for storage-battery charging and lighting service on the three-wire system.

The Bille central-station engine equipment consists of five vertical, triple-expansion engines of the [illegible] type, each operating at a speed of 100 [illegible] a minute. These vertical [illegible] engines each have a capacity of from 2,000 to 2,500 horsepower and were constructed by the [illegible] Maschinenfabrik Augsburg und Maschinenbaugesellschaft Nürnberg Aktiengesellschaft. Of these five units three of the engines are directly coupled to direct-current [illegible] of 1,750 kilowatts each, supplying a current at 600 volts pressure. The remaining two units are directly coupled to generators of 1,650-kilowatt capacity each, supplying polyphase current at 5,000 volts pressure. The electrical equipment in the station was installed by the Siemens-Schuckert Company of Berlin. One of the interesting features of this plant is the artistic switchboard and gallery shown at the extreme rear in Fig. 1, which is characteristic of German central-station practice.

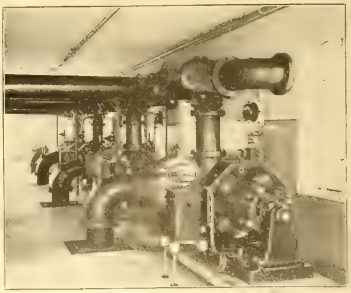

FIG. 2. ELECTRICALLY OPERATED PUMPS IN BILLE STATION.

This plant is one of a number of installations in Germany having both direct and alternating-current equipment in connection with storage batteries distributing current on the three-wire system. It is of comparatively recent construction and is the last one installed in Hamburg, the Barmbeck station having been built just before this plant in 1899; the Zollvereinsniederl station in 1898, and the first station of the four now in operation—the Zentralle Poststrasse—several years before. The last two stations supply current to 2,680 meters and 1,747 meters, respectively, the total outputs being 5,600 kilowatts and 2,400 kilowatts.

The total capital invested in the Hamburger Elektricitatswerke is nearly $8,500,000, and the combined plants have a total capacity of 19,950 kilowatts for the engine and generator equipments and 7,181 kilowatts for the storage-battery installations. There are 282,462 50-watt incandescent lamps on the lighting circuits as well as 3,852 arc lamps of the equivalent of 10 amperes each; also

commercial electric motors of a total capacity of 10,367 horsepower. The total number of electric meters installed on all of the lines in Hamburg served by these four electric-generating stations is 11,452 and the price for current charged is about 12 cents a kilowatt-hour for lighting service and about four cents for power service.

There are several other electric stations in Hamburg and its suburbs not operated in connection with the four principal plants above mentioned. These include the Nordl. Freihafen plant, with the sub-station Holländischerbrook of 1,703 kilowatts capacity; the Oswaldquai and the Petersenquai plants of 900 kilowatts and 165 kilowatts, respectively, as well as the Central Kuhwärder, with an output of 1,400 kilowatts.

Collins' System of Wireless Telephony.

Transmission of articulate speech from point to point electrically, without the use of conducting wires, has been experimented upon with varying degrees of success by numerous inventors. Among the methods proposed have been several which make use of the earth as the conducting medium. Work in this direction has led to the discovery that when a source of electromotive force, a transmitter and the earth are connected together in series by terminal conductors entering the earth, any variation in the resistance of the transmitter will produce a difference of potential at the two terminals entering the earth, and a slight current will flow, the earth forming part of the circuit. When this condition takes place, equipotential surfaces are established around each terminal, and while the major portion of the current flowing in the circuit passes directly from one terminal to the other through the earth, a certain amount flows, by less direct paths, and finds it way from one terminal to the other through ever-widening arcs, which extend a considerable distance from the conductors. These earth currents may be picked up at any point in their path by an ordinary telephone receiver whose terminals are also grounded. By certain modifications, also, an alternating current, such as is produced by the secondary of an induction coil, may be made serviceable in transmitting the impulses through the earth.

The above facts have been known for some time, but inventors have made use in their instruments of ordinary telephone transmitters and receivers. It was found, however, that although speech could be thus transmitted short distances, owing to the lack of sensitiveness and general inadaptability of the apparatus conversation could not be carried on with distinctness over any considerable distance.

Archie F. Collins of New York city has been working upon a system of this general nature, but which relates more particularly to the transmission of impulses by direct or alternating current having a higher voltage and amperage than has hitherto been employed. He has devised special sending and receiving apparatus which, he asserts, will permit of the transmission of speech over much greater distances than have heretofore been negotiated, and was granted a patent recently on the invention. The accompanying illustrations show the simplicity of Mr. Collins' apparatus.

The method of transmitting consists essentially in modifying a current (of sufficient electromotive force to produce an arc light) by means of a shunt, as shown in Fig. 1, or by superimposing a direct or alternating current on the arc-light circuit, as shown in Figs. 2, 3 and 4.

In Fig. 1 it is seen that the source of electromotive force, the transmitter (4) and the earth are in series, with the arc light connected in shunt. Any modification of the derived circuit (B), by virtue of a change of resistance due to a variable pressure of the diaphragm, is impressed upon the circuit (A), and the temperature of the arc and its resistance indicates a corresponding and proportionate change in the circuit (A). This variation of resistance in the arc produces in the circuit which includes it electrical undulations in the earth or other medium.

In a second modification of the method (shown in Fig. 2) the heavy-current circuit (A) includes a source of electromotive force, the arc light and the conductor terminals, forming connection with the earth or other medium in which they are embedded, and one of the windings (4) of a transformer coil. The circuit (B) is separated mechanically from the circuit (A), but is in inductive association with it through the complementary winding of the coil, as shown at (5). When the transmitter is in operation, an undulatory current is set up and superimposed on the current in the circuit (A), and the current is varied as indicated with reference to Fig. 1.

A third modification is shown in Fig. 3. In this case the current flowing in the circuit (A) is varied by an alternating current set up in the circuit (B), which includes a winding of a transformer coil and a condenser. A third circuit (C) includes a battery cell, a telephone transmitter and a winding of the transformer. It is the undulations of the current in this circuit which produce the alternating current in the circuit (B).

A fourth modification of this method is shown in Fig. 4, and has for its object the production of alternating currents in the circuit, which includes the earth or other medium. By referring to Fig. 4, (A) (B) (C) (D) indicate separate circuits. The primary circuit [represented by (A)] includes a telephone transmitter, a source of electromotive force, and the winding of a transformer coil. The secondary circuit (B) includes the complementary coil of the transformer, a condenser and the arc light. The third circuit (C) is in parallel with the circuit (B) and includes the arc light, a source of electromotive force, which feeds the arc, and the primary winding of a transformer. The fourth circuit (D) includes the secondary of the transformer and the conductor terminals.

In action the direct current from the source of electromotive force is changed into an undulatory current by means of the transmitter in the circuit (A). This sets up an alternating current in the circuit (B), by means of the transformer, and this current is then superimposed upon the current flowing in (C) feeding the arc light. Every imposition of the alternating undulatory current flowing in (C) produces identically the same effect upon the circuit (D) that the current in the circuit (A) has upon (B), with the final result that an alternating current having the same frequency and phase as that produced in the circuit (B), but with its amplitude greatly increased, is made to pass through the circuit including the earth or other medium in which conductor terminals are embedded.

As a receiving device there may be employed a simple telephone receiver having its conductor terminals embedded in the earth. When such a receiver is employed, the received impulses will have a value corresponding to the sensibility of the instrument. To further increase the amplitude and intensity of the impulses, so that the reproduction of speech may be louder, and without increasing the sensitiveness of the receiving telephone, Mr. Collins employs a method shown in Fig. 5, of which Figs. 6 and 7 are modifications.

Fig. 5 shows the receiver in its simplest form. The circuit (A) includes a source of electromotive force, an arc light and conductor terminals, embedded in the earth. The circuit (B) is derived from (A), which is in parallel to it and includes a telephone receiver or other means of indication and a resistance. When in operation, the function of this receiver is as follows: The received impulses through the earth are superimposed and impressed upon the current flowing in the circuit (A). These superimposed impulses vary the resistance of the arc and increase the variations of the current from the generator flowing through the circuits (A) and (B). The receiver in the circuit (B) is protected from excessive voltage by means of the resistance, and the circuit (B) [since it is in parallel with the circuit (A)] derives its energy from that circuit, and the telephone receiver responds to changes in the circuit, but with augmented amplitude and intensity.

In Fig. 6 the circuit (B) includes a condenser, in series with the transmitter instead of the resistance (shown in Fig. 5), which precludes the flow of the direct current in the circuit (A) through the receiver, but permits alternating impulses to act upon it, or a combination may be effected by including the receiver, the resistance of Fig. 5 and the condenser, Fig. 6, in the circuit (B).

Fig. 7 illustrates a modification of the invention in which two distinct circuits are represented by (A B). The circuit (A) includes a source of electromotive force, an arc light, conductor terminals and one winding of a transformer coil. The circuit (B) includes the opposite winding of the transformer coil, a telephone receiver and a condenser. This arrangement removes the telephone receiver from the circuit (A) and thus insures its safety.

Various other modifications of the receiving system are suggested, but which are based on the same principles as those just described. It will be seen that the whole system is a modification of the "speaking arc," but it is evidently a new adaptation of this interesting device which has hitherto found application principally as a subject for the lecturer.

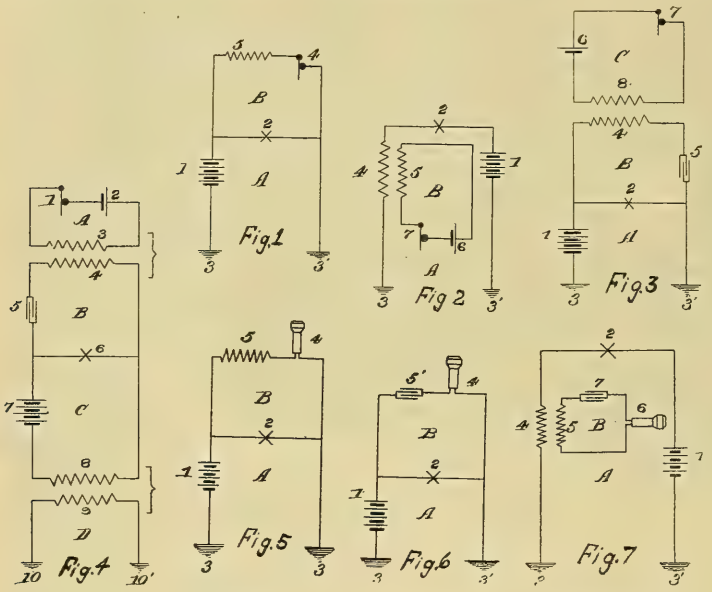

Fig. 4. Transmitter for Production of Alternating Currents.

Fig. 1. Simple Form of Transmitter.
Fig. 5. Simplest Form of Receiver.

Fig. 2. Modified Form of Transmitter.
Fig. 6. Modified Receiver.

Fig. 3. Transmitter with Condenser in Circuit.
Fig. 7. Receiver with Condenser in Circuit.

COLLINS' SYSTEM OF WIRELESS TELEPHONY.

One Lesson of the Dewey's Voyage.

The experience of the Navy Department in its efforts to keep in touch with the dry dock Dewey in its remarkable cruise from the Chesapeake Bay to the Philippines may result in a concerted attempt to secure an international control, within certain limits, of space telegraphy. The officials have had good reason to believe that in several instances Commander Hosley, in charge of the towing expedition, might have succeeded in communicating with the department, and that, too, at times when there was genuine apprehension as to the safety of the tow, had the shore wireless stations responded to his signals. Efforts will be renewed, it is said, to compel all wireless companies to accept any messages from any other company upon terms of fair compensation.

Trolley Express Service in New England.

The Old Colony Street Railway Company began running an express car on regular trips between Taunton, Mass., and Providence, R. I., last week. This is the first car to be run under the general street-railway freight and express law by any company which runs cars into Boston. The company expects soon to run express cars between Brockton and Providence. The express car makes two trips a day between Taunton and Providence, covering the distance about 25 miles in [illegible] hours. The company has three cars.

The rates are as follows: Packages weighing less than 25 pounds, 15 cents; packages weighing from 25 to 100 pounds, 25 to 30 cents; larger packages, 30 cents per 100 pounds. The cars will take or leave freight at designated stations in the larger places on the route. C. S. Seibel is to be freight agent at Taunton, the station being located in what was the boiler house in the company's old power plant off Winthrop Street. The company has engaged a double store at Center and Commercial streets in Brockton for an express depot. A local express company will collect and deliver matter for the railway company in Taunton.

The Old Colony company has also established a purchasing department by which express agents in any place will purchase goods for persons in other places. The company has obtained rights in Fall River, Mass., where express matter for New York will be delivered to the Enterprise Transportation Company, which runs steamboats between that city and New York. These rights will become effective as soon as the Fall River authorities remove certain conditions which the Massachusetts railroad commissioners pronounced irrelevant.

The Rhode Island company has been running express cars nearly five years and the Dartmouth and Westport Street Railway Company has been carrying freight between New Bedford and Fall River, Mass., for three or four years. Cars have been run between New Bedford and Providence over the Dartmouth and Westport and the Providence and Fall River roads.

The Pennsylvania Railroad's Extension to New York and Long Island—Long Island City Power Station. II.

[illegible]

The [illegible] the boiler [illegible] of flues, economizers and [illegible] to permit the operation [illegible] unit system [illegible] boilers on one turbine [illegible] certain features of interchange [illegible] porated so that the flues and [illegible] interchanged and [illegible] greatest capacity and highest [illegible] conditions of operation, [illegible] of the boiler and economizer plant [illegible] of service. One economizer [illegible] from two batteries of boilers.

Under normal conditions the gases from the four boilers discharge into their respective sections of the main flue, then pass through the economizer directly above and into the stack, being then under the control of the main damper regulator. The first and second-floor dampers and the flue partition dampers are open, thus permitting inequalities of quantity and pressure to divide under the different economizers irrespective of the boilers in service. In case it is found necessary to isolate any economizer for cleaning and repairs, this can easily be done by closing its inlet and outlet dampers, and the gases can then either be by-passed directly into the stack or divided up through the other economizers. The second-floor boilers can discharge into the stack through the flues and economizers and the first floor or vice versa. All the boilers can discharge through one economizer, or all economizers can be cut out, and stacks may also be cut out, so that the number of combinations possible is fully equal to any demands which extraordinary conditions may impose.

By the use of the economizers the hot gases are so reduced in temperature that they enter the base of the stack at about 350 degrees.

Each boiler is fitted with a Roney stoker. The bars are rocked by mechanical power derived from a shaft which is driven through a sprocket chain by a 4½ by four-inch Westinghouse standard engine, there being one engine to eight stokers. An arrangement is also provided for blowing in steam [illegible]

[illegible]

[illegible]

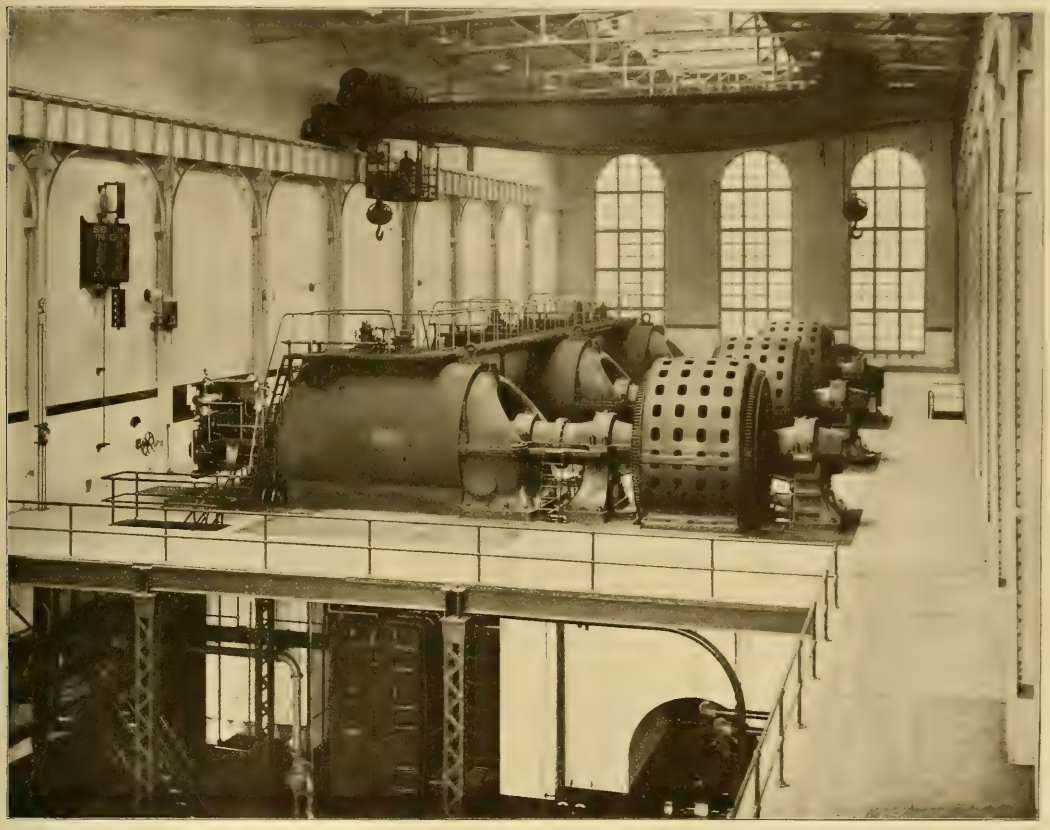

FIG. 5. INTERIOR OF ENGINE HOUSE IN LONG ISLAND CITY POWER STATION, SHOWING TURBO-GENERATORS.

bines are of the Westinghouse-Parsons single-flow type, rated to develop 5,500 kilowatts at 175 pounds steam pressure, and 27½ inches vacuum, running at 750 revolutions per minute. A general view of the three turbine units in the engine room is given in Fig. 5.

The Westinghouse-Parsons steam turbine is now so well known that a description of the principles involved in it is unnecessary.

The cylinder casting is made in halves, split horizontally, so that the upper part can be lifted off, enabling easy inspection of the interior of the turbine. The bearings of the turbine are supplied with a forced circulation of oil and are also water-jacketed. At each end of the cylinder where the shaft passes through a water-seal gland is provided which effectually prevents leakage of steam along the shaft. There is a large air space surrounding the cylinder for its entire length and it is lagged with asbestos and fitted with an outside jacket of sheet steel, giving a smooth cylindrical exterior. The entire structure of the turbine and generator rests on a heavy rectangular bedplate, which in turn rests on the foundation, but it is not fastened with anchor bolts.

The length of the turbo-generator unit is 47 feet, width 13 feet and height 14 feet to the top of the gallery railing. By way of contrast it may be stated that a four-cylinder piston engine of equal capacity, with its generator, occupies a floor space

about 55 feet long by about 35 feet wide, and is 39 feet in height.

Unique among governors is that which controls the operation of the Westinghouse-Parsons steam turbine. A train of levers deriving its motion from worm gearing on the main shaft of the turbine continuously actuates an oscillating pilot valve, which in turn actuates the main admission valve (which is of the poppet type) by varying the steam pressure against a piston that lifts it. Steam, therefore, enters the turbine through this main poppet valve, not in a continuous blast but in puffs, the duration of which is controlled by the amplitude of vibration of the little oscillating pilot valve. The advantages of this intermittent action of the governor are: First, that the turbine is always using boiler-pressure steam no matter what the load may be; second, that the admission valve, being constantly

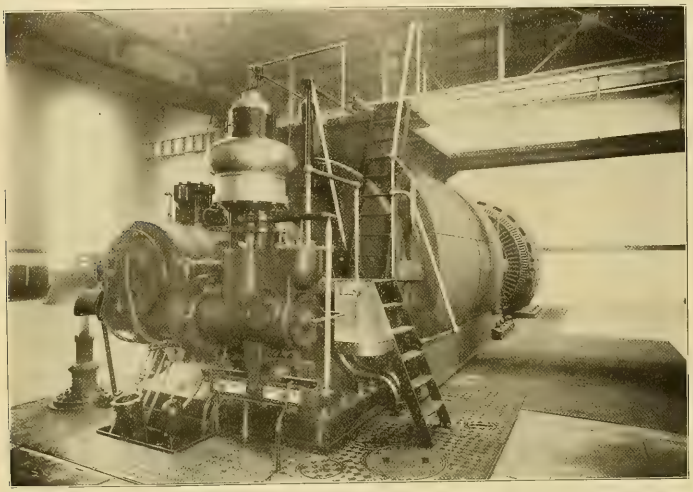

FIG. 6. STEAM END OF 5,500-KILOWATT TURBO-GENERATOR IN LONG ISLAND CITY POWER STATION.

in oscillation, has no opportunity to get stuck; and third, as the governor balls are moved in and out very slightly at every oscillation of the system of levers that is fulcrumed upon them they are never at rest, and it is practically impossible for them to wear. The most important parts of the governor mechanism also run in oil, which insures long life and the minimum of adjustment.

To secure the best results in parallel operation of alternating-current generators, close control of engine speeds is necessary. The construction of this form of turbine governor lends itself readily to fine adjustment.

Fig. 6 shows a view of the steam end of the turbo-generator. The system of levers fulcrumed upon the governor spindle and actuating the main admission valve on top of the turbine casing is clearly shown. Directly under the governor there is suspended a rocker carrying a weight which can be moved along it from one end to the other by a screw forming the extended shaft of a little motor carried on the rocker. This rocker is continually oscillating, receiving its motion through a vertical rod attached to the outer end of the governor-lever system. The inertia of the governor-leverage system is altered and its amplitude of vibration consequently changed by changing the position of the weight on the rocker through the operation of the little motor, which can be seen at the left-hand end of the rocker. This motor is controlled by suitable switch gear located in the electrical operating gallery, so that the switchboard attendant whose duty it is to throw the machines in parallel has simply to manipulate this speed-changing device in order to attain synchronism with the generator which he is about to couple to the system.

The steam consumption of the turbine is guaranteed by the builders not to exceed the following rates when operating at 750 revolutions per minute, with dry saturated steam at the throttle of 175 pounds gauge pressure, with a vacuum of 27½ inches mercury (referred to a 30-inch barometer) in the exhaust pipe:

Rated load, 5,500 kilowatts, 15.3 pounds steam per electric horsepower hour.
Three-quarter load, 4,126 kilowatts, 16.1 pounds steam per electric horsepower hour.
One-half load, 2,750 kilowatt, 18.1 pounds per electric horsepower hour.

These results will be improved by the following percentages by the use of superheated steam, temperature being measured at the throttle:

100° superheat.....10 per cent.
150° superheat.....12½ per cent.
174° superheat.....13¼ per cent.

The turbine is also fitted with an automatic safety-stop arrangement which shuts off the steam supply automatically in case the speed exceeds the predetermined limit. A device is also provided for controlling the action of the relief valve in the outboard exhaust connection.

The turbines were built at the East Pittsburg Works of the Westinghouse Machine Company.

Condensers.

A separate condenser is provided for each turbine of the counter-current surface type, built by the Alberger Condenser Company, and having 20,000 square feet of cooling surface, consisting of seamless drawn-brass tubes of No. 18 S. W. G., and one inch outside diameter. The condenser is placed in a large arched opening made in the turbine foundation. There is thus a marked saving in space made possible by the horizontal type of turbine, for it enables the entire condensing plant, consisting of condenser, circulating pump, dry-air pump and hot-well pump, to be compactly grouped within and about the base of the foundation.

The exhaust steam enters the condenser at the bottom. The dry-air pump exhausts the vapor from the top and the water condensation is collected from the bottom by the hot-well pump. The circulating water enters the tubes at the top, makes three passes and is discharged from the bottom of the condenser into the overflow flume directly underneath.

The intake flume is underneath the overflow and access to its contents is made possible by a well extending past the outflow flume down to the intake flume. Condensing water is lifted from this well by a 24-inch double-suction centrifugal pump made by the Morris Machine Works, capable of pumping 20,000 gallons of salt water per minute against a head of 20 feet. Each pump is driven by a 12 by 24 by 12-inch Westinghouse compound engine direct connected to it.

The condensed steam is drawn from the bottom of each condenser and discharged to the hot-well tanks in the boiler-room basement by a four-inch centrifugal pump direct connected to a 15-horse-power 220-volt direct-current motor running at 560 revolutions per minute. A by-pass arrangement to the overflow flume is provided for discharging the condensed steam directly into the flume if desired.

Vacuum is maintained in each surface condenser by means of a horizontal steam-driven two-stage dry vacuum pump, with Corliss valves and automatic governor on the steam end and positive valve motion on the vacuum end.

A somewhat unusual feature has been introduced into this station to prevent the serious deterioration usually occurring where salt water is used for circulation of surface condensers. It is the universal experience that more or less galvanic action takes place in any event at the expense of condenser tubes, but this is often aggravated in large and important plants by the fact that the water and the body of the condenser have formed a convenient path for stray electric-railway return currents getting back to their own power station some distance away through the condenser intake and the water of the harbor.

The method adopted to prevent this corrosion consists, first, in providing a shunt circuit between the incoming water pipes and the condenser flume in order to divert as large a proportion as possible of the current from the condensers. This was done by the insertion in each water-main connection of a short pipe with an insulating joint on each end of it. These short pieces of pipe were then connected to a 750,000 C. M. cable, which was carried to the outer end of the condenser intake. Such current as may leak from the pipes to the water contained in them thus has an opportunity to get back into the harbor without going through the piping system and the condensers.

In order to neutralize the effect of such current as might still leak past the insulating joints a small booster generator was provided, driven by a 220-volt motor, the positive pole of the booster being connected to the heavy grounded shunt cable above mentioned, the negative pole being connected to seven different points on each condenser, there being an adjustable rheostat in each of these branches of the negative circuit. This superimposed voltage can be adjusted by means of the rheostats to exactly counterbalance the natural galvanic electromotive forces due to the brass tubes, the iron shell and the circulating water, together with the stray electromotive forces from outside. With the destructive potentials so counterbalanced the condenser is in a neutral electric state, which effectively prevents the corrosion and pitting of condenser tubes and sheets and secures a far longer life than has hitherto been possible for this very important and highly vulnerable section of the steam equipment.

A differential voltmeter is provided which can be plugged to each of the sections of the negative circuit, there being a separate rheostat in each circuit. By adjusting the rheostats for each section it is possible to keep the potential at zero in all of them. The booster apparatus, shown in Fig. 7, is conveniently situated in the electrical bus gallery directly under the operating gallery. The rheostat panel for each condenser is situated conveniently to it in the engine-room basement, and observations at suitable intervals enable the operating force to maintain the condensers absolutely neutral.

Piping.

In making the layout for the piping of a power station the aim is to secure, first, safety; second, efficiency; third, simplicity, and fourth, flexibility, with due regard for the provision for relaying both pipes and apparatus. Last but not least, the question of cost, other things being equal, was considered all important.

In general the piping for the main power units in the plant was laid out to conform with the general design of the station on the lines of the unit system above referred to. In other words, the piping was so arranged that under normal condi-

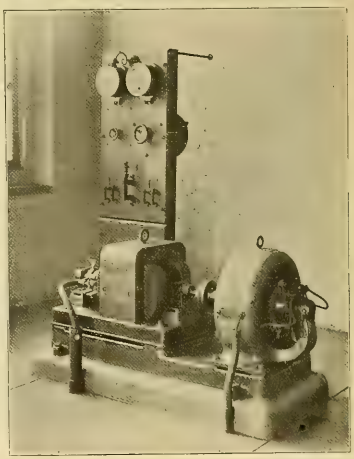

FIG. 7. BOOSTER FOR PREVENTING CONDENSER ELECTROLYSIS.

tions a given group of boilers and auxiliaries serves a single main power unit, which is provided with suitable cross and equalizing connections between itself and the similar system of piping of the adjacent power units. Space will not permit of a detailed description here. It may be remarked, however, that Fig. 8 is a view of the manifold connection where the group of boilers on the second floor discharges its steam into the top of one of the main feeders, which is then carried down to the point where it passes through the engine room wall under the turbine operating floor, having on the way a connection from a similar manifold with the corresponding group of boilers on the first floor. The two boilers on the south side of the boiler room are run into the same manifold as the two boilers directly opposite them on the north side, and the same arrangement is carried out on the lower tier of boilers.

As it is planned to use steam up to 200 pounds pressure, with 200 degrees superheat, special care had to be taken to design steam piping so as to allow ample flexibility for the excessive expansions due to these high temperatures. Long-radius pipe-bends were used throughout, and this arrangement has been found to furnish ample flexibility under the most exacting conditions. Full weight steam

pipe with extra heavy welded steel flanges was used throughout on the main steam piping. The fittings are of special design and made of open hearth cast steel. Particular attention is called to the heavy manifold connection in Fig. 8, where four seven inch boiler connections enter one 12 inch main.

FIRE PROTECTION.

Although the entire power station structure is absolutely fireproof, it is situated in the middle of a manufacturing district and adjacent to the water front in a position that calls for complete fire protection against outside conflagration. This is effected by an extensive system of cast iron flanged fire pipe line, with seven 1½ inch monitor nozzles disposed along the parapets surrounding the roof of the building, two at the middle of the coal bridge commanding the railroad yard and two on the coal tower itself commanding the water front. Four Siamese hose connections are provided at the sidewalk level at the four corners of the building, and one inside the boiler house at the east end of the coal bunker as a protection against possible fires in the bunker. This system is served by two 12 by 10 by 12 inch brass fitted 1,000 gallon Epping Carpenter pumps installed in the southeast

[illegible]

throughout the station is given herewith:

White—[illegible]
Bright red—[illegible]
Holly green and contrasting [illegible]
Bright red and blue flange [illegible]
Hull, when contrasting [illegible]
Yellow—Exhaust from [illegible]
one drop pipe.
Black—Boiler feed pipe[illegible]
drums, including headers [illegible]
Blue—All water piping [illegible]
water pumps and boiler [illegible]
Stenciled blue [illegible]
to match the finish to which it is adjacent.
Maroon—Blowoff piping.
Green—Air pipe.

FIG. 8. MANIFOLD CONNECTION IN MAIN STEAM PIPING IN LONG ISLAND CITY POWER STATION.

corner of the engine-room basement, with salt-water suction direct from the intake flume. These pumps are constantly under steam and are pumping against a head of 100 pounds, the fire-line system being fitted with a system of relief valves, all pipes and valves being properly protected from freezing, which constantly insures the immediate availability of the entire power of both pumps at any place where protection from fire may be needed.

LUBRICATING-OIL CIRCULATION.

There are three systems of distribution of lubricating oil. First of all is that which distributes the oil to the turbine bearings and includes a storage tank eight feet in diameter by 14 feet eight inches deep, situated in the boiler house at about the level of the coal bunker, from which oil is distributed by gravity to the turbine bearings. From the bearings it is carried to a filter tank, from which it is pumped automatically to the storage tank again by two compound duplex piston pumps.

There are about 5,000 gallons of oil in this system and about 90 gallons per minute is circulated through each turbine when in operation. About 20 gallons per day is drawn off for various purposes, this including a very small loss by evaporation.

The oiling system for the crank cases of the Westinghouse engines used for the auxiliaries includes a storage tank three feet in diameter by 10 feet nine inches high, which supplies by gravity a system of piping that leads to all Westinghouse reciprocating engines and allows the addition of new oil when needed.

Cylinder oil for the lubrication of the cylinders of the reciprocating engines is handled by the system, which includes a storage tank feeding by gravity through a system of piping that serves the lubricators on all the reciprocating engines and pumps. Fresh oil is raised into this storage tank from small receiving tanks by means of compressed air.

COMPRESSED-AIR CLEANING SYSTEM.

The station is equipped with a compressed-air system for cleaning and other purposes. Air is supplied to this system by two motor-driven compressors of the Westinghouse Traction Brake Company's D-4 type of water-cooled compressors, operating from the 220-volt supply circuit. Each compressor has a capacity of 50 cubic feet of free air

Slate—Crank-case oil piping between engines and separators.

Brass (not painted)—All oil piping, except the above-mentioned oil pipes painted slate color.

All the gate valves are made by the Chapman Valve Manufacturing Company and the globe valves by the Star Brass Company.

GENERATORS AND EXCITERS.

Since the standardization of the steam turbine as a prime mover a distinct type of electric generator has been designed to conform to the new speed condition imposed by the turbine. In a way it is a reversion toward the earlier types of high-speed generator. The difference between the size and weight of a 5,500-kilowatt turbo-generator and one of the slow-speed engine type is no less marked than the difference between the two types of prime mover. The "engine" type of generator runs from 60 to 75 revolutions per minute, while the turbo type, so-called, running at 750 revolutions, can be designed with far greater economy both of floor space and material—conditions which readily lend themselves to the greatest possible simplicity of design.

The stationary armature, enclosed in a large cylindrical yoke of cast iron, consists of a ring-shaped core built up of overlapping punchings of soft sheet steel with the interior surface slotted to receive the winding, having ventilating strips inserted at suitable intervals to form passages for the free circulation of air through the core and winding. The coils are wound with copper wire, and, as is usual with very large generators, the coils were built into the slots after the armature frames and cores were permanently in position on the bedplates. The coils are securely held in the slots by retaining wedges of hard fiber fitted into grooves formed in the armature teeth. The ends of the coils where they project beyond the ends of the laminated core are protected by large perforated cast-iron flanges, completely enclosing the opposite ends of the armature. The machines are "star-wound," i. e., the three sets of armature coils, needed for the generation of three-phase alternating current, are all connected to one point called the "neutral," and the neutral points of the three machines are connected to one neutral bus which is permanently grounded through a resistance.

The revolving field consists of a four-pole structure formed out of solid steel disks, milled to re-

[illegible]

power three-[illegible]
motor and generator [illegible]
shaft, bearings, and [illegible]
exciter is mounted [illegible]

[illegible]

Controlling the Direction of Space-telegraph Signals.

William Marconi recently presented a paper before the Royal Society dealing with methods of transmitting space-telegraph messages in certain desired directions and also describing a receiving apparatus for taking up the waves [illegible] in a given direction. The information which he presented related to the use of a straight horizontal conductor placed a short distance above the earth instead of the usual vertical one.

When an insulated horizontal wire is connected at one end to a sphere of a spark gap, the other sphere of which is earthed, and sparks are caused to pass between the spheres, it will be found on investigating the space around such an oscillator that the radiation emitted reach a maximum in the vertical plane of the horizontal wire, and proceed principally from the end which is connected to the spark gap, while the radiation is nil, or reaches a minimum, in directions which are approximately 100 degrees from the direction in which the maximum effect occurs. He had also noticed that any horizontal conductor of sufficient length, placed upon or at a short distance above the surface of the ground, and connected at one end through a suitable detector to earth, would receive with maximum efficiency only when the transmitter was situated in the vertical plane of the horizontal receiving conductors, and in such a direction that the end connected to the detector and to the ground was pointed toward the transmitting station. If, therefore, such a horizontal conductor was swivelled about its earthed end in a horizontal plane the bearing or direction of any transmitting station within range of the receiver would be ascertained.

The speaker then went on to give the results of actual tests demonstrating the phenomena above related.

In his experiments Mr. Marconi had noticed that the most advantageous length of the receiving horizontal wires, in order to obtain results at maximum distances, was about one-fifth of the length of the transmitted wave, if the wires were placed at a distance above the ground; but the receiving wires should be shorter if placed on the ground. He thought it would be instructive to investigate more thoroughly the difference of the results and curves obtained by means of horizontal wires placed at different heights above ground, and also the effect of varying the length of such wires. When using horizontal receiving wires, arranged as described, he had often noticed that the natural electrical perturbations of the atmosphere or stray electric waves, which were generally prevalent during the summer, appeared to proceed from certain definite directions, which varied from time to time. It would be exceedingly interesting, he thought, to investigate whether there existed any relation between the direction of origin of these waves and the known bearing or direction of distant terrestrial or celestial storms from whence these stray electric waves most probably originated. The experiments described were carried out during a period of many months. The tests over short distances were conducted over practically flat country, while those over considerable distances took place over hilly country, and in some cases partly across sea and partly across land.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

The Bille Central Station at Hamburg, Germany. By Frank C. Perkins. Illustrated.....297, 292
Collins' System of Wireless Telephony. Illustrated..... 292
One Lesson of the Dewey's Voyage..... 292
Trolley Express Service in New England..... 293
The Pennsylvania Railroad's Extension to New York and Long Island—Long Island City Power Station. Part II. Illustrated.....293, 294, 295
Controlling the Direction of Space-telegraph Signals..... 295
Editorial..... 296
The Charlottenburg Conference on Electrical Units of Measurement. By Henry S. Carhart. Portrait..... 297
National Civic Federation Inspects Public-utility Plants of Chicago..... 297
White Coal in France..... 297
A. C.-D. C. Locomotives for New York, New Haven and Hartford Railroad. Illustrated.....298, 299
A Telegraph Semi-centennial..... 299
Underwriters' Report on Electrical Conditions in Detroit..... 300
Space Telegraphy for North Pole Expedition..... 300
Marconi Company's Report..... 300
Oxone..... 300
Street Railways of York, Pa., Sold..... 300
General Electric Fan Motors for 1906. Illustrated..... 301
Iowa Conventions..... 301
Transportation Arrangements for Atlantic City Convention... 301
Argentine Republic as a Market for Electrical Goods..... 302
Motor Drive in a Large Furniture Factory..... 302
Consolidation of "Tri-Cities" Public-service Utilities..... 302
Laying Cables in Simplon Tunnel..... 302
Electric Light and Power Supply for London..... 303
Steam-turbine Installation in Siam..... 303
Thin Insulation..... 303
Two-part Street-railway Tracks..... 303
Proposed Foreign Tour of Institute Members..... 303
Electrical Conditions in Philadelphia..... 303
Ground-wire Clamp for Telephone and Telegraph Work. Illustrated..... 303
Wright Demand System in England..... 303
Indiana District Telephone Meeting..... 303
High-potential Circuit-breaking Apparatus. Illustrated..... 304
Canadian Telephone News..... 304
Southeastern Telephone Developments..... 304
Indiana Telephone Items..... 304
Telephone News from the Northwest.....304, 305
Why Europe Lags in Telephone Service..... 305
Extensions to Chicago Automatic Telephone System..... 305
General Telephone News..... 305

DEPARTMENTS.

Correspondence.....305, 306, 307
Great Britain..... 305
Dominion of Canada.....305, 306
New York..... 306
Southeastern States..... 306
New England..... 306
Ohio.....306, 307
Indiana..... 307
Northwestern States..... 307
Pacific Slope..... 307
Personal.....307, 308
Electric Lighting..... 308
Electric Railways..... 308
Power Transmission..... 308
Publications..... 308
Societies and Schools..... 308
Miscellaneous.....308, 309
Trade News..... 309
Business..... 309
Illustrated Electrical Patent Record.....309, 310

DATES AHEAD.

Fond du Lac Gas and Electrical Show, Armory E, Fond du Lac, Wis., April 9th to 14th.

Iowa Electrical Association (annual convention), Kirkwood Hotel, Des Moines, April 18th and 19th.

Iowa Street and Interurban Railway Association (annual convention), Kirkwood Hotel, Des Moines, April 19th and 20th.

Texas Independent Telephone Association (annual meeting), Waco, Tex., April 25th, 26th and 27th.

American Electrochemical Society (general meeting), Ithaca Hotel, Ithaca, N. Y., May 1st to 3d.

Southwestern Electrical and Gas Association (annual convention), Galveston, Tex., May 16th, 17th and 18th.

Indiana Independent Telephone Association (annual meeting), Claypool Hotel, Indianapolis, May 17th and 18th.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

Canadian Electrical Association (annual convention), Clifton House, Niagara Falls, Ont., June 19th, 20th and 21st.

Southwestern-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

PROFESSOR CARHART'S article on "The Charlottenburg Conference on Electrical Units of Measurement," presented elsewhere in this issue, will give the reader a clear idea of the status of the international movement for standardization in the legal definitions of electrical units. A great deal has been done in this direction since the necessity for electrical units was first recognized, but not a little remains to be determined. The gathering at Charlottenburg last autumn was one of the meetings for "tuning up" which precede the full international concert on electrical units of a future day. Dr. Carhart was the only American delegate present, and he speaks with knowledge—a knowledge gained not only by participation in the conference of last year, but by many years' experience in the determination of units and in representing his country at former assemblages of similar character.

ELECTRIC SIGNS give an appearance of brightness, prosperity and enterprise which can be attained in no other way. This fact is recognized by business men to a constantly increasing degree. Thus in Des Moines, where the Iowa Electrical Association will meet on the 18th and 19th of this month, a daily newspaper reports as follows: "The business men of Des Moines are making this city a brilliant spectacle at night. They have learned that making their buildings and the streets attractive promotes business. Trade follows the light. Light streets and light stores catch the crowds. Nobody wants to live or shop or eat in a dimly lighted place. Some Des Moines business houses have traced 25 per cent. increase of business directly to the installation of an electric sign. There may be may differences of opinion about the value of electric signs, but the preponderance of evidence from successful men is greatly in their favor." It is a fact that one can almost judge of the relative progressiveness of a city compared with others of the same size by the number of its electric signs.

THERE is a widespread popular impression that persons who have fallen into a state of suspended animation have been believed to be dead, and as such actually buried alive. While such gruesome calamities must be, happily, very rare, an infallible test which will prove beyond a doubt whether life has ceased would be a discovery of great importance. Prof. Elmer Gates of Washington, D. C., is said to have recently announced that he has discovered ultra-violet rays of a certain wave length which, when properly applied, constitute a sure test of the existence or non-existence of life in an animal organism. Living objects placed in these strange rays are said to cast a shadow which exists only as long as life is present in the body; when life is extinct the body becomes suddenly transparent to the rays and the shadow vanishes. If true, this is, of course, very mysterious and wonderful. What relation these rays bear to the life principle which distinguishes a living organism from inanimate matter is hard to fathom, but if the report of this discovery is to be relied upon, a step in advance has undoubtedly been taken in the effort to solve the fundamental mysteries of life, disease and thought transference.

ONE of our contemporaries devoted to railroad interests points out one advantage of the electric locomotive which may be overlooked. This relates to the matter of layovers in the roundhouse after the completion of a run. Steam locomotives, after a run of 100 miles or more, must lay over to enable attendants to examine and clean the boiler. This loss of time means a considerable loss of earning power of the equipment, especially in short runs, for the time required for the layover after a short run is about as long as after a long run. If the water of the district is poor the boiler must be washed, taking time for cooling and for refiring. If the boiler is fired by oil the delay is longer than otherwise on account of the heavy lining of fire brick in the firebox, which holds its heat for several hours. With the electric locomotive, it is needless to say, loss of time for boiler cleaning is done away with. This means that the capacity for earning dividends is increased. The average run of a steam locomotive is 10 hours, and as the customary layover in the roundhouse is five hours, the machine has no dividend-earning capacity for one-third of the time.

METRIC reform by the educational method has been set on foot in Canada. Mr. A. G. Seyfert, the United States Consul at Stratford, Ont., reports an active movement that has for its object the adoption of the decimal system of weights and measures. Active propaganda is at work to have the question properly presented to the Canadian people. The consul writes: "With a view of adopting the metric system in weights and measures at an early day the Canadian government is preparing and educating the people for the change. Prof. J. C. McLennan of the University of Toronto has been engaged by the Dominion government to devote the next year to explaining the system in a series of lectures in all the leading cities from Halifax to Vancouver. The professor delivered his first lecture on the subject at Stratford, February 7th, before the Board of Trade. According to his explanation, it is the object of the Canadian government to secure a uniform standard of weights and measures throughout the entire British Empire, and thus to advance trade relations among the different colonies of the empire. The Board of Trade at Stratford unanimously adopted resolutions urging adoption of the system."

This is a very sensible method of procedure, and it might be copied with advantage in the United States. Instead of asking Congress to pass a mandatory law, would it not be wiser, in order to bring about this great reform effectively and permanently, to begin a campaign of education? If additional laws are to be enacted, why not petition the Legislatures of all the states to make the teaching of the metric system compulsory in all public schools? The foundation must be laid before the superstructure is erected.

ONE feature of the agitation for the preservation of Niagara Falls against further diversion on the part of hydro-electric companies which is not to be overlooked is its effect on the Chicago Drainage Canal. This channel has now a capacity of diverting 300,000 cubic feet of water a minute from Lake Michigan to the Desplaines River and thence through the Illinois River to the Mississippi. In the rock cuts the canal has a capacity of 600,000 feet a minute, and this is apparently the capacity provided by existing law. The International Waterways Commission has recommended that this limit be the final and ultimate maximum of capacity of the Drainage Canal under any circumstances, and the president has endorsed these recommendations, together with others designed to restrict the diversion of water from the Upper Lakes and Niagara River in order to preserve the cataract at Niagara Falls.

The Chicago Drainage Canal was built primarily to protect the water supply of a population of two million people at present, and of a much greater number in the future, by diverting sewage from Lake Michigan. But it has also power possibilities which are now in process of utilization, as the readers of the Western Electrician are aware, and it may in the future serve as a ship canal connecting the Great Lakes and the Mississippi River. It has cost the city of Chicago about $46,000,000 up to date and is a public work of great magnitude and importance. The trustees of the Sanitary District have taken alarm at the report of the Waterways Commission and protest against that portion which relates to the Drainage Canal, asking that Congress fix the final limit at 840,000 or more feet, and lockage, instead of the 600,000 feet recommended by the commission. They do not see why the power interests of Niagara are more important than the health of the people of Chicago, and they ask for the higher limit to provide for the future needs of the city. Canadian power companies at Niagara, for instance, are allowed to divert over 2,000,000 feet a minute. The trustees have certainly a right to a respectful hearing, and their arguments should be given careful consideration.

The Drainage Canal is on a different basis than the Niagara Falls power companies, as it is not used for private profit.

The Charlottenburg Conference on Electrical Units of Measurement.

By Henry S. Carhart.

It will be remembered that the Chamber of Delegates at the St. Louis Electrical Congress decided to secure if possible the appointment of an international commission whose duty it should be to eliminate the existing differences in the definitions of the electrical units in different countries, and especially differences in the physical representations of those units. In pursuance of this action at St. Louis the president of the Reichsanstalt at Charlottenburg issued a call last June for a preliminary conference for the purpose of exchanging views and to ascertain to what extent unanimity respecting standards of electrical measurement might be expected. To this conference were invited the heads of government bureaus dealing with electrical measurements of precision in the United States, England, Belgium and Austria-Hungary; also certain physicists whose work has been conspicuous in the field—Lord Rayleigh, Professor Kohlrausch, Mascart and Carhart. All these were present at the conference, which opened October 23d, except Dr. Stratton of Washington and Lord Rayleigh.

PROF. HENRY S. CARHART.

The sessions of the conference were held at the Reichsanstalt, and this famous imperial institution was represented by Dr. Lewald, president of the governing body of the Reichsanstalt, Professor Warburg, president, and Professors Hagen, Jaeger and St. Lindeck. On nomination by Dr. Lewald, Professor Mascart of Paris was chosen chairman.

The conference continued in session for three days and reached conclusions with entire unanimity, except on one or two important points. The Chicago congress defined three international standards, namely, the ohm by the resistance of a specific thread of mercury, the ampere by the deposit of a definite weight of silver in the silver coulometer under defined conditions, and the volt as a specific fraction of the electromotive force of a Clark standard cell. For reasons not necessary to enter into here, it has turned out that in Germany only two of these concrete standards—the ohm and the ampere—have been legalized, leaving the volt to be determined by the application of Ohm's law. It has been shown by many researches since 1893 that the electromotive force of the Clark cell is about one part in 1,000 lower than the value legalized in the United States and England. Thus two values of the volt are in actual use. The conference therefore decided unanimously that it is desirable to choose only two independent standards as practical units instead of three. Conservatism and respect for the past quite as much as anything else led to the choice of the ohm and the ampere instead of the ohm and the volt. Briefs were presented by our Bureau of Standards and by myself in favor of the volt as defined by a Weston normal cell instead of the ampere as defined by the deposit of silver in a silver coulometer. These briefs appear as appendices to the Proceedings of the Conference printed at the Reichsdruckerei in Berlin.

The conference neither affirmed nor denied the correctness of the accepted value for the electrochemical equivalent of silver, but recognized that much work must be done before a revision of the specifications for the silver coulometer is possible. Hence the legal value of 1.118 milligrams of silver per coulomb remains, unless further investigations shall make it appear without doubt that this number should be changed. In fact, one or two members of the conference expressed the opinion that the present legal values of the ohm and the ampere should be retained, whether they are found by more precise investigations to conform to the theoretical definitions or not. The meter and the kilogram were cited as practical legal standards which do not correspond exactly with the original designed values. But it should not be forgotten that electrical units are a part of a correlated mechanical system derived from the meter, the kilogram and the second, or their sub-multiples; and any appreciable variation of the practical standards from the accepted C. G. S. definitions would introduce confusion, because the electrical kilowatt would not then conform to the [illegible]. This is not the case with the meter [illegible] and it makes no difference [illegible] form to their designed [illegible] electrical standards [illegible] the theoretical definitions [illegible] of arbitrary standards [illegible] instead of a correlated system [illegible].

It is now recognized that the [illegible] is a difficult piece of apparatus to [illegible] precision, and the ingenuity of investigators [illegible] to find the best method of preventing the [illegible] anodic liquid, discovered by Prof. [illegible], from reaching the cathode. It is [illegible] personal knowledge that investigation [illegible] coulometer is now in progress in [illegible] laboratories in Europe and America. If the silver coulometer is to be retained it should be brought to the highest point of perfection that the present state of science permits.

It is admitted by all that electric current will continue to be measured for purposes of calibration and in accurate research by means of a standard resistance and a standard cell. Practically the only use to which the silver coulometer will be put is in the determination or checking of the electromotive force of standard cells. If the electrochemical equivalent of silver and the electromotive force of the adopted standard cell are determined concurrently by means of the same ampere balance the choice of the ampere instead of the volt for the second independent unit will be of no great importance.

It is a personal gratification that my original proposal, made at the meeting of the American Institute of Electrical Engineers in 1903, to replace the Clark cell by the Weston, was unanimously approved by the conference. There was entire unanimity in the view that the Weston cell must contain solid cadmium sulphate, so that at both electrodes the corresponding salt shall be present in the solid as well as the liquid phase; also that the amalgam composing the negative electrode must contain from 12 to 13 per cent. of cadmium. It was further provided that precautions must be taken to insure the electrical integrity of the negative electrode by adopting a method of construction that shall prevent the liquid solution reaching the connecting platinum wire. In other respects the specifications were left to be determined. The view was advanced at the Reichsanstalt that the chief cause of variations in the electromotive force of the cell is the variation in the size of the crystals of mercurous sulphate. This view is not accepted in this country, but the subject needs further investigation. It is certain that the Weston normal cell is now reproducible to within one part in 10,000, or one hundredth of one per cent.

Among the proposals which the Reichsanstalt laid before the conference was one to establish an "International Bureau of Electrical Standards." The object in view was the preservation of international agreement among the fundamental standards for practical electrical measurements. The proposed bureau would be charged with the duty of setting up the mercury normal for the ohm and sending copies of it to the countries participating in the agreement. The metrological part of the undertaking was to be done in collaboration with the International Bureau of Weights and Measures in Sevres. For the initiation of the undertaking the proposed international electrical bureau was to be at the Reichsanstalt.

Whatever might be said in favor of this proposal, it was a new proposition, and several of the members of the conference did not feel authorized to commit themselves in favor of it. Much less could they commit their governments to the undertaking.

The conference expressed itself with due caution in favor of an international convention, conference or commission, to be called together in the course of a year. It is altogether likely that such a commission will be invited by the British government to assemble some time next autumn. It is not to be expected, however, that all outstanding questions to be settled will be ready for solution by that time. Still, great progress has been made, and time must be allowed before final action is taken to insure results that will last.

Socially the conference was the occasion of the most charming courtesies on the part of our German confreres. On the three successive days of the conference we were invited to luncheon at the home of President Warburg, where we were delightfully received by Mrs. Warburg and her lovely daughters. The members of the conference were further invited by President Warburg to a dinner at the Automobile Club. Twenty-six gentlemen sat [illegible]

National Civic Federation Inspects Public-utility Plants of Chicago.

[illegible] committee [illegible] man.

The Chicago party [illegible] dore [illegible] of Evanston [illegible] and D. H. Moffitt [illegible] relating to Chicago's municipal [illegible] water plants. The first day [illegible] up to hearing and discussing the reports [illegible] experts. In the forenoon of the second day the party was conducted in automobiles by City Electrician Carroll to the city light, water and pumping plants. The gas plants were also visited. In the afternoon John F. Gilchrist, representing President Samuel Insull of the Commonwealth Electric Company, took the party to the Fisk Street station of that company.

The Chicago trip will end the investigation for the present at least. Those in the Chicago party were Prof. Frank J. Goodnow of Columbia University; Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston; Walton Clark of the United Gas Improvement Company of Philadelphia; Walter L. Fisher of the Municipal Voters' League of Chicago; Edward W. Bemis, superintendent of waterworks at Cleveland; Frank Parsons, president of the National Public Ownership League of Boston; Prof. John H. Gray of Northwestern University; Prof. John R. Commons of the University of Wisconsin, and Edward E. Moffett, representative of trades-union organizations.

"White Coal" in France.

A consular report from Mr. Mason, the United States consul-general in Paris, and Mr. Skinner, consul at Marseilles, covering French trade, concludes as follows:

Greater industrial efficiency is being sought in all directions, but particularly by the distribution of energy supplied by rivers and streams. This is being especially felt in the region extending from the Mediterranean to the Alps. The degree to which this energy may be multiplied is infinite, but with present knowledge it is assumed that 2,000,000 horsepower may be economically obtained, of which perhaps a fifth has been secured or is in process of being secured.

The greatest completed French works are to be found in the Alps, where sparse population, narrowness of range of raw materials, and remoteness from large markets deter large industrial operations. At present, work is in progress on eight different plants, which will revolutionize manufacturing conditions in the whole Mediterranean region and in Durance Valley, where general conditions are favorable to manufacturing enterprises.

The Vesubie plant, now in operation, supplies Grasse with power at the rate of five cents per horsepower-hour. The Brillane and Saulce plants will soon be in operation, and will supply power to the Marseilles tram lines and other companies. These plants are 65 miles and 102 miles from Marseilles, the Saulce being the farthest. The Brillane plant deals with a sluggish, muddy stream—the Durance—and requires settling basins at intervals. The power will be transmitted under tension of 45,000 to 50,000 volts, which will be reduced near Marseilles to 3,500 and 5,000 volts. In the country overhead wires will be strung on iron poles, supporting an inverted porcupine platform under the cross-trees, to prevent unauthorized persons from reaching the wires. Underground transmission is regarded as ultimately necessary

A. C.-D. C. Locomotives for New York, New Haven and Hartford Railroad.

The present plans of the New York, New Haven and Hartford Railroad Company contemplate the electrical operation of its main line between New York city and Stamford, Conn., a distance of over 33 miles. That portion of the road which lies between the Grand Central Depot and Woodlawn, N. Y., utilizes the tracks of the New York Central Railroad and constitutes a portion of the electrical zone of that company within which the direct-current third-rail system is being installed. Between Woodlawn and Stamford the road will be equipped with the Westinghouse single-phase alternating-current system, and the trains will be operated by electric locomotives which take alternating current from the overhead-trolley line.

The power station of the New Haven company will be located at Riverside, Conn., three miles from Stamford. The power equipment will include three Westinghouse-Parsons horizontal steam turbines driving 25-cycle alternating-current generators of the revolving-field type, which have a rated continuous capacity of 3,750 kilowatts each when running single-phase and of 5,500 kilowatts when supplying a three-phase service. The generator armatures are designed for both single-phase and three-phase connection. They are wound for 11,000 volts and are connected direct to the trolley system. Absolutely no transforming stations or reducing transformers along the line will be required, but the entire system will be operated direct from a single central station without the interposition of sub-stations or auxiliary apparatus of any kind between the switchboard and the cars. This desirable simplicity is made possible by the alternating-current system and the high trolley electromotive force which will be employed. It is probable that, with a service equivalent to that now given by steam locomotives, electrical operation can be extended a distance of 20 miles beyond Stamford without the use of a higher transmission potential or the introduction of transforming stations.

High-potential Trolley Line.

The overhead construction will be supported from steel bridges, which will be located every 300 feet and which will normally span from four to six tracks, though on certain portions of the road longer bridges will be employed. Every two miles the bridge will be made of a specially heavy construction—forming an anchor-bridge, to make the overhead structure even more secure. The trolley wires will be hung from steel messenger cables, which in turn will be supported by heavy insulators mounted upon the steel bridges. Each trolley wire will be suspended from a pair of steel messenger cables by triangular supports, forming a double catenary suspension of great strength and stiffness. The triangular supports are placed about 10 feet apart. The messenger cables will have a total sag of about six feet, while the trolley wire itself will be held in a practically horizontal position.

The trolley system will be divided into sections approximately two miles in length, each section being separated from its neighbors by heavy line insulators. Adjoining sections will be connected through automatic oil-type circuit-breakers. If a short-circuit or other trouble occur in any section, therefore, it can be cut out without disturbing the operation of other portions of the line. Two feeder wires will be carried the whole length of the alternating-current line and will be so connected to the various sections of the trolley system by automatic switches that any section of four or more trolleys can be cut out of service and those beyond kept in operation.

The trolley wires will be held normally at a height of 22 feet above the track. The overhead system is designed with a safe margin to meet the stresses imposed by the most severe conditions, such as high winds or heavy coatings of ice.

Locomotives.

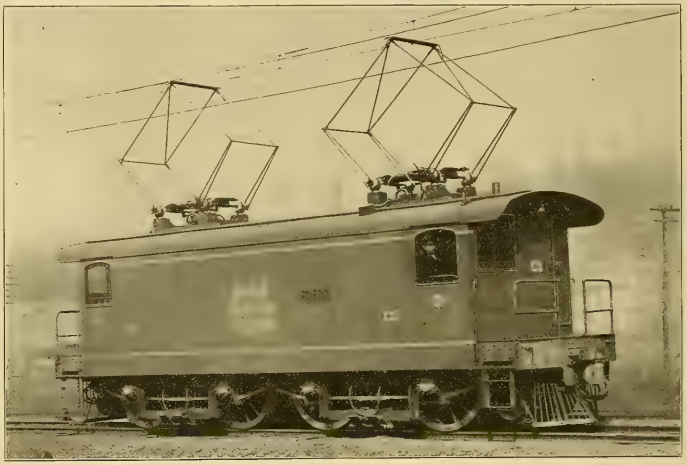
Thirty-five locomotives are to be furnished by the Westinghouse company, suitable for operation on the direct-current division between the Grand Central Depot and Woodlawn, and on the alternating-current portion of the line between Woodlawn and Stamford. One locomotive has already been constructed, and the results obtained assure the complete success of the alternating-current system.

The frame, trucks and cab of the locomotive were built by the Baldwin Locomotive Company, according to designs developed with the co-operation of the New Haven Railroad and the Westinghouse Electric and Manufacturing companies.

The Frame.—The frame is of the rigid type with side pieces made of steel channels to which are bolted and riveted other steel channels placed transversely, two over each truck, forming transoms for the transmission of the weight to the center pins. These channels are placed outside the wheels and as close together and as low down as the wheels and draw-head will permit, and are braced and squared by substantial steel flooring plates, which are riveted and bolted to the top flanges. The transoms are further braced by gusset plates which are riveted and bolted to the bottom flanges of both sets of channels and which transmit the tractive power from the center pin to the side channels. The frame is still further strengthened and secured by diagonal plate braces.

As the entire space between the wheels is occupied by the motors, it was impossible to transmit the drawbar pull through the center line of the locomotive; so the entire strain is carried by the strong plate girders which make up the locomotive frame. A Westinghouse friction draft gear is mounted directly underneath the box girder at each end and is applied to two steel bumpers laid horizontally between vertical gusset plates on the ends of the side channels.

The Trucks.—The running gear consists of two trucks, each mounted on four 62-inch driving wheels. The trucks have side frames of forged steel, to which are bolted and riveted pressed-steel bolsters, which carry the center plates. The weight on the journal boxes is carried by small semi-elliptic springs, with auxiliary coiled springs under the ends of the equalizer bars, to assist in restoring equilibrium. A very strong construction is secured without excessive weight by the use of bolsters 30 inches wide at the center plate and extended to nearly double that width at the ends, which are bolted to the side frames. Center pins 18 inches in diameter transmit the tractive effort to the frame. They are well lubricated to permit free motion on curves. The truck pedestals are provided with wedge and jib adjustments to take up wear, and the bearing brasses are easily removable by hand.



ELECTRIC LOCOMOTIVE FOR NEW YORK, NEW HAVEN AND HARTFORD RAILROAD.

The distance between truck centers is 14 feet six inches.

Cab.—The cab is formed of sheet steel mounted on a framework of Z-bars, which supports the walls and roof. Windows are provided at each end, giving an outlook on both sides and in front of the locomotive, and the driver is so close to the front that he can see the track a very few feet ahead. This advantage is not possessed by any type of steam locomotive now in service. The master controllers, auto-transformers, instruments, grid resistances, air-operating valves, compressors and other auxiliary apparatus are mounted inside the cab upon an angle-iron framework which is built into the cab and securely anchored to floor and roof. A clear passageway is left through the center. Trap-doors in the floor furnish easy access to the motors for inspection or repair.

Equipment.—The equipment of the locomotive includes four gearless motors, controlling apparatus and auxiliaries.

Motors.—The motors are of the compensating gearless type, designed for operation on both single-phase alternating and direct current. They are wound for approximately 235 volts on alternating current and 275-300 volts when operated by direct current. They have normal rated outputs of 250 horsepower on the basis of ordinary railway practice, and a continuous capacity of 200 horsepower each. The locomotive therefore has a continuous operating capacity of 800 horsepower.

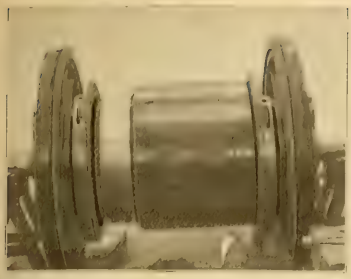
The motor frames are made of cast steel and are of a circular, skeleton form. They are divided horizontally into two parts, in order to give access to the inside of the field or to the armature. A laminated core with slotted projecting poles is built up within this frame and wound with field coils of flat copper strap insulated between turns with asbestos and filled with an insulating compound which is heat-conducting and waterproof, so that a sealed coil is produced which can withstand moisture and internal heat. Copper bars are placed in slots in the pole faces and connected to form a continuous neutralizing winding which forms part of the circuit including the main field coils, the armature coils and the auxiliary winding, all in series. This auxiliary winding produces a magnetic field which opposes and neutralizes the reaction of the armature. It is so formed that it need not be disturbed in order to remove the main field coils.

The armature core is built up of soft steel punchings, which are assembled on a cast-iron spider and held in place and keyed to prevent their turning. The surface is slotted and the armature winding is arranged in three layers. The two upper layers are composed of a copper strap connected to form the usual direct-current type of winding. The third layer constitutes the preventive winding. It is connected between the commutator and the main winding. This preventive winding is so proportioned as to minimize the combined loss due to the normal working current and that which is produced in the coil under commutation, when short-circuited by the brush in an alternating field. The individual coils are insulated along their entire length by overlapping layers of mica tape, and each group is further insulated from the core by a molded mica cell. The completed winding is held firmly in position by insulating wedges. The ends are banded down against the coil supports.

The commutator is formed of copper bars clamped between V-shaped cast-steel rings and insulated by V-rings and bushings of molded mica. It is pressed on the spider which supports the armature core. The brush-holders are of the sliding type with arms mounted on a rocker ring. Tension is provided with flat, phosphor-bronze springs, which have sufficient turns and are so mounted that friction between turns is eliminated and uniform pressure secured over a considerable range without adjustment. Each spring is held in a harness which definitely fixes the radius of movement of the spring tip. A pawl on the side of the spring harness allows easy adjustment of the tension.

Suspension.—The weight of each motor is carried on a frame which passes over the wheels and side frames and rests on the journal boxes. Each frame carries four bolts which receive the weight of the motor, and each bolt is fitted with a heavy coil spring at its lower end, through which all weight is transmitted to it, so that the motor is carried on very flexible springs and is independent of the truck frame.

The torque of the motor and the jar caused by sudden starts and stops are transmitted from the motor to the truck through heavy tie-rods, which affect the motion of the motor only lengthwise of the locomotive. The armature is not placed directly on a shaft, but is built up on a quill through which the car axle passes, with about five-eighths-inch clearance all around. The bearings which carry the field frame are mounted on this quill, and from a flange at each end of the quill seven round pins project parallel to the shaft into corresponding pockets formed in the hub of the driving wheel. The torque of the motor is transmitted from these pins to the wheel through helical steel springs which are wound with their turns progressively eccentric, and which are contained between two steel bushings, the smaller of which slips over the pin and the larger fits in the pocket in the wheel. These springs are under compression, both longitudinally and horizontally, so that, at all times, they fill the pockets in the wheel but permit a vertical and a lateral motion. Their longitudinal compression between the quill and the segmental cover over the outer ends of the pockets in the wheel keeps the motor at all times midway between the hubs. The end play of the motor does not come directly on the wheels, but is taken by strong coiled



A PAIR OF DRIVERS FOR ELECTRIC LOCOMOTIVE, WITH MOTOR ARMATURE, BEARINGS AND HOUSINGS.

springs inside of the driving pins, which pass against the covers in the outer ends of the spring pockets in the wheels. Though normally required to transmit only the torque of the motor and to keep the motor axis parallel to the axle, these springs are amply strong to carry the entire weight of the motor. They allow a total vertical movement of about three-fourths inch. The torque of the motor is taken by heavy parallel rods, which anchor the frame to the truck above and below the axle and permit vertical or side motion of the motor, but prevent excessive bumping strains from coming on the driving springs. If these springs are compressed more than one-fourth inch by the heavy centrifugal force exerted by the motor when rounding curves, the force is taken up by noses on the motor which fit into corresponding recesses in the cross-ties between the side frames of the locomotive.

This suspension has the advantage of removing all dead weight from the axle, of driving through springs, and at the same time of having the motor thoroughly anchored to prevent undue strain on the driving spring. The only parts of the locomotive not spring supported are the driving wheels, axles and journal boxes. It is a great improvement on any method of mounting gearless motors heretofore devised.

Forced Ventilation.—The motors are arranged for ventilation by a forced circulation of air which enters under pressure, is distributed throughout the motor and escapes through the perforated covers. In the floor of the cab there is a natural conduit formed by the side channels of the frame, the floor and side walls of the cab, and a lower plate, through which air is carried to the motors, transformers and resistances. This method of cooling improves the continuous capacity of the apparatus and is, in a large measure, accountable for the high continuous rating of the motors, which almost equals that on the one-hour railway basis. The air furnished to the motor is taken from the inside of the cab and can therefore be kept relatively clean and dry.

COMPLETELY EQUIPPED TRUCK OF ELECTRIC LOCOMOTIVE USED ON NEW YORK AND NEW HAVEN RAILROAD.

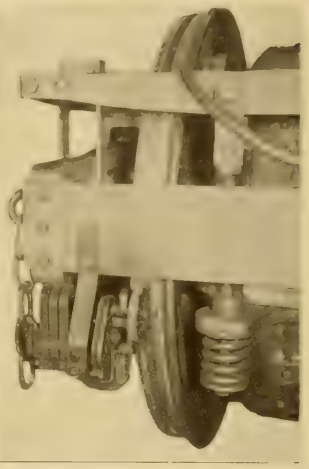
Current Collection.—On the direct-current part of the line, current is taken from the third-rail system by eight collecting shoes, four on each side of the locomotive, arranged in pairs of two each. There are two pairs on each side, one at each end, for the purpose of bridging such gaps as may occur in the third-rail system. The direct-current contact shoes are designed to work on two forms of third rail—one in which the shoe runs under the rail, and the other on top of the rail. To collect alternating current from the high-potential overhead-trolley line, the locomotive is equipped with two pantagraph-type bow trolleys, each of which has a capacity sufficient to carry the total current required by the locomotive under average conditions, two being provided to insure reserve capacity.

The Control System.—On direct current the motors are controlled in series parallel, as in ordinary street-railway practice. In alternating-current operation no resistance is used in the regular run, but a small resistance, which constitutes a preventive device to diminish the short-circuiting effect current supply to all. Each line switch is provided with an overhead trip, so connected that all of the switches of both switch groups, as well as both the line switches, open in case of an overload or short-circuit on either pair of motors or in the circuit of either pair. The overload trip is automatically locked out when brought into action and cannot be reset until the master controller is returned to the off position.

The external resistances used in regulating the flow of current to the motors are arranged in two groups which are connected in series when the motors are in series, and in series with each motor when the motors are in parallel. The change over between the direct current third rail and the alternating-current overhead system can be made easily and quickly, even when the locomotive is running at full speed.

An ammeter is mounted in each end of the locomotive in plain view of the operator when at the master controller.

The master controller is of the drum type and



MAGNETO SPEED INDICATOR FOR ELECTRIC L[illegible] M[illegible].

two blowers, driven by similar motors, and which furnish air to the transformers, motors and direct-current rheostats; oil circuit-breaker for the high-tension circuits; switches to change the equipment from alternating to direct current; a steam generator to supply heat to the railway coaches in cold weather; a complete Westinghouse air-brake equipment, signal apparatus, automatic bell ringers, whistles, sanding apparatus, etc.

Dimensions and Performance.—The New Haven locomotive measures 30 feet four inches over the bumpers and weighs approximately 85 tons. It is capable of handling a 200-ton train in local service on a schedule speed of 26 miles an hour, with stops averaging about two miles apart—making in such service a maximum speed of about 45 miles per hour. It can also handle a 250-ton train on through service with a maximum speed of about 60 miles per hour. With heavier trains it is planned to couple two or more locomotives together and operate them in multiple.

Tests.—The tests which have been made on the first locomotive equipped show that it will, without difficulty, meet all the requirements for which it has been designed.

This locomotive has, on actual test, repeatedly accelerated a 200-ton train at a rate of 0.5 mile per hour per second, which is in excess of the rate required by the service conditions of the New Haven road. The current and power consumption correspond very closely to the predetermined values. The line upon which the locomotive has been tested is not well adapted to high-speed work, on account of the numerous sharp curves which exist, but, in spite of these adverse conditions, the locomotive has been operated at speeds above 60 miles an hour without difficulty.

A Telegraph Semi-Centennial.

The current year of 1906 marks the fiftieth anniversary of the founding of the Western Union Telegraph Company. By act of the Legislature of the state of New York, passed April 4, 1856, the company was granted its original charter. Prior to that date and between the years 1851 and 1856, the predecessor company was known as the New York and Mississippi Valley Printing Telegraph Company. The change to the name of the Western Union was to shorten a long title and to adopt one that would indicate the union of the western lines, which had just been consummated, into one compact system

Underwriters' Report on Electrical Conditions in Detroit.

The National Board of Fire Underwriters has made an exhaustive report on the city of Detroit, Mich., and special attention has been given to electrical conditions. What follows is interesting as representing, in part, the conclusion of the fire-insurance people.

In relation to inside work it is reported that in December, 1905, 25 new and 68 old installations were inspected by National Board engineers to ascertain the quality of the city inspection work and the general condition of the old work. In the new work inspected, a total of 244 alleged defects was found, or an average of about 10 to each installation. The following most prominent deficiencies found include 63 per cent. of the whole:

Circuits overfused; flexible cord not properly suspended; flexible cord too long or used as line wire; stranded wires not properly soldered at connections; wires not properly bushed through walls, floors, etc.; unapproved tubes and bushings; wires in contact with or not properly separated from gas pipes or other metallic or conducting bodies; unapproved insulation of service wires; unapproved insulation of wires for conduit work; bad work around meter; rheostat or starting box not properly separated from inflammable material and wooden molding not standard or not waterproofed.

A large conduit equipment recently approved was found to contain the following defects: Fusible cut-out located 50 feet from service entrance; lead sheathing of service cable not grounded; conduit system incomplete and not grounded; a number of outlets without outlet boxes; absence of junction boxes in a number of places; conduit not bushed at outlets; some single braid wire in unlined iron conduit; unapproved fixture wire; fixture canopies not insulated; distribution all floors through picture molding; unapproved cartridge fuses and rheostat improperly mounted.

It is asserted that fully 80 per cent. of the defects found are due to original installation and should have been remedied through rigid inspection.

In the old work inspected 744 alleged defects were found, or an average of about 11 to the installation, one equipment running as high as 18. In addition to the deficiencies noted under new work many cases were found of porcelain-base link-fuse cut-outs, unapproved flexible cord or cord old and frayed, joints not properly spliced or joined or not properly soldered and taped, wires not properly supported, cleats unapproved or in poor condition, wires in wooden molding in damp places, wires not properly arranged in elevator shafts, insulation of wires unapproved or in poor condition, dead wires in buildings and numerous other defects.

Outside construction work receives practically no supervision from the city, and is said to be in a poor condition in a large number of cases. The rule requiring wires to be placed underground is poorly enforced in regard to telephone, telegraph and signaling wires, numerous lines of which cross streets. In lighting and power work services from the underground systems are brought up in the interior of blocks and distributed along the rear of buildings; the telephone, telegraph and signaling systems almost universally use distributing poles in the interior of each block. All of the principal companies own conduit systems and frequently high and low-tension circuits occupy the same manhole. Pole lines are often used in conjunction by high and low-potential lighting circuits and telephone, telegraph and fire-alarm circuits.

The municipal lighting plant supplies current for all street and public-building lighting. No series arc-light circuits enter buildings; maximum voltages are 5,500 volts, both alternating current and direct current. Part of the alternating current is stepped down to 110 volts alternating current for incandescent lighting, some of the transformers being located inside of buildings, notably at the fire-alarm headquarters. Within one-half mile of the City Hall all wires are underground, except for a pole line from the station through the southeast part of the district; part of the wires adjacent to this district are also underground.

The Edison Illuminating Company supplies commercial light and power. Three-phase 4,600-volt alternating current is brought from outside the city limits through independent conduit to two sub-stations and transformed to 120-240 volts direct current; neutral grounded at station. All wires within one-half mile and some as far out as the three-mile circle are underground.

The Peninsular Electric Light Company also furnishes commercial light and power. Three-phase 4,600-volt alternating current is brought from outside the city limits through a conduit used by the Edison Illuminating Company. Part of this is distributed without transformation, part stepped down to 2,300 volts, part to 108-216 volts and part to 120-240 volts alternating current in two sub-stations. Bank transformers on poles and a few individual transformers in dwellings step down the 2,300-volt current to 108-216 volts. No current is supplied within the half-mile circle, and only a small amount of wires underground outside.

The Detroit United Railways Company operates all of the street railways and has about 192 miles of overhead trolley, with rail return, operated at 565 volts direct current, with 284 miles of overhead feeders. Rails are well bonded, generally with heavy copper wire, with special arrangement at turn-outs and crossings. There is only a small amount of return feeder.

The following companies maintain low-tension or signaling systems, all circuits being protected from heavy currents by one-fourth to one-half ampere fuses at least at one end: Michigan Telephone Company, Co-operative Telephone Company, Western Union Telegraph Company, Postal Telegraph Company, Michigan Auxiliary Fire Alarm Company, American Still Alarm Company, and the city fire-alarm and police signal systems.

Space Telegraphy for North Pole Expedition.

Announcement is made by the Chicago Record-Herald that Walter Wellman has negotiated a contract with the American De Forest Wireless Telegraph Company for equipment of the Wellman-Record-Herald North Pole expedition with space telegraphy. This application of space telegraphy is interesting. Leading wireless companies, on both sides of the Atlantic, are said to have sought the opportunity to furnish their systems to the expedition. Mr. Wellman decided in favor of the De Forest company, after a thorough investigation of various systems, particularly in view of the good results of the De Forest system in work for the United States Navy.

Abraham White, president of the De Forest company, promises to furnish the means of sending a wireless message from the Pole to the Record-Herald, provided Mr. Wellman succeeds in reaching the Pole in his great air ship.

The wireless company undertakes to demonstrate the possibilities of the wireless art and of its system by establishing and maintaining communication between the expedition and Norway, no matter how far from Norway the airship may voyage, even to to the North Pole itself. By its contract the company agrees to establish wireless station No. 1 at Hammerfest, Norway, which is the most northerly town on the globe, with regular cable communication to the civilized world. Station No. 2 is to be upon the expedition steamer Frithjof, now lying at Tromso, Norway. This steamer is to carry the expedition and its equipment, including the airship, to North Spitzbergen, where headquarters are to be established. As the Frithjof is to remain at the headquarters, wireless communication is to be established between that point and Hammerfest, 650 statute miles distant.

Wireless station No. 3 is to be installed upon the airship, and messages are to be sent back to the Frithjof at Spitzbergen, and from Spitzbergen to Hammerfest. The De Forest experts expect to be able to transmit from the airship a distance of 650 statute miles, or 575 geographical miles, which is equivalent to the distance between the headquarters and the Pole.

All the wireless installation for the polar expedition is to be installed before June 15th, as on that day Mr. Wellman expects to leave Norway for Spitzbergen. Whether the airship voyage from Spitzbergen toward the Pole be made this year or next will depend upon circumstances. The De Forest company has full charge of the wireless equipment and is responsible for securing results.

Mr. M. J. Smith is the wireless expert and superintendent of the Wellman-Record-Herald expedition. He is said to be the foremost space-telegraph operator in America. Mr. Smith will be the operator on the airship.

It is said to be not improbable that by July or August the De Forest company may be able to maintain wireless communication across the Atlantic Ocean. The British De Forest company is establishing a station at Iceland, and it is possible that a station may be able to get Hammerfest or Spitzbergen, and to transmit across to Newfoundland or the American mainland.

Marconi Company's Report.

The Marconi Wireless Telegraph Company has issued a report showing the net profit for the year ended September 30, 1905, to have been £16,750. In view of large expenses for development it was decided to make no distribution to shareholders. The report says the company is making satisfactory progress all over the world, and the business of space telegraphy is being extended wherever profitable business seems likely to result. The report says that the directors are unable to give publicity to many existing and pending contracts.

The expenditure during the year on development was £13,244. The amount of the company's shares in the American, Canadian and Marconi International Marine companies stands at £1,439,285. As regards progress and work done, mention is made of new patents for directed transmission, and it is stated that the new station in Canada is now finished and has been working satisfactorily. This station has been tested for the transmission of messages to England, and the directors are satisfied that the difficulty of transmitting signals in bright sunlight has ben surmounted, and that a regular service can be maintained. A station like the one in Canada is being erected in Ireland. Considerable development has taken place in the use of the system in the navy, especially from the high power station at Cornwall. Seven stations have been erected in China for inland work.

Oxone.

The Niagara Electro-Chemical Company of Niagara Falls has a new product, to which the name "Oxone" has been given. It is a discovery of George F. Brindley, who for years has been manager of the Niagara plant, but who will shortly depart for the Orient. It is a specially prepared fused form of sodium peroxide, bluish gray in color, and has the peculiar property of emitting free oxygen when it comes in contact with carbon dioxide charged with moisture. It is this peculiar quality that arouses the belief that "Oxone" is to be particularly beneficial in submarine navigation, for the use of "Oxone" aboard the submarine vessels will insure a supply of pure air, for it will keep the supply of free oxygen quite constant.

Two experiments made with "Oxone" in Niagara Falls have attracted attention. The first was the placing of a man, Dr. R. von Foregger, in an air-tight box, three by six feet in size, two pounds of "Oxone" being placed in the box with him. According to calculations made, the air supply in the box should have lasted Dr. von Foregger about 20 minutes, after which he should have succumbed to asphyxiation. Instead, however, he remained in the box six hours, smoking and reading. He suffered no distress, but apparently was exhilarated. At the end of six hours the air in the box grew bad very rapidly, but the conclusion was that had more "Oxone" been used he could have remained in the box for a longer period of time.

Still another experiment was made before the Western New York section of the American Chemical Society in the public-library building in Niagara Falls on the evening of Tuesday, April 3d, when five healthy rabbits were placed in an air-tight box with something over six ounces of "Oxone." At the end of three hours they were taken out, in seemingly perfect condition.

A further use for "Oxone" may be found in its probable usefulness in connection with mining. "Oxone" generators in the form of a portable apparatus may be placed on the market. In this form the new product would be of value to country physicians who might be called upon to provide a supply of free oxygen in cases of serious illness—pneumonia, for instance.

Street Railways of York, Pa., Sold.

The negotiations which have been going on for the sale and purchase of the York (Pa.) Street Railway and its valuable franchises has been consummated. Brown Brothers of Philadelphia made the purchase. It is said that several millions of dollars were involved in the sale of the roads. Captain W. H. Lanius, president and founder of the road, will tender his resignation and a new president will be elected; also a new board of directors. The property is one of the most valuable pieces of trolley roads in the state. The York County Traction Company, previous to the sale, owned and controlled all of the lines of street railway in the city of York, together with the suburban line to Dallastown, Red Lion and Windsor, and the York and Dover electric railway. In addition, there is the York Haven Street Railway Company and the York and Wrightsville Street Railway Company. These 25 miles of suburban road are allied to the York County Traction Company, and operated by the York Street Railway Company. The total trackage of the entire system is 56 miles, and there are carried during the year something over 4,000,000 passengers.

The Edison Electric Light Company, the Westinghouse Electric Light Company and the York Steam Heating Company belong to the trolley property. The corporations which have been chartered by the promoters of the trolley system are as follows: Penn Park Street Railway Company, Red Lion and Windsor Street Railway Company, Wellsville Street Railway Company, York and Dallastown Electric Railway Company, York and Dover Electric Railway Company, York and Hanover Street Railway Company, York and Manchester Electric Railway Company, York and Wrightsville Electric Railway Company, York County Traction Company, York Haven Street Railway Company, York Street Railway Company. The new corporation, upon assuming control, will extend the trolley lines already projected. They will form a network over the entire country.

General Electric Fan Motors for 1906.

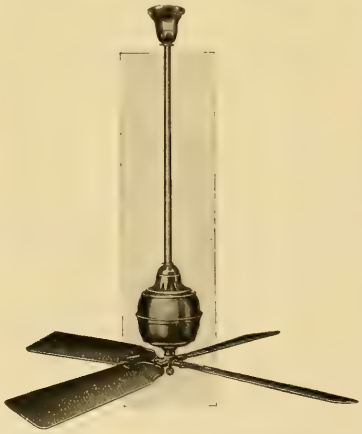
Fan motor practice has become more or less fixed, and the General Electric Company's fan motors for 1906 retain all of the distinctive features which have made them standards in previous years. Attention has been concentrated on increasing the efficiency of the motors by embodying every electrical and mechanical improvement suggested by past experience. As a result the general appearance of the 1906 fan is very similar to the predecessors, and it retains the good qualities of careful design and construction. Both direct and alternating-current fans have a special black design, a positive trunnion adjustment and excellent lubrication.

In the design of the blades the end attained was that of distributing the air over a wide angle, not of delivering a straight column of air covering a limited area. Coupled with this excellent blade

Alternating-current Desk Fan.

Alternating-current Exhaust Fan

Direct-current Wall Bracket Fan.



Direct-current Ceiling Fan with Wood or Aluminum Blades

GENERAL ELECTRIC FAN MOTORS FOR 1906.

design is a sure and positive trunnion adjustment, which permits the quick change of the breeze for either horizontal or vertical circulation. In making these changes the position of the motor can always be positively fixed by a notched clamp and thumbscrew. Wick oilers are provided, and the oiling devices require no attention beyond the annual renewal of oil. As has been stated, the blades of the fans are constructed on correct mathematical principles properly to distribute the air over a wide angle, and, at the same time, they are carefully balanced and hung, insuring elimination of disagreeable humming.

For frequencies of 60, 125 and 140 cycles the General Electric fan consists of a single moving element without contacts, revolving in a ventilated cast-iron field frame of compact design. Speed changes in the alternating-current motors are obtained by a six-point reactive coil and switch. The variation in speed so obtained makes the standard desk or wall bracket type of fan motor of universal application. It may be operated on slow speeds for the office desk and home or on the higher speeds for stores and halls.

The General Electric Company's direct-current fans have cast-iron frame of elliptical form, with ventilated removable end shields, rendering the brushes, commutator and armature easily accessible. Rectangular brushes are used, giving the largest area of contact on the commutator, and an ingenious brush holder insures constant brush pressure on the commutator, keeping it polished and practically free from wear. Speed regulation is provided in the direct-current desk and wall bracket type by a [illegible] switch and [illegible] speed.

In addition to the [illegible] type of direct-current [illegible] the company [illegible] fan for either [illegible] are ordinarily [illegible] can also be furnished [illegible] use in damp locations. In the [illegible] regulating device [illegible] erated by a button at the [illegible]

For special ventilating purposes [illegible] hotel and restaurant [illegible] tor is supplied, for use on [illegible] direct current. These comprise the [illegible] vated and trunnion type of the [illegible] current and alternating-current [illegible] a special bracket, and adapted [illegible] windows, ventilating ducts, etc. Complete motor blower fan can also be supplied [illegible] purposes in mine and factories. Another type for both alternating and direct current [illegible] compact little telephone-booth fan motor, which helps make conversation pleasant in a closed telephone booth on a hot day.

All these various types can be furnished in the standard commercial sizes, and for any commercial voltage or frequency, or can be ordered with special windings for operation on odd voltages or frequencies. In general, the standard finish is black with brass trimmings, but this practice, too, may be varied to suit the taste of the customer.

Iowa Conventions.

The sixth annual convention of the Iowa Electrical Association will be held at the Kirkwood Hotel, Des Moines, on April 18th and 19th, beginning at 10 a. m. on the opening day. Partly in unison with it, the third annual convention of the Iowa Street and Interurban Railway Association will be held at the same place on April 19th and 20th. Both conventions have excellent programmes, that for the electrical association having already appeared in the Western Electrician.

Mr. L. D. Mathes, general manager of the Union Electric Company of Dubuque, and secretary of the Iowa Street Railway and Interurban Association, has issued a characteristic circular calling attention to the features of the convention of his association. These include papers on "Transfers," by J. F. Ohmer of Dayton; "Testing," R. W. Conant, Cambridge, Mass.; "Gasoline Motors," F. W. Held, Chicago; "Standard Car Body and Truck," G. H. Tontrap, St. Louis; "Discipline," J. G. Huntoon, Davenport, and "Operator and Supply Man."

Transportation Arrangements for Atlantic City Convention.

[illegible] meeting [illegible] Atlantic City [illegible] for the [illegible] than June 1st next [illegible] turn until [illegible] [illegible] at the meeting delegates [illegible] Mr. George L. Perry [illegible] transportation, to be [illegible] address in New York [illegible] It has been arranged that [illegible] will be in attendance [illegible] 5th, 6th, 7th and 8th. A [illegible] collected for each certificate [illegible]

In the West rapid progress [illegible] organization of [illegible] Already arrangements have been made by Assistant General Transportation Agent Frank L. Perry [illegible] Building, Chicago, with Assistant General Passenger Agent C. L. Kimball of the Pennsylvania Lines at Chicago, to furnish delegates [illegible] West with one of the most elaborate special Pennsylvania trains, consisting [illegible] and observation cars, Pullman standard sleepers and the Pennsylvania Lines dining cars. The train to be furnished is in fact equivalent in equipment to the Pennsylvania Limited and the "Pennsylvania Special," the latter the "18-hour train" Chicago to New York. This N. E. L. A. train will be run east from Chicago over the Fort Wayne Route, through Fort Wayne, Pittsburg, Harrisburg and Philadelphia, all rail to Atlantic City.

This special convention train, which will be the official train for the exclusive use of delegates, electrical supply men, their ladies and friends, will leave Chicago at 2 p. m. (Chicago time) Sunday, June 3d, to arrive at Atlantic City Monday, June 4th, 4 to 5 p. m. (Atlantic City time). It will run through solid from Chicago to Atlantic City. Those in the West desiring to join the convention party and go east from Chicago to Atlantic City on this "special" should without delay early make reservations direct, addressing C. L. Kimball, 2 Sherman Street, Chicago, or apply to the city ticket office, 248 South Clark Street, Chicago, as the road for convenience is handling all inquiries appertaining to reservations for Mr. Perry for the National Electric Light Association.

For the benefit of those living in the west in a zone between Chicago and the Pacific Coast, and who might consequently be willing to pass through Chicago on their way East, arrangements are being perfected by which there will likely be started over the Burlington route from Denver a special car to leave that point at a time suitable to make easy connections at Chicago with the Pennsylvania Special leaving Chicago from the same depot for Atlantic City Sunday at 2 p. m., June 3d. Special trains will also be run from Boston, New York and Philadelphia.

Further information in various parts of the country may be obtained from the following named:

C. O. Simpson, Little Rock Railway and Electric Company, Little Rock, Ark.

W. J. Barker, Denver Gas and Electric Company, Denver, Colo.

C. H. Hodskinson, 70 State Street, Boston, Mass.

A. H. Manwarine, Tenth and Sansom streets, Philadelphia, Pa.

A. E. Giles, Empire Building, Atlanta, Ga.

J. W. Cunningham, Capital Electric Light, Motor and Gas Company, Boise, Idaho.

F. S. Hunting, Fort Wayne Electric Works, Fort Wayne, Ind.

J. H. DeGrange, New Orleans Railway and Light Company, New Orleans, La.

F. F. Phillips, Peninsular Electric Light Company, Detroit, Mich.

H. J. Gille, St. Paul Gas Light Company, St. Paul, Minn.

A. G. Monroe, secretary Nebraska Electric Companies, Omaha, Neb.

W. R. Huntley, Buffalo General Electric Company, Buffalo, N. Y.

F. H. Gale, General Electric Company, Schenectady, N. Y.

H. W. Plummer, Asheville Electric Company, Asheville, N. C.

W. J. Hanley, 100 and Columbus Savings and Trust Building, Columbus, Ohio.

J. J. Cagney, Montreal Light, Heat and Power Company, Montreal, Canada.

W. E. Seavey, Junction City, Kan.

Samuel G. Reed, Seventh and Alder streets, Portland, Ore.

J. C. McQuiston, Westinghouse Companies, Pittsburg, Pa.

W. M. Fuller, Charleston Railway, Gas and Electric Company, Charleston, S. C.

J. R. Cox, Brush Electric Light and Power Company, Galveston, Tex.

John Montgomery, Jr., Utah Light and Railway Company, Salt Lake City, Utah.

W. S. Hege, Allis Chalmers Company, Milwaukee, Wis.

H. G. Nicholls, 14 King Street, East, Toronto, Canada.

F. B. Blankenstein, Virginia Passenger and Power Company, Richmond, Va.

Argentine Republic as a Market for Electrical Goods.[1]

The population of Argentina does not exceed 5,500,000; nevertheless, the imports in 1905 amounted to £41,000,000 [£1 = $4.87], and the exports to £65,000,000, making a total trade of £106,000,000, or an average per inhabitant of over £20. The only countries which have a greater average total trade per inhabitant are Holland, Switzerland, Belgium and the United Kingdom. This fact in itself should be sufficient to attract the attention of manufacturers of all classes to this market. Moreover, comparing the total figures for 1905 with those for the previous year, we find that the imports increased by about £3,000,000 and the exports by about £12,000,000, while the figures for 1904 showed an increase of nearly £12,000,000 over the average of the previous five years in the imports, and an increase of about £14,000,000 in the exports.

The detailed figures for 1905 are not yet available, but the figures for 1904 show a marked increase in the importation of electrical goods. Taking a few of the headings given in the trade returns for Argentina, we find that the imports of telephone apparatus in 1904 amounted in value to 25,107 pesos [1 peso = 96 cents], or an increase of 8,792 pesos on the quinquennial average; almost half the imports are from Belgium. The value of dynamos imported was 60,946 pesos, an increase of 6,453 pesos; 25,465 pesos were from the United Kingdom and 21,561 from Germany. The imports of material for electrical appliances amounted to 304,095 pesos, or an increase of 108,823 pesos; the imports from Germany amounted to 117,115 pesos, an increase of 51,156 pesos; from the United Kingdom, 98,040 pesos, an increase of 40,733 pesos, and from the United States 28,686 pesos, a decrease of 17,320 pesos. Motors, other than wind motors, were imported to the value of 571,433 pesos, an increase of 244,286 pesos; from the United Kingdom 123,854 pesos, an increase of 59,926 pesos; from the United States 228,689 pesos, an increase of 131,095 pesos; and from Germany 109,673 pesos, an increase of 51,468 pesos.

Wire and cables for electrical purposes were imported to the value of 662,213 pesos, an increase of 144,654 pesos; the imports from Germany exceed those from all other countries together, and amount to 453,046 pesos, an increase of 217,024 pesos; the imports from Italy are next, amounting to 92,894 pesos, an increase of 92,894 pesos; the imports from all other countries show a decrease as compared with the average of the previous five years; in the case of the United Kingdom this decrease amounts to no less than 74,087 pesos. Electric meters were imported to the value of 40,776 pesos, of which 25,200 pesos were from Germany. Electric bells are practically all of German origin, while two-thirds of the electric ventilators imported come from Italy. Carbons for arc lamps were imported to the value of 27,054 pesos, of which 14,417 pesos were from Germany; and there were practically none from the United Kingdom. Arc lamps were imported to the value of 34,786 pesos, and incandescent lamps to the value of 99,274 pesos; of the former, 25,222 pesos were from Germany, and of the latter 56,376 pesos. Tramway material was imported to the value of 499,958 pesos; the imports from Germany amounted to 200,313 pesos; from the United States 142,894 pesos, and from the United Kingdom 103,610 pesos. In telegraph material, the United Kingdom holds almost the whole of the trade.

So much for the statistics of the imports of electrical goods, which goes to show that, as a general rule, the imports from Germany have increased greatly, while in most cases those from the United Kingdom have not increased in anything like the same ratio. In many cases the cause of this increased trade with Germany may be traced to the fact that German capitalists have taken a keen interest in South American undertakings, and particularly in those of Argentina, hence the supplies for these undertakings have been of German origin. The interest which German capitalists have taken in Argentine enterprises was recently commented on by the German minister at Buenos Ayres, who stated that German capital in that country was in a very flourishing condition, and that its employment was being greatly increased, particularly in electrical enterprises. The change in the last few years in the conditions on the Argentine market as to the countries supplying electrical machinery is extremely interesting. Reporting in 1898, Mr. Worthington, the commissioner appointed by the British government to inquire into the conditions of trade with South America, stated, with reference to Argentina, that the bulk of electric-light plant, and practically all the electric-traction plant, was imported from the United States, and that American manufacturers had gained their trade by supplying machinery to the requirements of the market, and capable of working well under local conditions. In the commissioner's own words: "The American electric machinery is looked upon as the most advanced. The English, I am told, have not kept pace with the American improvements and new inventions, while the Germans have carefully watched and promptly copied the Americans." German manufacturers are now evidently gaining the reward of their labors at the expense even of American manufacturers.

In all parts of Argentina concessions are continually being granted for electric-lighting, power and tramway works, but in this connection it may be well to repeat the warning recently given by the British consul at Rosario, that great care should be taken by capitalists to ascertain the legality, exact terms, etc., of concessions before making any investments. Among some of the works recently undertaken, or proposed to be undertaken, may be mentioned the electric lighting of Rosario and the electrification of its tramways, the electric lighting of Bahia Blanca and other towns, the extension of the electric tramway systems of Buenos Ayres, the installation of new telegraph lines and the extension of those at present existing. Proposals are also being made for an extensive system of underground railways for Buenos Ayres, and it is stated that German capital is already interested in this project, which promises to be a very important work. The construction of port works at Rosario, which is now being carried out by two amalgamated French firms, although, perhaps, not of direct interest from an electrical point of view, may be cited as a further proof that great developments are being made in the conditions of the country. Recent notices in the Argentine Press state that the minister of public works proposes to ask Congress to sanction the construction of extensive port works at Buenos Ayres, as the present port has become inadequate to cope with the increased trade.

The duty leviable on electrical goods in Argentina is, as a rule, 25 per cent. ad valorem, with the exception of certain kinds of wire, which pay only five per cent.; certain kinds of shades which pay 40 per cent., and carbons for arc lamps which pay 35 per cent. At the present time a surtax of two per cent. ad valorem is leviable on all goods paying a duty of 10 per cent. or more, so that in the great majority of cases electrical goods would pay 27 per cent. ad valorem. The valuations for duty are fixed from time to time by the customs authorities. Duties are payable in gold (one peso gold = 4s.), but national currency is accepted at the rate of one peso = 44 cents. Machinery, main pipes, etc., for the public installation of gas or electric lighting are only dutiable at five per cent., and in many cases special provision is made that the goods necessary for certain public works shall be admitted duty free.

The following are amongst the chief importers of electrical goods in the larger towns of Argentina:

Buenos Ayres—Cia Luz Electricia y Traccion del Rio de la Plata; Cia Sud Americana de Luz y Fuerza; Cia de Alemana Transatlantic; Cia de los Tramways de la Capital; H. Kruger, 386 Florida; Otto Straube, Congallo 1,701; Adolfo Mantels & Co., Belgrano, 602; Juan Quevado, Cangallo, 380; Augusto Parcus, Moreno 477; Juan Carosio y Cia, Sulpacha 433; Le Roy de Bonneville Edmundo, Cangallo 1,268; Walter Kohlstedt, Monreno 487.

Bahia Blanca.—Empresa de Luz Electrica.

Rosario.—Wedekind & Weihmüller, Libertad 754.

Apart from these there are, of course, the large importing dealers who have their own agents in Europe and who often visit producing markets themselves, and the smaller ones who order through agents and travelers. In the case of firms having their own buying agents in England, payment is usually made on this side, against shipping documents. For direct trade good travelers or agents are practically indispensable, as the personal element enters very largely into business. In this respect it may be mentioned that in Buenos Ayres a tax of about £4 7s. 6d. per annum is levied on foreign commercial travelers, whilst in other provinces the taxes range from £8 15s. to £147 per annum. The travelers should be well supplied with catalogues printed in Spanish, which is the language of the country, with prices in Argentine currency, and weights and measures in the metric system. Samples and models are also of great value in gaining orders. Samples without commercial value are admitted free of duty; samples of value are charged with duty which is refunded on re-exportation within six months. Advertising of the most elaborate and expensive type is very much in vogue. It is important to note that a contract signed in the United Kingdom cannot be enforced in Argentina unless it has been visé at an Argentina consulate in tthe United Kingdom.

In conclusion it may be stated that in a recent report the British Consul at Buenos Ayres wrote as follows: "The opportunities for the extension of British trade appear to exist in every direction and in every line of business. What is wanted are the people who are willing and also qualified to take advantage of the openings."

1 From the Electrical Review of London.

A big Pittsburg brewing concern whose brewery stands near the Carnegie Technological Institution advertised recently that it would put "Tech" beer on the market. Director A. A. Hammerschlag of the Carnegie schools saw the advertisement and communicated with Mr. Carnegie, who protested, but to no avail.

Motor Drive in a Large Furniture Factory.

From the seven buildings, of brick and concrete construction, which constitute the new works of the Horrocks Desk Company of Herkimer, N. Y., are produced annually a great number of desks and typewriter cabinets. The arrangement of the buildings in relation to each other is particularly suited to the economical process of manufacture used, in which the raw material, lumber, etc., entering the factory, progresses by various stages to the completed product, packed for shipment without a single retrogression or unnecessary handling. The manufacture of this product is also greatly facilitated by the use of motor drive in the various departments.

The power-house equipment contains three 450-horsepower boilers, supplying steam to a 250-horsepower high-speed engine, direct coupled to a 150-kilowatt generator wound for three-phase, 240 volts and a speed of 225 revolutions per minute, and a smaller engine (150 horsepower) of the same type is direct connected to a 75-kilowatt generator of characteristics similar to those of the larger machine. A 12½-kilowatt 120-volt belted exciter is driven from the shaft of the 150-kilowatt generator, while a 12½-kilowatt engine-type exciter is installed for auxiliary purposes and also used for running the watchman's lights at night and for the office lighting when used. The generators are of the Allis-Chalmers make.

The power derived from this plant is applied to some 70 Allis-Chalmers induction motors, which drive every machine in the plant, either directly mounted upon it or belted to it from ceiling, side wall or floor. These motors range from two to 40 horsepower and aggregate over 500 horsepower in all. The main building is equipped with an extensive blower system operated by two 40-horsepower motors. Shavings are carried direct to the power house and automatically fed to the boiler fires.

The office and main building of the group faces German Street and has a frontage of 202 feet by 74 feet in width, four stories high. Adjoining it on the west is the office building, which is 30 by 32 feet, and three stories in height. The finishing building standing south of the main building is 252 by 62 feet and four stories in height, connected to the main building by a two-story bridge leading from the third and fourth stories. The power house adjoins the main building on the south.

Consolidation of "Tri-Cities" Public-service Utilities.

The Tri-City Railway and Light Company of Hartford, Conn., has filed a certificate of incorporation in that city. Its authorized capital is $12,000,000 and it will acquire and hold the stock of the traction, light and power utilities of Rock Island and Moline, Ill., and Davenport, Iowa. Harry A. Saben and J. Morris Miller of New York and William Waldo Hyde of Hartford are the incorporators.

There is in the locality of the "Tri-Cities" at the present time eight separate companies, supplying light, power and transportation for about 100,000 inhabitants. These are the Tri-City Railway Company, operating a railway in Davenport, Rock Island and Moline; the People's Light Company, doing a gas and electric-light business in the city of Davenport; the People's Power Company, doing a gas and electric-power business in Moline and Rock Island; the Davenport and Suburban Railway, between Davenport and Grand Island; the Davenport Gas and Electric Company, a direct competitor of the People's Light Company; the Mississippi Valley Traction Company, operating an electric railway between Moline and Watertown, and the Moline Water Power Company, which controls the Mississippi River waterpower developments in the district.

The report of the physical condition of the properties of these companies was made by J. G. White & Co., and it is probable that the operating department of the same company will be charged with the work of operating the consolidated system in accordance with the best modern practice.

Laying Cables in Simplon Tunnel.

The laying of the electric cables for the Simplon Tunnel has been completed, says a Swiss correspondent of the London Times Engineering Supplement, and a few details of the plan adopted may be of interest. The train which carried the drums was composed of a passenger coach for the staff of workpeople, a truck for tools, one carrying the lighting plant, another for the cables, a third fitted up with side pulleys for unrolling the drums, and then another cable truck, with its truck for pulleys, making seven vehicles in all, in addition to the engine. With this equipment two kilometers of cable were laid, and then the train went back to the station for more drums, with which it returned to the tunnel. Owing to these special arrangements it became possible to lay the whole length of the cable, amounting to 68.34 miles, in a little over a fortnight.

Electric Light and Power Supply for London.

Of the numerous bills before the English Parliament for furnishing power to London through large generating plants situated outside the city only three propositions deal with the problem in a really comprehensive manner. These are as follows: The administrative County of London and district electric power bill, which is a replica of last year's measure; the "additional" electric power supply bill, and the scheme promoted by the London County Council. Of these the "additional" electric power bill is an extremely novel one, for the proposition is to erect a generating station on the coal fields some 50 miles to the north of London and having negotiated a private right-of-way with the railway company into London, the intention is to build an overhead transmission line on land adjoining the railway track to a point touching the outskirts of London, and thence to distribute the electrical energy by means of underground mains. Primarily, it is stated, this scheme contemplates a large consumption for the electrical working of railways in and around London, and it is strongly supported by many railway companies.

The scheme of the London County Council is to utilize the power house which is being built at Greenwich for supplying the council's tramways as well as the existing cable ducts, etc., to build a new generating station further to the west on the Thames and to supply electric power in bulk to local authorities and electric-light companies.

The administrative County of London and district electric power scheme as promoted last year took as its field of operations a district embracing nearly 400 square miles, and as London only totals 117 square miles it will be seen that it was a very comprehensive scheme. The idea was to erect huge generating stations—90,000 kilowatts each—and, in short, to supply electric power wholesale to existing suppliers, to railways, canals and docks, and also to ordinary power consumers under certain conditions. It is now historical that the proposal failed to pass into law by a mere hair's breadth, owing to the session of Parliament terminating a few days before its final stage could be reached.

When these proposals were discussed in the House of Commons an effort was made to determine the issue as a party question, but to a certain extent this has been frustrated, and the present position is that the London County Council bill has been sent to a committee, while the other promoters have a full locus standi to oppose there.

G.

Steam-turbine Installation in Siam.

One of the most progressive of the independent principalities of Asia is the little kingdom of Siam on the Indo-Chinese Peninsula. In the principal city, Bangkok, is a modern electric-railway power plant, operated by the Siam Electricity Company, and equipped with reciprocating engines and generators. Because of the increased demand for power, an additional unit has become necessary, and a Curtis turbo-generator has been decided upon as most suitable. This is a 500-kilowatt 575-volt machine, built by the General Electric Company of Schenectady, N. Y. The boiler plant for this station is unique, in that paddy husks are burned in place of coal. The fuel is brought down the river from the rice fields in flat-bottomed boats to the power house and unloaded directly into the boiler room by an elevator and belt conveyor, built by the Link Belt Engineering Company, and operated by several direct-current 500-volt General Electric motors. This method of using rice husks for fuel is an economic utilization of a waste product similar to the use of the crushed sugar cane, or bagasse, on sugar plantations.

Thin Insulation.

In the Western Electrician of November 11, 1905 (page 374), it was noted that in Germany a new insulation for wires had been invented which had the desirable feature of being extremely thin, with strength to withstand comparatively high voltages. The Allegemeine Elektricitäts Gesellschaft of Berlin has now placed on the market two kinds of this insulated wire, using the substance known as "acetate wire" and "enamel wire." The first is produced by depositing successive layers of cellulose tetra-acetate on the wire. The result is a tough covering not exceeding 0.02 millimeters in thickness and capable of withstanding 1,500 volts. Acetate wires are supplied up to 0.17 millimeters in diameter. "Enamel wire" is supplied in sizes from 0.2 millimeter up to two millimeters in diameter. The covering is from 0.015 to 0.025 millimeters thick and is said to possess great elasticity and toughness. Although the covering is non-hydroscopic and unaffected by brine or vinegar, except at high temperatures, and by sulphuric acid, except when of great [illegible] the [illegible] the action of all the [illegible]

Two-part Street-railway Tracks.

An invention [illegible] track can be made [illegible] by United States Consul [illegible] The invention separates the [illegible] the wearing surface from the permanent girder support. It allows of the renewal of the wearing surface when worn out without pulling up the whole of the roadway or interfering at all with the under girder, which is tied down to the concrete bed.

The invention is not in the rail [illegible] machine requisite for combining the two sections effectively. One locomotive carries the three machines that are necessary, one machine for rolling on the upper rail and two for cutting it off when it is worn out. The wearing portion of the rail fits down over the lower portion, the rolling-on machine bending the depending flange inward so as to grip the supporting rail. These depending flanges are converted into cold-rolled springs, with an inward grip so intense that at a test made by the Sheffield Test Works the adhesion of the top section to the bottom section in a length of only one foot was found to be 23 tons. The cutting machine cuts a groove into one of the depending flanges of the rail to a depth of one third or half the thickness of the metal, while the breaking-off machine applied to the two flanges breaks off the partly cut flange, thereby releasing the head rail. These operations do not in any way injure or disturb the under T-section.

If each time a renewal of the rails is necessary the cost of taking up the whole of the track is avoided there must be a great saving, and the general manager of the Leeds tramways estimates this economy at 53⅓ per cent. Another great advantage asserted for the system is that the work of renewals can be done very speedily at night, and involves so small an amount of material on the road that the traffic is very little interfered with.

Proposed Foreign Tour of Institute Members.

The Institution of Electrical Engineers of Great Britain is making preparations to entertain members of the American Institute of Electrical Engineers and kindred institutions who will visit England during the coming summer. The plans contemplate a stay of several days in London and a tour of the provinces from June 23d to July 27th. It is necessary that prompt advice of the number who will probably attend be given to the Institution, so that there will be sufficient time in which to make the railroad arrangements and to secure hotel accommodations in the provinces.

The Associazione Elettrotecnica Italiana has also extended an invitation to the Institute to visit Italy during the Milan Exposition. This invitation has also been accepted by the board of directors on behalf of the membership. The visits contemplated by the Associazione include Naples, Rome, Florence, Genoa, Turin, Milan (Exposition) and Venice, and the time fixed by the Associazione is June 1st to June 15th. It is expected that the party will meet in Milan on June 1st, spending several days there visiting the exposition, which promises to be of great interest, both from a technical and an artistic standpoint, and then undertake the circular tour above outlined, with visits to the important transmission plants and the main points of interest along the route. The detailed programme is not yet available, but it is expected that the expenses of the 15 days' circular tour in Italy will be about the same as those of the English tour, or approximately $75.

In order to give the Italian visit an official character it is necessary that at least 15 take part in the tour. The week between the tours in Italy and Great Britain may be spent by the members in France, Switzerland or Italy, according to their personal inclinations.

Electrical Conditions in Philadelphia.

Mayor Weaver of Philadelphia in his annual message to the councils of that city strongly advocates the encouragement of competition for public lighting of the city. He does not believe in considering the establishing of a municipal plant unless the city does not succeed in getting a competitive plant established by a private corporation. Up to 1906, Mr. Weaver says, the city has been paying $110 a year for each arc light, which price was reduced to $99 for 1906, when agitation for a competing company became popular. Mr. Weaver expects soon to report details of a New York company, which proposes to establish a plant in Philadelphia with all wires underground, giving arc lights at $85 and paying the city five per cent. of the gross earnings. He warns existing wire-using companies that the time is not far off when all wires will have to be placed underground.

Ground-wire Clamp for Telephone and Telegraph Work.

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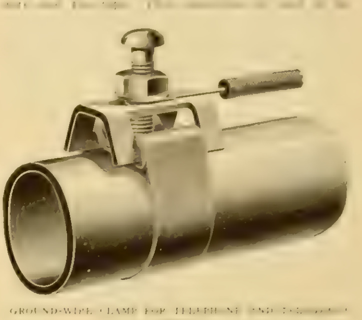


GROUND-WIRE CLAMP FOR TELEPHONE AND TELEGRAPH WORK.

more secure than the most carefully wrapped [illegible] and the total cost to be less than one-half that of the wrapped connection.

The necessity for a good ground connection is becoming more apparent to telephone men, particularly for selective ringing party-line service. A water pipe is often the most available and efficient ground plate. A soldered connection to such a pipe cannot be made satisfactorily, and a wrapped connection consumes considerable time and is often imperfectly applied.

Wright Demand System In England.

The Wright maximum-demand system of charging has done good service to the electricity supply industry. In addition to affording a means of arriving at equitable tariffs, it also did much in the earlier days of its development to educate the central-station engineer as to the true significance of the load factor and its influence on the cost of generation. So valuable was the system, in fact, that, in spite of the difficulty of explaining it to consumers, and the consequent suspicion with which the method of charging was sometimes regarded by those who had failed to understand the system, it was adopted by a very large number of electricity works. Thanks to the knowledge brought by its application, many central-station men have now substituted for the maximum-demand system flat rates of charging, with discounts which make sufficient allowance for the character of the load of individual consumers, and there are now comparatively few towns in which the Wright system is the only tariff in use. In some it has been abandoned altogether, while in others flat rates are offered as an alternative method of charging. Brighton, the town in which the maximum-demand system was born, has hitherto been among those in which every consumer was charged on the maximum-demand system, but the Brighton Corporation has now decided to give every consumer the option of being charged at a flat rate of 4d. (8 cents) instead of on the Wright system at 7d. for the first hour and 1d. after. As it requires a two-hours' user of the maximum demand per day at 7d. and 1d. to bring the average charge down to 4d. per unit, it is probable that a large number of consumers will adopt the alternative.—Electrician, London.

Indiana District Telephone Meeting.

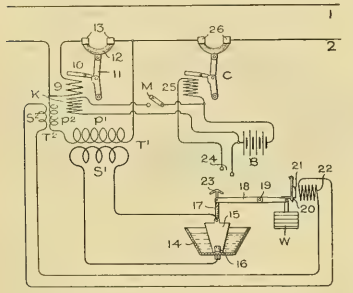
The Second District of the Indiana Independent Telephone Association, composed of seven counties in Northeastern Indiana, held its first meeting at Ft. Wayne on April 5th. W. L. Moeller, vice-president for the district, presided, and E. M. Popp was selected as secretary. Nine new companies were admitted to membership, making this one of the strongest districts in point of numbers—both as to companies and telephones—in the association. After transacting some routine business, Mr. W. S. Vivian of Michigan, manager of the Independent Telephone Clearing House of that state, was introduced and addressed the meeting.

The proposition to cut off all companies having any connection with the Central Union companies aroused an animated discussion, but final action was deferred on the matter until the meeting of the state convention in Indianapolis, May 16th to 18th

High-potential Circuit-breaking Apparatus.

Circuits having high self-induction or capacity and employing currents of high potential are often injured seriously in their insulating qualities through sudden breaks and the consequent surging which takes place. This danger is especially apt to result in underground circuits where the conductors are carried in cables. In fact, any sudden change in the current flowing in a cable is apt to bring about a resonant increase of potential which will be disastrous to the insulation.

Edward M. Hewlett of Schenectady, N. Y., has devised an improved circuit-breaking device, for which he received a patent recently, although application was made several years ago. The principle upon which the device is based is to cause the making or breaking to take place gradually—



HIGH-POTENTIAL CIRCUIT-BREAKING APPARATUS.

as, for example, by gradually increasing the impedance of the circuit immediately before breaking, or in making the circuit by first introducing a large impedance and then gradually and progressively withdrawing it. The device may be made for manual or automatic operation, the accompanying illustration showing the latter form.

The circuit-breaker actuating coil is indicated at (9), and operating in conjunction therewith is the armature (10), which serves to trip the bridging contact piece of the circuit-breaker in any well-known manner. One end of the armature (10) serves to retain in place the knuckle of a toggle lever (11), which operates a bridging contact piece (12) for connecting together the contact blocks (13), inserted in the line (2). Shunted about the switch formed by the terminals (13) and bridging piece (12) is the primary (P') of the transformer (T'). In series with the primary (P') is the primary (P^2) of another transformer (T^2). The secondary (S') of the transformer (T') is connected to a resistance-changing device. This rheostat consists, preferably, of a metallic retaining vessel containing acidulated water, and in contact electrically with one terminal of the secondary (S'). The other terminal of the secondary is connected to a metallic plate (15), which may be inserted at different depths in the liquid contained by the rheostat, and which in one of its extreme positions is embraced by two metallic spring fingers (16), secured to the bottom of the retaining vessel (14). The plate (15) is pivotally connected through an insulating rod with one end of a lever (18), fulcrumed, for example, at (19). A weight is suspended from the opposite end of the lever and is of such a value as to overbalance the plate; but the apparatus is normally retained in the position shown by a catch (20), which engages the lever in any suitable manner. The catch is suitably pivoted and carries an armature within the influence of an actuating coil, excited by current derived from the secondary (S^2) of the transformer, already referred to, the primary of which, as has been noted, is in series with the primary of the transformer (T'). The lever carries a bridging contact (23) which operates in conjunction with the terminals (24) to close a local circuit. This circuit has in series therewith some suitable source of electromotive force—as, for example, the battery (B) and a circuit-breaker coil (25), which operates a circuit-breaker (C) of any suitable form, thus serving to open the main line (2) at the contacts (26).

In the operation of an apparatus such as just described, suppose that the current in the mains has increased beyond the limit allowed by the circuit-breaker. The current in the circuit-breaker coil (9) then acts to draw down the armature (10), thus releasing the toggle and opening the circuit at the contacts (13). This operation does not actually break the main circuit, but diverts the current through the primaries (P'P^2) of the transformers (T'T^2). The resistances of the respective secondaries are comparatively small, so that only a moderate amount of impedance is by this operation introduced into the main line. Current then flows through the actuating coil (22) and releases the catch, thus allowing the weight to fall, and so raise the contact plate (15) away from the bottom of the retaining vessel of the water rheostat. The resistance of the secondary (S') is thus gradually increased in an obvious manner, and so gradually increases the impedance of the main circuit, and thus reduces the current flowing therein. The downward motion of the weight forces the bridging contact (23) into connection with the contacts (24), and so closes the local circuit through the battery or other source of electromotive force and the circuit-breaking coil (25), thus operating the circuit-breaker (C), and so opening the main circuit, the current in which has been reduced to a safe amount by the operation of the transformer (T') and the water rheostat.

Canadian Telephone News.

The attorney-general of the Manitoba government has been in Ottawa in the interests of his government's scheme for provincial control of telephones. He has arranged that, as soon as possible, a deputation from the Union of Canadian Municipalities shall wait upon the Dominion government to urge the passing of such federal legislation as will enable Manitoba either to buy out the telephone or to establish a separate provincial system.

Prominent representatives of the Bell Telephone Company of Canada have been visiting the town of Ingersoll, Ont., and have offered reduced rates to subscribers. This step has been taken in consequence of the fact that a proposed Independent company has given notice to the Town Council that it will make application for a franchise. The contract with the Bell company expired last October and the company now offers business telephones for $25 and residence telephones for $20.

A bill is now before the Ontario Legislature, having been introduced by a member of the provincial cabinet, respecting local municipal telephones. It will enable 20 or more subscribers to secure for themselves, at the lowest cost, all the advantages of a telephone system upon petitioning any municipality for it, and stating their intentions as to location, etc. The municipality may then proceed, at the expense of the subscribers, to establish the system.

It is now clear that the Dominion government has dropped the scheme of ex-Postmaster-general Sir William Mulock to nationalize the telephone systems of the Dominion, and has adopted instead the policy of bringing the Bell company and its competitors under the jurisdiction and control of the railway commission of Canada.

Arrangements are being made by the Grand Trunk Railway Company for a telephone system of its own. This may supersede the telegraph as the instrument and medium of control. The central exchange will be at the general offices of the company at Montreal, where the switchboard, with all necessary terminal facilities, will be erected. Wires will be run from Montreal to Portland, Me., on the one hand and from Montreal to Chicago on the other. This new system will involve the expenditure of upward of $400,000 and the construction of many thousands of miles of copper wire. W.

Southeastern Telephone Developments.

It is announced that the Southern Bell Telephone Company will spend $100,000 on a new system extending from Danville to Richmond, Va. A system is also being built between Staunton and Winchester.

A case involving tax on $5,000,000 worth of property of the Cumberland Telephone Company at Hopkinsville, Ky., alleged to have been omitted from the returns for assessment for some years back, has just been decided in favor of the defendant company. The court sustained the demurrer, holding that the property of the company sought to be assessed was not liable for state and county taxes, as the notes, bonds, etc., held by the company had already been assessed by the state board of valuation, or should have been.

Ed L. Barber, president of the new Central Home Telephone Company, has announced at Louisville, Ky., the objects of this new concern, which proposes to merge some 15 or 20 telephone companies in Kentucky and Indiana. Long-distance facilities will be increased largely, the Central company operating in connection with the Louisville Home Telephone Company and the Independent long-distance company. It is said that a number of companies in various Kentucky towns have already been taken in. The Columbia Finance and Trust Company is acting as trustee of the securities of the companies acquired. As these are purchased by the Central company, the local management of the various companies absorbed are not being altered in any manner. The officials of the trust company are also said to be interested in the new organization, which is capitalized at $5,000,000.

Clyde R. Hoey and associates have incorporated as the Shelby Mutual Telephone Company at Shelby, N. C., with $10,000 capital.

Raleigh, N. C., holding the distinction of being the only town in the United States, as far as is known, to have three telephone systems, will likely be served with fewer systems soon. The Merchants' association has voted to cut out the Bell and Interstate systems and use the Raleigh Telephone system, urging its patrons at the same time to follow suit. L.

Indiana Telephone Items.

The Indianapolis Telephone Company has filed its petition with the Board of Public Works, asking for the right to increase its rates, stating that present rates will not enable the company to maintain a high standard of service and make a reasonable return on the investment, or warrant such additions and improvements as the present demands of the company absolutely require. The increase asked would raise business telephones from $40 to $52 a year, and residence telephones from $24 to $30. The company also asks to have the franchise extended to 40 years from July, 1906, and so amended as to require a payment to the city of $6,000 a year flat, instead of $6,000 and $2 a telephone for all over 6,000 telephones in service. The petition asks for the right to make an additional annual charge of $2 a telephone for each 1,000 telephones over 15,000 that may be used. The company now has 9,500 connections. In consideration of the proposed grant the company pledges to increase the efficiency of the service and to invest $500,000 in a new fireproof building and install a new plant therein in 12 months. The board has set April 16th as the date for the first hearing as to the changes asked.

C. A. Jay, general manager of the Citizens' Telephone Company of Kokomo, is asking for bids on the putting in of $15,000 worth of underground and overhead cables. The present lines are to be extended and greatly improved.

The Central Union Telephone Company has obtained franchises in Plainfield and Avon, in Hendricks County, and has located exchanges in each place.

The Citizens' Telephone Company, which was refused a franchise by the City Council of Evansville on April 2d, will make another application, it is announced. There are 10 members of the City Council, and when the vote was taken it stood five to four, with one member, Dr. J. E. Owen, absent. Dr. Owen is in favor of the franchise. Mayor Boehne, in a statement to the public, says the City Council made a mistake in not passing the franchise, and he believes that it will do so at the next opportunity.

The Central Union Telephone Company has taken over the mutual company at Shelbyville, according to a statement given out at that city by John and Daniel Deprez and David B. Wilson, owners of the Independent plant. The Shelbyville Independent exchange has about 600 subscribers and the Central Union about 800.

There is much complaint on the part of the patrons of the Home Telephone Company of Wabash who attempt to use the Independent United lines between Wabash and Marion, which were taken over some time ago by the Central Union Telephone Company. The Home Telephone Company of Wabash and the New Long-distance Telephone Company own jointly a copper metallic circuit from Wabash to Marion, which is cut into the Marion office of the Central Union. Instead of sending the messages to Wabash over this circuit, as heretofore, the Central Union now persists in sending Wabash messages through the Central Union exchange in Wabash. The patrons of the Home company are refusing to receive messages sent this way and insist on the call coming over the Home company's line.

The Branch Independent Telephone Company, which has lines in Randolph and Jay counties, Indiana, and Dark and Mercer counties, Ohio, has been sold to the Eastern Independent Telephone Company of Winchester. This combination will make a strong company of the Eastern. S.

Telephone News from the Northwest.

The Herman Telephone Company of Herman, Minn., has filed articles of incorporation with a capitalization of $50,000. C. J. Bacon heads the list of stockholders.

The Brainerd (Minn.) Telephone Company has sold its system and franchise to the Northwestern Telephone Exchange Company. The latter company will improve the system and extend the line to Walker and Bemidji.

The Hennepin Telephone Company has been incorporated, with headquarters at Long Lake, Minn.

The Commercial Club of Aberdeen, S. D., considering the application of a second telephone company for admission to the city, has concluded that one company is sufficient.

H. E. Poseley, principal owner in the Stewart and Buffalo Lake (Minn.) Telephone Company, has

sold his interests to C. L. White of Stewart, Minn.

The Farmers' Mutual Telephone Company has been organized at Ringsted, Iowa. Andrew Larsen is president and E. T. Sorum secretary. R.

Why Europe Lags in Telephone Service.

Herbert Laws Webb has written a series of three articles on "Commercial Telephony" for the London Times Engineering Supplement. Perhaps the idea was suggested by the following editorial recommendation in the Western Electrician of January 20th last, referring to telephone conditions in London: "The Times could no doubt do a real service to its readers by publishing a series of articles showing what a modern telephone service should be and how the public should take advantage of it. There is a telephone engineer in London, an Englishman, but well versed in American practice, who could write well on such a topic if prevailed upon to do so." At any rate, the first article of the series appeared on March 28th under the sub-title, "Why Europe Lags." Among other things, Mr. Webb says:

"No observer can be three days in an American city without noting that the telephone service is a highly developed part of the current machinery of business and social life, that the use made of it is prodigious, that its efficiency and regularity are of a high order, and that it is employed by almost all classes of the community. No traveler who has also roamed over Europe can have failed to note that it is only in America that the telephone service has reached this high pitch of development, efficiency and popularity. No sane person, traveler or stay-at-home, will deny that, the telephone service being absolutely and beyond compare the quickest and most direct means of communication, a highly developed and efficient telephone service is of great value to every active community as a time and labor saver, as an economizer in production and distribution, even as a saver of life and property. Therefore, why does Europe lag?

"Broadly speaking, the reason for the wide gulf between the position of the telephone service in America and that which it occupies in Europe lies in the difference of the attitude of the public—and of the representatives of the public—of the two continents toward the telephone service. In America the telephone service has been treated as a friend, or as a promising youngster capable of effecting vast improvement in the conduct of affairs. No artificial restrictions have been imposed to hinder its development, and neither the telephone managers nor the public has put the question of cost before the question of efficiency.

"In Europe the telephone service has never been treated as a legitimate business enterprise and has never had a fair field. From the very beginning it has been treated as a mere offshoot of the telegraph—which it is not—and it has occupied the position of Cinderella in the family of methods of communication placed under government control. As a result, not only have all sorts of harassing restrictions inseparable from a bureaucratic control been brought to bear, but telephony as a science, telephone engineering as a specialty and telephone administration as a distinct branch of organized effort have been neglected."

Extensions to Chicago Automatic Telephone System.

Work has been begun by the telephone department of the Illinois Tunnel Company to extend the automatic telephone service to the new territory reached by the tunnel extensions on the North, West and South sides in Chicago. In the January directory issued by the company notice was published canceling the meter service on May 1, 1906. Delays in extending the system, however, have caused the company to feel unwarranted in charging a flat rate at this time and service will continue under existing contracts to all present subscribers.

Some arrangement may be made before long for connecting the automatic system of Chicago with surrounding Independent telephone systems. The Tunnel company has been waiting, it says, for the outlying companies to get their systems together and working unitedly so that when entrance is given into Chicago it will not be necessary to deal with a large number of systems individually. An officer of the Tunnel company stated that several thousand telephones will be added to the Chicago system soon.

The Chicago Telephone Company reports a net gain of 1,412 subscribers in the city in March and 725 in the country, a total increase of 2,137 for the month. The total number of the company's telephones in service March 31st was 150,184, of which 109,520 were in the city and the rest in the country and small towns which the company serves.

GENERAL TELEPHONE NEWS

The Star Telephone and [illegible] Company of Upper Alton, Ill., [illegible] from [illegible] to [illegible].

The Hamilton [illegible] Company has been incorporated [illegible] by R. B. Anderson and others.

The Johnson County Telephone Company of Stuartville, Neb., has been incorporated with a capital of [illegible] by David I. [illegible] and others.

On April 1st the Missouri and Kansas Telephone Company put into effect a new toll [illegible], making an average reduction of [illegible] per cent. [illegible] state named.

The Citizens' Telephone Company of [illegible], Ark., has been incorporated with a capital [illegible] of $5,000. H. C. Stanton, W. A. Streeter and others are incorporators.

J. W. Johnson and associates of Dana, Ill., have incorporated as the People's Mutual Telephone Company, with a capital of $10,000. They will operate an exchange in Dana.

A company has been organized at Granite, Okla., with J. W. Seay, president; W. H. Green, vice-president; Dr. C. N. Keats, secretary, and A. H. Seay, treasurer, to construct a telephone system.

The select committee of the Manitoba (Canada) Legislature appointed to investigate the general telephone conditions and report to the provincial government has endorsed government ownership of the telephones.

The Western Oklahoma Telephone Extension Company, operating in Roger Mills and some of the other southwestern counties of Oklahoma, has sold out all of its interests to the Pioneer Telephone and Telegraph Company of Fort Worth, Tex.

The Southwestern Telephone and Telegraph Company has engaged C. L. Thompson to prepare plans for a new telephone exchange building in Little Rock, Ark. The building will be two stories, 60 by 80 feet, pressed brick, fireproof construction.

The Hamilton Home Telephone Company has made application for a franchise to build and operate an exchange in Middletown, Ohio. The application was accompanied by a petition signed by over 100 business men asking that the ordinance be passed.

J. P. Janson of Little Falls, Minn., has succeeded W. A. Stanton as manager of the Northwestern Telephone Exchange Company's system at Owatonna, Minn. The rural lines centering there will be improved and about 60 miles of extensions made.

The Chesapeake and Potomac Telephone Company will erect an addition to its exchange on Madison Avenue, near Robert Street, in Baltimore, Md. One story will be added to the present building and a three-story addition to the rear. The building will be fireproof throughout.

The Flat Branch Mutual Telephone Company of Shelbyville, Ill., has been incorporated with a capital of $2,000. The line will be built at once and will have connection with the Queen City Mutual Telephone Company's line of Shelbyville. David L. Morey and Frank G. Beckett are among the incorporators.

The Illinois Mutual Telephone Company (Independent) has planned a number of extensions for the coming season which will connect the Rockford Home Telephone Company with a number of other towns in Northern Illinois. This is made possible by the merging of several Independent companies. The officers of the Illinois Mutual Telephone Company are: President, William Neely of Seward; secretary and manager, C. S. Thomas; treasurer, F. S. Hollenbeck. The headquarters are at Seward, Ill.

The First District of the Illinois Independent Telephone Association held a meeting at Joliet on April 10th. Plans to get a franchise into Chicago for Independent telephone lines and other matters of interest to the district were discussed. The First District comprises Henry, Lake, De Kalb, Du Page, Kane, Kendall, Cook, Will, Grundy and Kankakee counties. A. J. Vernier of Kankakee, state vice-president from the First District, was elected president, E. C. Hennis of Sandwich vice-president, and J. C. Joslyn of Sycamore secretary and treasurer.

Among the telephone companies recently incorporated are the following: Current Lake Co-operative Telephone Company, Ruthton, Minn.; Newkirk Commercial Telephone Company, Newkirk, Okla.; Citizens' Telephone Company, Success, Ark.; Audubon Telephone Company, Audubon, Minn.; Shipton Telephone Company, Shipton, Kan.; Oakview Telephone Company, Hennessey, Okla.; Farmers and Merchants' Telephone Company, Granite, Okla.; Medicine Lodge Telephone Company, Medicine Lodge, Kan.; Douglas County Telephone Company, St. John, Kan.; Home Telephone Company, Capron, Ill.; Mutual Telephone Company, Danville, Iowa.

CORRESPONDENCE.

Great Britain.

[illegible]

[illegible] undertaking. [illegible] of Parliament, [illegible] matters, are familiar with the [illegible] been asked in the House of Commons [illegible] any steps could be taken [illegible] purchasing the municipal under[illegible] appeared to be to buy [illegible] obsolete or useless, and [illegible] in 1911, presumably at a profit. [illegible] overlooked the fundamental fact that the postmaster-general is only bound in 1911 to buy such plant as is suitable for his purpose, less depreciation, and no good will, so that it matters not whether the company or the municipalities own the [illegible] in 1911, the terms would be the same. It may be that the reason the municipalities are listening to the terms of the company is because the terms offered by the postmaster-general are unsatisfactory to them.

That this may be so is given color by the fact that the Swansea corporation has just refused somewhat indignantly an offer for its undertaking by the postmaster-general on these terms. Something under $150,000 has ben spent on this undertaking, but taking into account depreciation and the fact that the exchange building would be useless for the state service in 1911, an offer of only 60 per cent of the above sum was made and has been rejected.

There have been quite a series of fights in the committee rooms of the House of Lords recently between railway companies wishing to inaugurate motor omnibus service in localities where the municipalities have electric tramway services in operation. The main object of the railway companies is to run their buses between certain definite points and their stations, where these are very often not adequately served by the tramways. Of course, most of the results in favor of the railway companies have hinged upon local conditions, but an unsuccessful attempt has been made to have it determined that for a railway company to run motor omnibuses is beyond its authority.

A good deal of discussion will take place during the coming few weeks on the question of electric vs. steam winding for collieries. Two papers have been read before the Institution of Electrical Engineers and two whole nights have been allotted for their discussion. One of the authors, who is in danger of being branded a "traitor to his trade," has produced figures which tend to prove that at present the efficiency of steam winding is so great that existing electric winding machinery stands no chance whatever in competition therewith. But as several others are prepared to contest his figures a useful result should be obtained. It is a subject very little discussed here hitherto and any light that can be thrown upon it will be welcome.

One great advantage of electric tramways over motor omnibuses is the economy resulting from the generation of the motive power at one center instead of on each vehicle. It has been announced, however, that a new type of omnibus is being experimented with, in which a suction gas plant will be employed on each car, and with which the cost of power will be reduced to that of electric cars. Another item of news is that the head of the biggest electric traction concern in Great Britain is now engaged in erecting a large factory for the manufacture of motor omnibuses. G.

Dominion of Canada.

Ottawa, Ont., April 7.—It is stated that the town of Merritton, Ont., will take over one or two mill plants, having excellent waterpowers, and develop electrical power to be sold to manufacturers at very low prices.

Another electric power company has been incorporated by the Dominion government to carry on business outside of Canada. The Official Gazette

contains the notice of incorporation of the Yucatan Power Company, which apparently proposes to supply a portion of Central America with electrical energy. The company is authorized to issue $1,000,000 capital stock, and, to facilitate financing, the city of Montreal is named as the head office.

Thoroughly to equip the lighting plants of the city of Kingston, Ont., it is probable that the committee on light and power will submit a by-law to the people next month involving the sum of $80,000. Since the plant was taken over in 1904 some $35,000 has been expended, but the additional sum is needed to make the concern profitable and give light at the lowest possible cost.

The city of Peterboro, Ont., has applied to the Ontario Legislature for power to acquire waterpowers and supply electricity to manufacturing concerns. The city has now received an offer from the Peterboro Light and Power Company to furnish any factories with power up to 2,000 horsepower for a period of 10 years at the rate of $20 per horsepower per annum. The offer is being considered.

That the telegraph business of Canada is growing rapidly is evidenced by the fact that the Canadian Pacific Railway Telegraph Company contemplates during the summer the construction of 610 miles of new pole lines and 4,068 miles of wire, of which 1,966 will be copper. With the increased facilities the company will be able to give rapid service between all the leading cities in Canada. It is the only telegraph system in the Dominion stretching from ocean to ocean under one management. W.

New York.

New York city, April 7.—Another bill has been introduced in the state Assembly to compel the attorney-general to determine the legality of the "transportation monopoly operating under the name of the Interborough Rapid Transit Company."

The Elsberg rapid-transit bill, in its emasculated form, was advanced a stage at Albany on Thursday night. The New York City Rapid Transit Commission is protesting against the bill and desires to have a free hand to deal with bidders of future subways. August Belmont is also objecting to the bill and declares that it is intended to force municipal operation.

Chief Engineer George H. Rice of the Rapid Transit Commission recommends that automatic ventilating valves should be placed in the roofs of the subways, midway between the stations, thus exhausting the foul air at these points. The cost of these valves would be $275,000, and Mr. Rice states that they ought to be put in before June 1st.

A dispute has arisen between the Rapid Transit Commission and the Interborough Rapid Transit Company on a proposal to connect the feed wires of the subway with those of the surface lines in the Bronx. These wires would run partly through conduits built by the city along the walls of the subway, at a cost of more than $1,500,000. The engineers of the Interborough Rapid Transit Company are making the proposal in order to utilize surplus power from the subway power house for the Bronx trolley lines.

It is stated unofficially that the New York Central Railroad is not disposed to substitute a tunnel for its surface tracks on Eleventh Avenue, as required by recent legislation, but is suggesting that it should be allowed to put up an elevated line. W. J. Wilgus, vice-president of the New York Central, states that the engineering difficulties of constructing a subway so near to the river front would be almost insurmountable, and it would be entirely too expensive.

At the meeting of the Electrical Engineering Society of Columbia University on Wednesday evening, H. D. Hawks of the General Electric Company read a paper, illustrated with lantern slides, on "Electric Locomotives," his general idea being to point out the advantages of the direct-current system of traction to be used on the New York Central Railroad. Mr. Hawks' address was an analysis of the paper on the same subject read by B. G. Lamme before the New York Railroad Club, as recorded in the Western Electrician for March 24th. A second paper, on "Gasoline-electric Cars, as Recently Installed on the Delaware and Hudson Railroad," was read by Mr. H. G. F. G. Chatain of the General Electric Company. Both speakers are graduates of Columbia University of the class of '95.

The Brooklyn Rapid Transit Company is contemplating the construction of an elevated terminal at the Manhattan end of the Williamsburg Bridge to accommodate eight-car trains, at a cost of $100,000. Longer platforms are also planned for the stations on the connecting Brooklyn lines. The work, if finally approved, can be accomplished in about 16 months.

The executive officers and engineering staff of the New York City Railway, under the chairmanship of A. E. Aeby of the Pennsylvania Steel Company, gave a farewell dinner on Friday evening to W. Boardman Reed, who is retiring from the position of chief engineer. President Vreeland presented to Mr. Reed engrossed resolutions and a $400 ring, and the legal department of the company gave him a gold watch.

On Monday next George W. Kittredge will become chief engineer of the New York Central and West Shore railroads, in succession to H. Fernstrom, who resigned some months ago. Mr. Kittredge is 50 years of age, a native of Andover, Mass., a graduate of the Massachusetts Institute of Technology, and until recently chief engineer of the Cleveland, Cincinnati, Chicago and St. Louis Railway.

Franchise terms have been agreed upon between the Board of Estimate and the Atlantic Telephone Company, after six months' negotiations. The company, which is Independent, agrees to pay the city a minimum aggregate of $3,000,000 for a 25-year grant to do a general telephone business in the city. Harry P. Nichols, chief of the Bureau of Franchises, originally reported in favor of a compensation of $7,750,000. The company insists on the right to lay its wires in the ducts of the Empire City Subway Company, which are partly owned by the New York Telephone Company. The company agrees to establish a five-cent interborough rate and low rates for outside connections. Various legal details have yet to be fought out. The Atlantic company is connected with the New York and Eastern Telegraph and Telephone Company, which held its annual meeting on Tuesday, when the control of the affairs of the company passed from D. A. Reynolds to Paul E. de Fere.

The Beck Flaming Lamp Company, with an office at Canton, St. Lawrence County, New York, has been incorporated with a capital of $300,000. This company will manufacture the Beck arc lamp, as described in the Western Electrician of July 15, 1905. The directors are C. J. Klebere, L. J. Auerbacher and S. S. Newton, all of New York. D. W. W.

Southeastern States.

Charlotte, N. C., April 7.—The town of Tuscaloosa, Ala., has granted a franchise to Robert Jemison of Birmingham for establishing public utilities, including electric lights, street railways, etc.

The city of Louisville, Ky., will save about $38,000 a year under the terms of a new contract with the Louisville Lighting Company, which takes effect on May 1st. The city will pay $65 for arc lights instead of $84, the former rate.

The Louisville (Ky.) Lighting Company will expend the sum of $300,000 in improvements that are contemplated, including a new turbine unit with a capacity of 3,000 kilowatts. The investment has been authorized and work will likely start in a short time and will be completed about October 1st.

The stockholders of the Birmingham Railway, Light and Power Company have voted an additional issue of $1,000,000 preferred stock to be sold at par to the present holders, making the total stock $7,000,000, half preferred and half common. A meeting of the directors followed, at which the authorized $1,000,000 was voted unanimously.

A decision has been rendered in the County Court declaring the franchise of the Louisville Traction Company non-assessable, and the company thus wins a back-tax suit, the Louisville Railway Company paying taxes on the property represented by the traction company's franchise. It was further decided, however, that the traction company owed back taxes on certain amounts, it being alleged that the traction company had transferred to the account of the railway company $700,000 in cash, the Louisville railway now being sued for taxes on that amount.

At an enthusiastic meeting of the Albany (Ga.) Business League a resolution was adopted that a committee immediately take up the matter of the city ownership of an electric-railway system, the power to be brought from Big Shoals.

The fight in the city of Richmond, Va., over the establishment of a municipal lighting plant is still being waged and at a recent meeting of the committees on finance and electricity a report by A. W. Trafford, appointed to make the investigation, was heard. The report favored municipal ownership and stated that the present cost of lighting to the city would more than pay interest on the amount needed for a complete plant. On the other hand the present electric-lighting interests are naturally opposing the measure.

A letter was recently received at Washington, D. C., from B. H. Ritchie of Emporia, Kan., asking for information upon municipal ownership, including street railways, etc. Captain Chester Harding replied that Washington owns only its water system; that there was no agitation for municipal ownership, and that such ownership is not practicable or advisable, especially where a bond issue is necessary to raise funds. L.

New England.

Boston, Mass., April 7.—The board of directors of the Boston Chamber of Commerce has vigorously protested against the passage of a bill authorizing the construction of subways by the Boston Elevated Railway Company, which is now before the Massachusetts Legislature. The board objects to any legislation which will abrogate or curtail any of the city's rights under existing laws.

The increased use of arc lights in lighting Boston is shown in a statement recently issued in connection with the agitation for municipal ownership of the city's lighting plants. During the year ended January 31, 1899, the city spent $368,446 for 2,893 electric lights, or $127 per light. During the year ended January 31, 1905, the city spent $441,174 for 3,731 arc lamps, or $118 per light. The first-named year was the last in which the city did its own lighting, the work having been done by a company since then.

The Hartford (Conn.) street commissioners have voted to order the removal of all overhead electric wires within half a mile of the Hartford City Hall before October 1st. The Hartford Electric Light Company, the Western Union Telegraph Company, the Southern New England Telephone Company and the Holmes Electric Protective Company are affected by the order.

A Hartford County (Conn.) Superior Court judge has granted the city of New Britain's motion that the state of Connecticut be made a party plaintiff to the city's suit against the New York, New Haven and Hartford Railroad Company, in which the city asks for the discontinuance of the company's third-rail electric service within the city limits, on the ground that it is a menace and danger to the public. It is said that if it is assured that there is serious opposition to the third rail, the company will abandon the services.

The United Electric Signal Company of Attleboro, Mass., has been incorporated in this state. It has a capital of $200,000. Stephen A. Wood, Joseph M. Metcalf, Frederick G. Hovey, Ralph C. Estes and Louise R. Barrett are the incorporators.

The Boston Elevated Railway Company is equipping its open surface cars with side rails to prevent passengers getting on and off the left side of the cars.

M. C. Allen, special agent for the American Telephone and Telegraph Company, has been in Worcester, Mass., offering positions to members of the senior class of the Worcester Polytechnic Institute, for their acceptance after graduation.

New Haven (Conn.) people are forming a company to run a line of electric stages between that city and East Rock, which will compete with the Consolidated Railway Company. During the summer the stages will be run to Savin Rock.

The fund committee of the Massachusetts Institute of Technology alumni has raised $241,000 for the benefit of the Institute. This amount was contributed by 1,250 men. The following alumni have been elected members of the corporation governing the Institute: For five years—Charles T. Main, '76, Frederick W. Wood, '77, and T. C. Du Pont, '84; for four years—Frederick E. Copeland, '76, Joseph P. Gray, '77, and Frank L. Locke, '86; for three years—Eben S. Stevens, '68, Richard H. Soule, '72, and Frederick H. Nowell, '85. Three alumni will be elected in 1907 and three in 1908. B.

Ohio.

Cleveland, April 7.—The Chamber of Commerce of Cleveland has recommended that the Cleveland Electric Railway Company be granted a new franchise for 25 years, in consideration of a reduction of fares within the city to three tickets for 10 cents, 15 for 50 cents, or 30 for $1, to be used for single fare without transfer, and five cents for a cash fare or when a transfer is desired. A single fare would carry a passenger to the river from the east line and to Erie Street from the west lines. Mayor Johnson is not favorable to such an arrangement, nor is the railway company, it seems. Mr. Johnson wants three-cent fares. Again, such an arrangement would work a hardship upon laboring people who are compelled to transfer.

The Ft. Wayne-Lima line, it is said, now holds the record for fast-schedule time. Trains make the distance of 32⅝ miles in 60 minutes, including five stops at stations and three stops at railroad crossings.

At a caucus of the members of the Cleveland City Council, a few days ago, it was decided that $40,000 will be spent in making additions and extensions to the city light plant.

H. H. Clough and associates have asked for a franchise for a belt line in Elyria. The proposed line would take in the factory district as well as extend around the city. The Cleveland and Southwestern has been desirous of building such a line also, and the Lake Shore has been seeking an entrance to the heart of the town on some plan. A. L. Garford, the well-known manufacturer, is interested, with others, in the matter.

The first of an order of 25 gasoline-electric cars has been completed for the New York Central by the Wellman-Seaver-Morgan Company at the Akron shops. The gasoline engine and generator are placed under the car, and the entire space in the car may be used for passenger purposes. The coach will seat 60 passengers and is built after the pattern of coaches now in use on the road.

A franchise has been granted by the council at Upper Sandusky to John J. Barber of Toledo, representing the Findlay, Carey, Upper Sandusky and Marion Electric Railway Company, to build an electric railway through the town. Should this line be built it will supply the link connecting Columbus and Toledo by a comparatively direct line.

The Ely syndicate is said to be negotiating for the purchase of the property of the Steubenville Traction Company and the Steubenville and Wellsville line. The traction company owns the electric-light and gas plants also, and operates a line to

Empire. The Ely people already have large holdings in Eastern Ohio.

The Dayton and Troy, the Western Ohio and the Toledo Urban and Interurban have announced that, after May 1st, through limited service will be established between Dayton and Toledo and that no extra fare will be charged. All the electric roads have under consideration the matter of doing away with extra fare on the limited trains, and action may be taken shortly on this point.

The Columbus Railway and Light Company has arranged to double-track the West Broad Street line. An ordinance is now pending for that purpose.

The Columbus, London and Springfield and the Columbus, Grove City and Southwestern have adopted the association mileage book, although none of the other Appleyard roads have yet taken it up.

O. M. C.

Indiana.

Indianapolis, April 7. The Lafayette and Logansport Traction Company has been incorporated with a capital stock of $500,000. The incorporators are Frank H. Cutshall, Henry E. Vordermark, Samuel L. Morris, Frederick H. Schmidt and Frederick E. W. Scheimann, all of Ft. Wayne. The company proposes to build and operate street and interurban properties and furnish electric light, heat and power.

The Vincennes Traction and Light Company has filed articles of incorporation with a capital stock of $200,000. The company expects to run a traction line through Knox, Daviess, Gibson and Sullivan counties. The incorporators, owners of $10,000 worth of stock of the Vincennes Street Railway, are Benjamin G. and Morris Hudnut and Charles A. Gordon of Terre Haute, William Foley of St. Louis and George E. Henry of Vincennes.

The directors of the Evansville and Eastern Interurban Company have signed a mortgage for $550,000, to cover a bond issue for that amount to the Pittsburg Bond Company, which will furnish the necessary capital for building the road from Newburg to Rockport, Ind. Construction has been begun.

The council of Noblesville has granted the Capital City Circuit Traction Company a 30-year franchise on Conner Street, the principal residence thoroughfare in the city. According to the terms of the franchise, the company is required to sweep the street over which the line runs, light the street with electricity and erect a modern passenger station. The road must be completed and in operation by January 1, 1910. The proposed line will connect Noblesville, Greenfield, Shelbyville, Franklin, Danville and Lebanon.

At an annual meeting in Philadelphia this week of the directors of the Indiana Union Traction Company, the following-named officers were elected: President, Arthur W. Brady of Anderson; chairman board of directors, George F. McCulloch of Muncie; first vice-president, J. Levering Jones of Philadelphia; second vice-president, W. Kelsey Schoepf of Cincinnati; third vice-president, D. G. Edwards of Cincinnati; treasurer and assistant secretary, John J. Collier of Philadelphia; secretary, William C. Sampson.

Several Ohio members of the Central Electric Railway Association have decided to stop charging excess fares for limited service on their traction lines, and it is thought the same policy will be adopted by all the interurban companies in Indiana and Ohio. The Ft. Wayne and Wabash Valley Traction Company is willing, it is said, to drop the excess fares immediately if the other lines will follow suit. The officers of the Central association are advocating the straight-fare policy.

The general offices of the Indianapolis and Northwestern Traction Company have been moved from Lebanon to Indianapolis, where they have been consolidated with the offices of the other companies in the traction merger.

The City Council of Linton has passed an ordinance asking for bids for the purchase of the municipal electric-light plant.

The Board of Public Works of Terre Haute has made a five-year contract with the traction company for street lighting at $70 a lamp. This puts an end to municipal lighting for at least five years.

S. S.

Northwestern States.

Minneapolis, April 7.—The foreclosure sale of the Benton Power and Traction Company of St. Cloud, Minn., took place April 2d, the Granite City Railway Company being the only bidder and securing the property at $35,748. There will be no change in the management, E. E. Clark remaining as manager.

The state Legislature has granted permission to the Fort Dodge, Des Moines and Southern Railroad Company to build an electric railway through the college grounds at Ames, Iowa. This insures another interurban line for Des Moines, Iowa.

The Minneapolis City Council has passed a resolution directing the removal of all poles and electric wires in streets on which new paving is ordered, and conduits must be provided if the various companies would use these streets.

The Iowa Gas-electric Railway Company has been formed and proposes to establish a chain of electric railways from Sioux Falls, S. D., to Kansas City. The [illegible] J. W. Budd of Des Moines.

The [illegible] Company and [illegible] proposed [illegible]

The W[illegible] has been granted [illegible] town, Wis.

The [illegible] power for the [illegible] has been worked out.

J. G. C[illegible] and H. [illegible] the Stone [illegible] pany.

Heder & Hartung [illegible] plate putting in a large [illegible] tric light plant for the [illegible]

W. G. Schroder and [illegible] the Beltrami Electric Light and Power Company at Bemidji, Minn., with a [illegible]

F.

Pacific Slope.

San Francisco, April 5. The Northern California Power Company has ordered an additional Westinghouse 2,000-kilowatt three-phase generator for installation at the Volta power house. The company's transmission lines are now tied in with those of the California Gas and Electric Corporation near Chico, and the latter company will purchase all the surplus power of the former. Further extensions are being made and the Northern California company is now in a good position for earning dividends.

The Owens River Water and Power Company of San Francisco now has good prospects for pushing its electric transmission system to completion. The best water rights on the Owens River in California are held by this company, which has been engaged in hydraulic development on a small scale for several years past. This company planned to be the first to transmit current about 100 miles to Tonopah and Goldfield, Nev. Various obstructions were thrown in the way and in the meantime another company completed the first transmission line into the Tonopah region. The present prospects are for the Owens River Company, which has ample capital available, to carry out its original plans in short order.

The Santa Rosa and Northern Railroad has been incorporated with a capital stock of $500,000 by W. A. Cattell, W. T. McMurray, W. G. Taylor, J. H. Sanford and P. S. Scales, all of Santa Rosa. The company will build a road from Santa Rosa to Healdsburg and thence up the Dry Creek Valley to the Geyserville and Skaggs Springs wagon road, an estimated distance of 23 miles. The road will probably be an electric road, as the persons interested in this road are also interested in the Petaluma and Santa Rosa, an electric road.

The California Gas and Electric Company is planning a big power line to supply Vallejo, Cal., and the government shops on Mare Island direct from its present trunk system at Cordelia. A big force of men is now being assembled and material is arriving at South Vallejo and at Cordelia for the work.

The Shasta Electric Company has been incorporated with a capital stock of $1,000,000 by C. W. Fancher, R. C. Wilson and W. E. Wretman.

The Inland Power and Electric Company has been incorporated with a capital stock of $1,000,000, of which $700,000 is in the treasury. Offices have been opened in the Mohawk Building in Spokane, Wash.

The Grays Harbor Lighting Company of Aberdeen, Wash., has been reorganized under the new name of the Grays Harbor Railroad and Lighting Company and new articles of association have been filed. The capital stock is $500,000 and the incorporators are G. F. Stone, J. W. Geary and J. B. Bridges.

The General Electric Company of Portland, Ore., which recently purchased the Citizens' Light and Traction Company of Salem, will install 600 additional horsepower at the Salem plant and will also add 250 additional horsepower boiler capacity, making 1,100 horsepower available for transmission. Plans are perfected for transmitting power at 60,000 volts from Oregon City for the Willamette Valley Traction Company to furnish light and power to all towns along its line.

A.

PERSONAL.

With the February number of the Electrical Age the editorial connection of Mr. Albert Spies with that journal ended, having extended from January, 1904, to February, 1906.

H. B. Wales, manager of the Salisbury-Spencer (N. C.) Electric Railway Company, has resigned to accept another position. He will be succeeded by James A. Trimble of Grand Rapids, Mich.

R. H. MacMullan, general manager of the Des Moines (Iowa) Edison Light Company, has sent word that he will return to Des Moines as soon as the weather is more favorable. After recovering from an illness last October, Mr. MacMullan was taken with an attack of pneumonia and a few days later suffered from bronchitis. As a result he has [illegible]

[illegible]

[illegible] bus, Ohio [illegible]

[illegible]

[illegible] that company [illegible] Mr. Cotter [illegible] to head a [illegible] quarters in Chicago.

The death [illegible] tric railway. He retired [illegible] years ago because of [illegible] was caused by apoplexy. [illegible] Berea, Ohio, on April 5th.

Henry Williams Parkhurst, [illegible] the Western Society of Engineers [illegible] years ago assistant to the [illegible] construction of the Illinois Central [illegible] St. Luke's Hospital in Chicago on [illegible] He was struck by an Illinois Central [illegible] crossing the company's tracks [illegible] February 20th, sustaining a fracture of the skull.

General Eugene Griffin, first vice-president of the General Electric Company, sailed from New York on April 10th on the steamer [illegible] General Griffin plans an extended trip in England and on the continent, largely for rest and recreation. As he is a director in the French Thomson-Houston Company and vice-chairman of the British Thomson-Houston Company, these interests will naturally claim a portion of his time.

T. F. Grover, formerly vice-president and general manager of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., and more recently connected with the financial end of various electrical properties, has now taken the management of the Trinidad Electric Railroad Company and the Trinidad Light and Power Company of Trinidad, Colo. Mr. Grover has a wide acquaintance throughout the Northwest, and was particularly well known among the members of the Northwestern Electrical Association, in the affairs of which he took a prominent part.

Francis W. Parker, state senator in the Illinois Legislature, is a candidate for the Republican nomination for Congress in the Second Congressional District of Illinois, comprising a large part of the South Side of Chicago. Mr. Parker is a patent lawyer well kown to many electrical men of Chicago. W. Clyde Jones is a candidate for the Republican nomination for state senator. He is a lawyer who has made electrical litigation a specialty. He was an organizer and president of the old Chicago Electrical Association and is treasurer of the Benjamin Electric Manufacturing Company.

The resignation of Prof. Frederick R. Hutton from the secretaryship of the American Society of Mechanical Engineers is pending. He has held the position for 23 years, but feels that the work requires a secretary who can devote his entire time to it. His services have been considered indispensable, and an effort will be made to make an arrangement by which Mr. Hutton will be designated as honorary secretary, with another man to attend to the detail work. Professor Hutton is the head of the department of mechanical engineering of Columbia University.

D. G. Edwards, vice-president in charge of traffic of the so-called merger traction lines of Indiana, announces that Frank D. Norviel has been appointed assistant general passenger and freight agent of the Indiana Union Traction Company, Indianapolis and Northwestern Traction Company, Indianapolis and Martinsville Rapid Transit Company, Indianapolis and Eastern Railway Company, Indianapolis Coal Traction Company, Richmond Street and Interurban Railway Company and Ft. Wayne, Van Wert and Lima Traction Company. This promotion makes Mr. Norviel traffic manager for all

the lines in Indiana owned by the Dolan-McGowan syndicate. All passenger and freight agents of the lines named will report to him and receive instructions and tariffs from his office in the Traction Terminal Building, Indianapolis.

Charles Haynes Haswell is the oldest engineer in the world in active practice, says the Scientific American. He is 96 years of age and is consulting engineer to the Board of Estimate and Apportionment of New York city. He never misses a day at his office, it is said. Mr. Haswell built the first practical steam yacht, built the first steam warship for the United States, was the first engineer-in-chief of the United States Navy, and designed and superintended the construction of warships and other vessels, the foundations of buildings and bridges, etc. He is the author of Haswell's Engineers' and Mechanics' Pocket Book, and is a member of the leading engineering societies.

C. R. Maunsell has resigned as manager of the Edison Electric Illuminating Company of Topeka, Kan. His action results from the passing of the control of the Edison company to the street-railway company of Topeka, controlled by L. E. Myers and associates. Mr. Maunsell is an active worker in the National Electric Light Association. He is an authority on district heating and is well known to electrical men. F. F. Maunsell, chief electrician of the Topeka Lighting Company, has also resigned to take a position as superintendent of the electric-light plant at St. Joseph, Mo. John T. Huntington, who left the Elgin, Aurora and Southern Traction Company, has succeeded C. R. Maunsell at the Topeka plant.

Mrs. R. H. Pierce, wife of Richard H. Pierce, died in Newtonville, Mass., on April 7th after an operation for appendicitis. Before removing to Boston three years ago Mr. and Mrs. Pierce were for many years residents of Chicago, where Mr. Pierce was head of the engineering firm of Pierce, Richardson & Neiler. Mr. Pierce is well known and highly esteemed among electrical engineers. He was electrical engineer in charge of construction and operation at the Chicago World's Fair of 1893 and chief engineer of the power plant of the St. Louis World's Fair of 1904. Mrs. Pierce was a daughter of Elisha Morrow of Green Bay, Wis., and a lady of quick intelligence, gracious manner and high character. The bereaved husband is the recipient of the sincere sympathy of his friends.

ELECTRIC LIGHTING.

Weatherford, Okla., is contemplating a municipal electric-light plant

The Home Light and Power Company of Galesburg, Ill., has petitioned for a franchise to operate a light plant.

F. J. Holman and J. W. Smead of Spokane have been granted a franchise for an electric-light plant in Odessa, Wash.

Arrangements are being made for the establishment of an independent lighting plant to supply Fort Sam Houston, Texas.

The Chickasha Light and Power Company has been given a franchise to install an electric-light system in Chickasha, I. T.

The Goodland (Kan.) Heat and Power Company has been incorporated with a capital stock of $50,000, and will put in an electric-light plant.

The Home Light and Power Company of Galesburg, Ill., has been incorporated by E. P. Hobson, Harry Gardt and I. S. Callender. It is proposed to furnish light, heat and power.

The Villa Grove (Ill.) Electric Company, proposing to operate an electric-light and water plant in Villa Grove, has been incorporated by V. J. Elmore, E. C. Elmore and C. W. Hageman.

The concentrator, power house and electric-light plant of the Pennsylvania and Wyoming company at Grand Encampment, Cheyenne, Wyo., is said to have been destroyed by fire at a loss of $300,000; insurance, $154,000.

The South Bullfrog Gas and Telephone Company of Los Angeles is making arrangements to install an electric plant for light and power purposes at Beatty, Nev. The plant will have a capacity of 500 horsepower, machinery, including gas plant and generators, having been ordered.

President H. W. Goode is said to have confirmed the report that the Portland General Electric Company has closed a deal whereby it assumes the ownership of the Citizens' Light and Traction Company of Salem, Ore., and the Union Light and Power Company of Silverton. The two plants will be consolidated under the name of the Citizens' Light and Power Company of Salem, and the headquarters and management will remain in that city.

ELECTRIC RAILWAYS.

The Texas Traction Company of Sherman, Texas, proposes to build a line to connect with Dallas. J. F. Strickland is president.

The Allegheny Valley (Pa.) Street Railway Company will construct a trolley line from Aspinwall, Pa., a distance of 11 miles. A power house will be erected at Tarentum at a cost of $27,000. The equipment for the plant will cost $80,000.

Ohio papers have been printing items to the effect that the New York Central has secured the connecting link which will join Cleveland and Buffalo by trolley, and later on connect New York and Port Huron, Mich., a distance of 911 miles. The company has options on all but the Pennsylvania and Ohio Traction Company's lines, it is said, between Ashtabula and Conneaut. Conneaut and Jefferson people, who own the line, held out, but it is now reported that an option has been secured from the McGovern syndicate, which controls the road.

The formal concession for the proposed Alpine railway from Brig to Gletsch has recently been granted to Messrs. Imfeld and Stubb by the federal authorities. This line, of standard gauge, will start from Naters, near the northern mouth of the Simplon Tunnel, and ascend, by steep gradients, to the top of the Rhone Valley, a distance of 42 kilometers. The line is intended principally for the conveyance of tourists to see the snow-slide, known as the Rhone Glacier, about a mile above Gletsch. The electric motive power for traction will be generated by waterfalls.

The city of Cleveland, Ohio, has lost its suit in the United States Supreme Court against the Cleveland Electric Railway Company. The suit involved the city's right to grant a charter to a new street-car company in Woodland Avenue in the face of the old company's contention that the latter's charter had not expired. The litigation was a part of the city's campaign to enforce a three-cent fare. The controversy hinged on the validity of an extension of a previous charter to the old corporation—an extension until 1908—which no less than four ordinances proved to have been actually granted, according to the Supreme Court.

Within the last fortnight, says the Manufacturers' Record, two things were done which speak eloquently of the demand for high-speed electric railways in the South. One was the letting of a contract to build the projected line from Baltimore to Washington, and the other was the beginning of construction on the line from Houston to Galveston. Considering these enterprises in connection with the Richmond and Chesapeake Bay electric railway, now building in Virginia, and other proposed interurban-railroad plans in the southern states, a large future for such transportation undertakings in this section seems to be fast approaching.

POWER TRANSMISSION.

In addition to other extensions recently announced, the Portland (Ore.) General Electric Company has adopted plans for a large power plant at Oregon City, which will involve a total expenditure of $2,000,000. It will be situated at the east end of the Willamette River Falls, opposite the present plant, known as Station B. Work preparatory to beginning the construction of the building will be carried on during low water this summer.

PUBLICATIONS.

The Allis-Chalmers Company has ready for distribution a new bulletin entitled "Gates Tube Mill for Wet Pulverizing in Mining Work."

To follow the "beaten path" is often to "get in a rut" is the warning of the Calculagraph Company of New York city. The company believes that a calculagraph is a necessary adjunct to the modern factory and tells why in a little booklet which it is sending out to the trade.

The first issue of a monthly magazine called The Third Rail has made its appearance. It is published by the benefit association of the employes of the Brooklyn Rapid Transit Company and is devoted chiefly to the interests of the men who work on the cars and in the shops and stations of the railway company. Much of the matter is contributed by the railway men themselves.

A leaflet from the Pittsburg Transformer Company of Pittsburg, Pa., tells of the winding department in the company's factory, where the transformer coils are made. Illustrations are embodied showing the lathes upon which the coils are formed and also examples of the completed product. An attractive calendar for the month of April is also included among the company's latest literature.

"General Electric Straight Air-brake Equipments," "G.E. M High-efficiency High-candlepower Incandescent Units" and "Direct and Alternating-current, Automatic, Carbon-break Circuit-breakers, Type C, Form G," are the titles of three new bulletins issued recently by the General Electric Company. The company has at the same time ready for distribution two leaflets on sockets, shades and portables and upon lightning-arrester apparatus. Still another piece of literature which deserves more than passing attention is the new General Electric fan-motor catalogue for 1906. This is a highly artistic bit of work, and although the attention is at once arrested by the bright and catchy cover design, the inside of the booklet is no less interesting, containing descriptions of an extensive line of fans, each type illustrated.

Originality is one of the distinguishing features of the new catalogue on Voltax issued by the Electric Cable Company of Bridgeport, Conn. It is in the form of a small book bound in boards, the reading matter being printed on a heavy grade of slightly tinted paper. Voltax is a new insulating compound and the catalogue contains among other things descriptions of tests made upon the insulation by the Electrical Testing Laboratories.

The Exide battery instruction book for 1906, issued by the Electric Storage Battery Company of Philadelphia, is now ready. It will be found helpful to storage-battery users who have Exide cells, and the rules set forth in the pamphlet, if followed strictly, bring the best results from the batteries. The pamphlet embodies a description of the battery parts, directions for charging, taking cells out of service, the use of measuring instruments, and rules for assembling and for the general care of the batteries.

SOCIETIES AND SCHOOLS.

Dr. W. M. Thornton has been appointed to the newly created professorship of electrical engineering at the Armstrong College, Newcastle, England. He has been head of the electrical engineering department of the Armstrong College for seven years.

A. P. Stradling of 131-141 South Fourth Street, Philadelphia, has been appointed master of transportation for the coming meeting of the National Fire Protection Association, which is to be held in Chicago, May 22d-24th. At that meeting a proposed amendment to the articles of association will come up for consideration allowing individuals, firms and corporations interested in the protection of life and property against loss by fire to be eligible for subscribing membership.

The final list of questions for the 1906 "Question Box" of the National Electric Light Association, edited by Mr. Paul Lüpke of 222 East State Street, New York city, has been prepared. A few things in connection with the answers to these questions are to be observed for the convenience of the editor. Each answer should be upon a separate sheet of paper, signed with the signature that the contributor wishes to appear in print, and bearing the number of the question. The answers "Yes" and "No," though they are to the point, do not tell the reasons "why." The reasons why are what members of the association want to know, and answers shaped accordingly will do the most good.

The eleventh annual convention of the International Association of Municipal Electricians will be held at New Haven, Conn., August 15th, 16th and 17th. At this meeting the following papers will be presented and discussed: "History of the Fire Alarm and Police Telegraph;" "Details of Certain Auxiliaries to Fire-alarm Apparatus;" "Advisability of Protecting Municipal Electricians by the Civil Service Laws;" "Comparison of Underground and Overhead Wiring, and of the Relative Values of Single, Rubber-covered Wire and Lead-encased Cable for Underground Construction;" "Conditions Surrounding the Inspection of Wires in the Southwest." In addition to this, the Question Box will be a feature at this meeting. Any questions for explanation should be sent to the secretary, and they will be assigned to someone who is competent to answer them fully. Membership application blanks and information will be furnished by Secretary Frank P. Foster, Corning, N. Y.

MISCELLANEOUS.

Alaskan cable and telegram tolls paid to the United States government in March aggregated $14,500, and exceeded the receipts for any previous month. In the fiscal year which ended last June the government collected more than $100,000 in tolls.

The Great Falls Electric Properties, incorporated at Newark, N. J., proposes to construct and control street railways, amusement parks and waterpower in any part of the world. The capital is $1,000,000 and the incorporators are Pressley E. Bisland, William S. Brayton and Robert Randall.

Space telegraphy was put in public service on January 1, 1906, at Mazatlan, Mexico, and messages are now being sent and received from Guaymas and Santa Rosalia, Lower California, the latter place having been without telegraphic communication. The tariff rate for a message is $1 American currency, for each 10 words and 10 cents, American, for each additional word. It is too early to give an opinion as to the success of the system, which consists of two plants, called the Slaby-Arco and Telefunken, both of which were imported from Germany.

In the year 1904 there were exactly the same number of establishments engaged in the smelting and refining of zinc in the United States as in 1900, namely, 31, but the capital invested increased from $14,141,810 to $23,132,586, or 63.6 per cent.; the number of salaried employes increased from

208 (who were paid $440,200) to 342 receiving $3,754,003. The total value of the output increased from 4,860, earning $2,355,921, to 6,357, earning $3,754,003. The total value of the output increased from $18,188,498 in 1900 to $24,791,290 in 1904, or 36.3 per cent. This included in 1904 373,070,078 pounds of spelter and sheet zinc, valued at $19,210,850. The output of sulphuric acid increased from 117,655,214 pounds, valued at $424,670, to 154,600,036 pounds, at $570,000.

The executive committee of the Olympia Electrical Exhibition, held in London, last year, reports that the undertaking shows a profit balance of nearly $18,000, leaving a substantial balance, after returning to the exhibitors a rebate of 25 per cent. on the sums they paid for space. Donations were made out of the balance to the benevolent fund of the Institution of Electrical Engineers and to the Electrical Trades Benevolent Association. The remainder constitutes a nucleus of a fund for starting another exhibition. In the event no exhibition is held in the next five years, the money goes to the above named benevolent funds. The trustees are Sir William Preece, E. Cuncliffe Owen, J. E. Kingsbury, C. S. Northcote and a nominee of the Incorporated Municipal Electrical Association.

Preparations are being made by the Jamestown Exposition Company to celebrate the three-hundredth anniversary of the first English settlement in America with an elaborate exposition at Sewalls Point, near Jamestown, Hampton Roads, Va., in 1907. More than 20 of the states of the Union will have unusually large and attractive buildings. About 17 other buildings will be erected (several of the largest 600 by 350 feet), for a display of manufactures, liberal arts, machinery, art, agriculture, transportation, electricity, history, varied industries, etc. A special building will also be erected for foreign exhibits. Application for space should be made by June 1, 1906, if possible, and further information will be furnished by Algar M. Wheeler, chief department of exhibits, Norfolk, Va.

It is proposed to amend the United States patent laws by repealing section 4886, and enacting in its stead the following: "Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new system of process of conducting or carrying on a business or business operation, or any new and useful improvement thereof, not known or used by others in this country before his invention or discovery thereof, or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned [illegible] the fee required [illegible] ings and [illegible] the purpose [illegible] Gill, and [illegible] patent.

The Supreme Court [illegible] cided that the West [illegible] pany must lower the [illegible] under the Chicago River [illegible] decision has no bearing [illegible] situation. The tunnel [illegible] way company, by whom [illegible] authority granted by the city [illegible] begins the lowering of the W[illegible] Salle Street tunnel it can compel [illegible] pany to lower the tunnel at Van Buren street.

TRADE NEWS

The Standard Underground Cable Company has opened an office, for the special convenience of its southern friends, at Atlanta, Ga., in Suite 1223 Candler Building. Mr. C. A. Brown will be in charge and will give his personal attention to all correspondence coming to the new office.

Cuba ranks second in importance in the trade relations of the United States with other countries in the Western Hemisphere. The total trade of the United States with the countries named in the fiscal year 1905 was: With Canada, $203,000,000; with Cuba, $125,000,000; with Brazil, $111,000,000; with Mexico, $92,000,000, and with Argentina, $39,000,000.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until April 24th for furnishing eastern navy yards with submarine cable, lighting wire, circuit-breakers, fuse plugs, electric bells, fiber, mica, dry cells, parts for Telefunken wireless system, annunciators, insulating tape, etc., embraced in schedule 450, which can be obtained at the Navy Pay Office in New York, or upon application to the bureau at Washington.

The Evening Wisconsin of Milwaukee says: "The Wisconsin Brake and Electric Company, the new corporation which will take over and carry out the reorganization of the National Electric Company in the interest of the Westinghouse company of Pittsburg, Pa., has been organized in Milwaukee. The incorporators are W. D. Hickman of this city and two outsiders, Carl W. Boehm and J. A. McCormick, who represent the Westinghouse interest. The capital stock of the new company is but $5,000, which is stated to be only the nominal stock used [illegible] jobbing [illegible]

[illegible] Bending [illegible] in the Hadley [illegible] J. D. [illegible] the Hadley [illegible] also interested in the new [illegible]

BUSINESS

A new test of Dixon's [illegible] Professor Goss of Purdue [illegible] anew its value [illegible] affinity for metal surfaces.

"The adoption of an appropriate name for any manufacturing business is very important," says Machinery, "for it oftentimes has [illegible] in the success of the concern. If possible, the name should tell the business and also the place. It is obvious that the name 'Smith Bell Company' tells more than 'Smith Manufacturing Company,' but 'Schenectady Bell Company,' for example, is still better. It not only discloses the business but also the location of the concern so far as the name of the town is concerned, and this is usually enough. Such a name in the directory is self-explanatory, but what is more important is that possible customers will more readily remember a concern so named. Advertisements in trade journals do not yield all their results immediately; it is no uncommon thing for firms to get answers to 'ads' that appeared 10 or 20 years before. Many more returns would be received if people could always remember 'who' and 'where'."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 3, 1906.

816,554. Electric Furnace. Anson G. Betts, Troy, N. Y. Application filed May 20, 1904.

In combination with an electric furnace comprising a hearth adapted to contain a bath of liquid conductor are a channel, both ends of which lead into the hearth and adapted to contain liquid conductor, electrodes arranged to supply electric current to pass through the liquid conductor in the channel, and means for causing a circulation of liquid conductor from the hearth through the channel and back to the hearth. (See cut.)

816,571. Flexible Connection and Suspension Means for Gearless Motors. Karl F. Elers, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

Mechanical features of a motor-suspension system are described.

816,600. Suspension Means for Electric-railway Motors. Charles A. Psilander, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

The motor armature is flexibly mounted on the axle, the field-magnet frame having bearings for the armatures. Spring connections are made between the middle positions of the magnet frame.

816,610. Flexible Connection for Gearless Motors. Robert Siegfried, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 22, 1905.

The truck wheel has a cylindrical chamber or opening and a set of yielding resilient rings arranged side by side in the opening. A sleeve or quill for the motor armature has a boss that projects through the set of rings in the wheel chamber.

816,611. Flexible Connection and Suspension Device for Gearless Motors. Robert Siegfried, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 22, 1905.

A quill for the motor armature loosely surrounds the driving axle, connections being made between the quill and truck wheel.

816,612. Flexible Connection for Gearless Motors. Robert Siegfried, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 18, 1905.

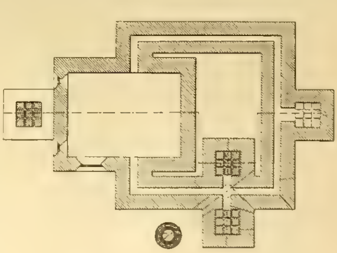
Mechanical features are described.

816,619. Telephone Desk Stand. Henry Tideman, Menominee, Mich. Application filed September 14, 1905.

In a telephone desk stand are a base, a cap, a web attached to the base and the cap and forming a part of the shaft connecting them and a detachable plate forming the completing portion of the shaft between base and cap.

816,628. Electric Transmission Pole. John L. Weller, St. Catharines, Canada. Application filed July 29, 1904.

The pole is made of concrete with longitudinal steel rods running through it.



No. 816,554.—ELECTRIC FURNACE.

816,636. Adjustable Support for Incandescent Electric Lamps. Oscar T. Banks, London, England. Application filed October 6, 1904.

A telescopic support to imitate a candle holds the incandescent lamp.

816,649. Electric Automatic Mail Carrier. Michael Danner, Panola, Ill. Application filed August 8, 1905.

An electric telpher system to carry mail pouches is the basis of the patent.

816,676. Mechanism for Operating Railway Signals. William V. Moak, Utica, N. Y. Application filed July 13, 1905.

The mechanism of the signal is driven by an electric motor controllable from a distance.

816,686. Horsepower Indicator and Engine-overload Alarm. John F. Shreffler, Chicago, Ill. Application filed November 28, 1904.

Electric contacts on a graduated scale are closed at a predetermined point on the scale by the pointer, which is moved by the steam pressure. The contacts are part of an alarm circuit.

816,762. Apparatus for Controlling the Passage of Cars or Vehicles Along a Railway. Louis H. Thullen, Edgewood, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed January 18, 1905.

Combined with a reversible electric motor are a switch-and-lock movement operated thereby and an electric clutch in circuit with the motor and adapted when energized to couple the armature of the motor with the switch-and-lock movement whereby the movement will be operated. A Circuit controller is operated by the movement for opening the circuit, including the electric clutch but not the motor circuit.

816,767. Chronograph. Meyer Wildermann and Robert L. Mond, London, England. Application filed November 18, 1903.

Electromagnetic means operate the pens of the chronograph.

816,792. Lock. Oliver H. P. Green and Delos Carpenter, Orion, Mich. Application filed September 6, 1904.

The lock is actuated by an electromagnet controllable by a switch on the inside of the door.

816,804. System of Motor Control. Axel Magnuson, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed January 18, 1905.

Electromagnetic switches in the motor-controlling circuits co-operate with means for generating a variable voltage in proportion to the speed of the motor, the voltage being applied to the electromagnetic switches in the controlling circuits, which are arranged to be actuated by the variable voltage.

816,805. System of Motor Control. Axel Magnuson, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed June 14, 1905.

A motor, a source of pulsating current therefor, a direct-current generator driven by the motor, a starting switch for the motor, a single magnet for actuating the starting switch, the magnet being energized by pulsating and direct currents and means dependent upon the generator for controlling the motor are the essential features. (See cut on next page.)

816,806. Electric Traction Elevator. Axel Magnuson, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed November 17, 1905.

An electric motor has a magnetic sheave arranged to be driven thereby. A cable connects the sheave and the car, a generator being connected to run with the motor and arranged to energize the sheave.

816,819. Two-division Telephone System. Howard M. Post, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed October 24, 1902.

In a telephone system are a telephone line, relays at the central office, parts controlled by the relays and means for causing the operation of the relays singly from the substation and simultaneously from the central office.

816,869. Electric Elevator System. Axel Magnuson, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed May 23, 1905.

Combined with an alternating-current motor are a reversing switch, a generator connected to run with the motor and arranged to produce a direct current proportional in strength to the speed of the motor, means for controlling the motor by the direct current thus produced and means on the reversing switch for causing the generator to produce its current in the same direction when the generator is run in one direction or the other.

816,875. Trolley Harp. Barney Murphy, New Haven, Conn., assignor of one-half to Fred Wallace, New Haven, Conn. Application filed August 24, 1905.

Details are described.

816,890. Electric Hoisting Apparatus. Almon E. Norris, Cambridge, Mass. Application filed September 23, 1904.

Electric driving means are arranged with a step-by-step electric controller and a controlling lever arranged relatively remote from its controller.

816,894. Apparatus for Telephone Switchboards. Henri E. A. André, Paris, France, assignor to the Western Electric Company, Chicago, Ill. Application filed April 27, 1904.

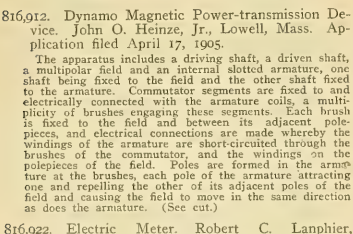
An answering and a calling plug and a plug circuit unite the lines. Telephonic apparatus is associated with the plug circuit, and blocking mechanism renders the telephonic apparatus inert. A relay operates the blocking mechanism, and a circuit for the relay is completed as the answering plug engages the terminal of a busy line.

816,900. Portable Insulated Support for Double-wire Electric Lines. Albert Collet, Paris, France. Application filed May 19, 1904.

Steel ladders hinged together at their upper ends and carrying a winch for straining the wires support the latter, the ladders being insulated from the ground.

816,903. Combination Clock and Fan. Spencer D. Earl, Norristown, Pa. Application filed May 5, 1905.

The combination consists of an electric fan, clock and source of electricity, with make-and-break apparatus included in the circuit and adapted to be operated from one of the wheels of the clock to make and break the circuit alternately.



NO. 816,805.—SYSTEM OF MOTOR CONTROL.

816,912. Dynamo Magnetic Power-transmission Device. John O. Heinze, Jr., Lowell, Mass. Application filed April 17, 1905.

The apparatus includes a driving shaft, a driven shaft, a multipolar field and an internal slotted armature, one shaft being fixed to the field and the other shaft fixed to the armature. Commutator segments are fixed to and electrically connected with the armature coils, a multiplicity of brushes engaging these segments. Each brush is fixed to the field and between its adjacent polepieces, and electrical connections are made whereby the windings of the armature are short-circuited through the brushes of the commutator, and the windings on the polepieces of the field. Poles are formed in the armature at the brushes, each pole of the armature attracting one and repelling the other of its adjacent poles of the field and causing the field to move in the same direction as does the armature. (See cut.)

816,922. Electric Meter. Robert C. Lanphier, Springfield, Ill. Application filed March 9, 1904.

Combined in a mercury motor meter are an armature, a pressure field coil having series connection therewith and means for varying the relative amount of pressure field current passing through the armature.

816,930. System of Motor Control. Axel Magnuson, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed June 13, 1905.

A motor, a controlling device therefor, a generator connected to run with the motor and an electromagnetic clutch dependent upon the action of the generator arranged to cause the controlling device to be actuated by the movement of the motor are the patentable features.

816,931. System of Motor Control. Axel Magnuson, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed November 16, 1905.

A generator is connected to run with a motor, a source of current supply being connected to the motor and to the field of the generator. Motor-controlling means separate from the field of the motor is operated by current from the generator.

816,938. Electric Programme Clock. August L. Ronell, Forest City, Iowa. Application filed March 10, 1905.

Details are described.

816,948. Controller for Automatic Telephone Systems. Alton E. Stevens, Fall River, Mass. Application July 12, 1905.

Our claim reads: "A shaft, a cam mounted thereon, a contact arm; a series of contracts with which the contact arm may be moved successively into engagement, a series of manually operated parts operatively connected with said cam, whereby said contact arm may be moved into engagement with one or more of said series of contacts."

816,981. Cross-arm for Electric or Signal Wires. Anthony H. Iliohan, Oakland, Cal. Application filed March 21, 1905.

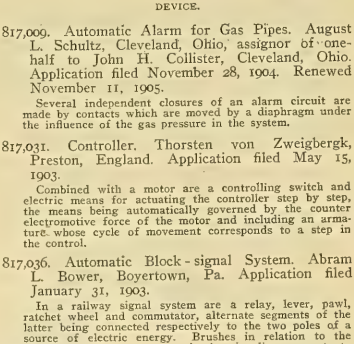
In a cross arm are an insulating body, pins secured in and depending below and to one side of the body and having insulators on their free extremities, and insulating inclosures removably applied to the under side of the body around portions of the pins.

816,990. Sparking Igniter for Gasoline Engines. John C. McLachlan, Toronto, Canada. Application filed October 31, 1904.

Details are described.

816,996. Electric-light Fitting. Herbert E. Plass, New York, N. Y., assignor to the Howard Miniature Lamp Company. Application filed June 9, 1905.

An ornamental fixture for holding an incandescent lamp is described.



NO. 816,912.—ELECTRICAL POWER-TRANSMITTING DEVICE.

817,009. Automatic Alarm for Gas Pipes. August L. Schultz, Cleveland, Ohio, assignor of one-half to John H. Collister, Cleveland, Ohio. Application filed November 28, 1904. Renewed November 11, 1905.

Several independent closures of an alarm circuit are made by contacts which are moved by a diaphragm under the influence of the gas pressure in the system.

817,031. Controller. Thorsten von Zweigbergk, Preston, England. Application filed May 15, 1903.

Combined with a motor are a controlling switch and electric means for actuating the controller step by step, the means being automatically governed by the counter electromotive force of the motor and including an armature whose cycle of movement corresponds to a step in the control.

817,036. Automatic Block-signal System. Abram L. Bower, Boyertown, Pa. Application filed January 31, 1903.

In a railway signal system are a relay, lever, pawl, ratchet wheel and commutator, alternate segments of the latter being connected respectively to the two poles of a source of electric energy. Brushes in relation to the commutator segments transmit the signaling currents to a signal circuit.

817,056. Machine for Forming Metal Tubes. Edwin T. Greenfield, Monticello, N. Y. Application filed August 5, 1904.

The mechanism is electrically operated.

817,082. Apparatus for Subjecting Air to Electric Discharges. John E. Mitchell and Dennis Parks, St. Louis, Mo., assignors to the Alsop Process Company, St. Louis, Mo. Application filed January 3, 1906.

In an apparatus for modifying air by the electric discharge, are a yieldably mounted electrode and a pair of electrodes reciprocable into and out of contact with opposite ends thereof, the electrodes being connected with a suitable source of electricity. (See cut.)

817,086. Conduit for Electric Wiring. Daniel H. Murphy, Milwaukee, Wis., assignor to the Safety Armorite Company, Pittsburg, Pa. Application filed June 9, 1902.

A metal pipe has a metallic coating on one surface and a flexible enamel coating applied directly to the other surface.

817,104. Igniter for Internal-combustion Engines. Arthur R. Curtis, Golden, Colo. Application filed April 10, 1905.

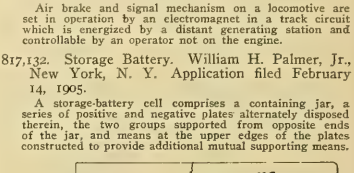
Combined with two electrodes are a weak spring acting on one electrode to normally separate the electrodes, an electrode-actuating lever, a second spring mounted on the lever and through which the latter acts to close the electrodes, the last-named spring also acting on the lever to effect a separation of the electrodes and simultaneously reacting on an electrode to hold the two electrodes in contact until the instant of separation.

817,131. Automatic Railway Signal. John Neumaier, Milwaukee, Wis., assignor of three-fourths to George L. Baldauf, Milwaukee, Wis. Application filed July 8, 1905.

Air brake and signal mechanism on a locomotive are set in operation by an electromagnet in a track circuit which is energized by a distant generating station and controllable by an operator not on the engine.

817,132. Storage Battery. William H. Palmer, Jr., New York, N. Y. Application filed February 14, 1905.

A storage-battery cell comprises a containing jar, a series of positive and negative plates alternately disposed therein, the two groups supported from opposite ends of the jar, and means at the upper edges of the plates constructed to provide additional mutual supporting means.



NO. 817,082.—APPARATUS FOR SUBJECTING AIR TO ELECTRIC DISCHARGES.

817,137. Apparatus for Producing Electric Waves. Alessandro Artom, Turin, Italy. Original application filed January 3, 1903. Divided and this application filed July 6, 1904.

Three discharge terminals have means to supply each with current differing in phase from that in the others, and aerial conductors connected thereto and disposed at right angles to each other.

817,140. Telephone Transmitter. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Original application filed January 27, 1902. Divided and this application filed April 3, 1902.

A telephone transmitter comprises a flat main diaphragm, an open non-flexible ring, a flexible auxiliary diaphragm and suitable means for securing the auxiliary diaphragm to one side of the ring to form a cup, the auxiliary diaphragm forming the bottom of the cup. Oppositely arranged electrodes are secured to the diaphragms within the cup, granular carbon being placed between the two electrodes with means for securing the main diaphragm to the cup. A bridge is rigidly connected with the electrode associated with the auxiliary diaphragm.

817,146. Switching Device for Electric Lamps. John McCullough, Newark, N. J. Application filed June 23, 1903.

In an electric lamp are a lamp bulb, a collar upon the base, a tube within the collar, a contact part contained within the tube, and connected to a lamp filament, a second contact part adjacent to the first-named contact part and connected to the lamp collar and means movable axially in the tube itself, adapted to close the circuit between the two contact parts.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on April 9, 1906:

400,890. Regulation of Electric Motors. Forée Bain, Chicago, Ill.

400,916. Current-collecting Device for Electric Railways. R. M. Hunter, Philadelphia, Pa.

400,926. Electric Railway. Robert Lundell, New York, N. Y.

400,951. Electric Circuit-testing Device. M. Robinson, Newton, Mass.

400,971. Alternating-current Electric Motor. Elihu Thompson, Lynn, Mass.

400,972. Induction Coil and Self-inductive Apparatus. E. Thompson, Lynn, Mass.

400,973. Armature for Dynamo-electric Machines. E. Thompson, Lynn, Mass.

400,978. Electric Heating Apparatus. H. F. Watts, Sandusky, Ohio.

400,980. Standard Tangent Galvanometer. E. Weston, Newark, N. J.

400,985. Telegraph Apparatus for Ships. James B. Willis, Portsmouth, County of Hants, England.

401,006. Electric Self-winding Timepiece. Manuel Carranza, Guatemala, Guatemala and Jose M. Tinoco, San Francisco, Cal.

401,014. Insulating and Coating Compound. Alfonso De Figaniere, Philadelphia, Pa.

401,035. Electrical Night Signaling Apparatus. Emil Kasselowsky, Berlin, Germany.

401,041. Electromedical Apparatus. J. J. Lewin, San Francisco, Cal.

401,050. Galvanic Battery. James H. Phalan, New Haven, Conn.

401,052. Electric Winding for Torsion-pendulum Clocks. H. Rabe, Hanau, Germany.

401,122. Armature for Electromagnets. J. Geary, Philadelphia, Pa.

401,153. Electric Gas-lighting Burner. J. Geary, Philadelphia, Pa.

401,254. Tube or Conduit. George H. Gillette and King G. Gillette, New York, N. Y.

401,155. Conduit for Electrical Conductors. George Gillette and K. G. Gillette, New York, N. Y.

401,200. Electric Valve Controller. William E. Norris, Waterbury, Conn.

401,207. Combined Mechanical and Electromagnetic Motor. Charles A. Randall, London, England.

401,231. Electric Railway. S. H. Short, Denver, Colo.

401,225. Apparatus for Laying Electrical Conductors. W. F. Smith, Philadelphia, Pa.

401,226. Electric Meter. W. F. Smith, Philadelphia, Pa.

401,227. Mechanical Telephone. G. Thomas, New York, N. Y.

401,230. Regulator for Dynamo-electric Machines. Charles J. Vandepoele, Chicago, Ill.

401,231. Reciprocating Electric Engine System. Charles J. Vandepoele, Lynn, Mass.

401,255. System for Transmitting and Distributing Electricity. Stanley C. C. Currie, Philadelphia, Pa.

WESTERN ELECTRICIAN

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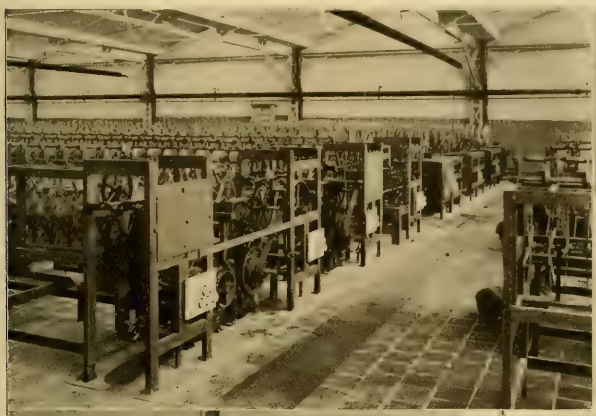
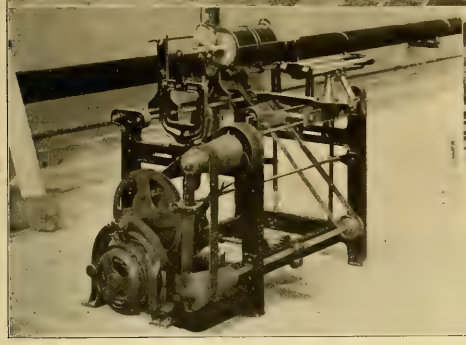
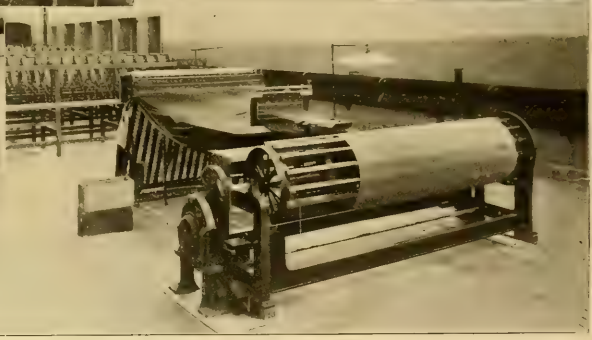
Electrical Operation in Silk Factories.

By Dr. Alfred Gradenwitz.

The growing attention paid to electrical operation for textile works is due to the fact, more and more generally realized, that the electric motor shows a number of valuable features rendering it especially available for the operation of such delicate machinery. The illustrations reproduced herewith represent a few typical electrical drives in the Krahmen & Gobbers silk factories in Germany. Besides their extensive Crefeld works this concern possesses two other factories at Wassenberg, the electrical equipment of which was supplied by the Siemens-Schuckert Company.







Spooling Machines.
Edge Warping Machine.

Ribbon Warping Machine.
Warping Machine.

ELECTRIC DRIVE IN A GERMAN SILK FACTORY AT WASSENBERG.

The power station that supplies the electrical energy is installed in the older factory at Wassenberg and contains a generator of 105 kilowatts capacity, generating current at 600 volts, with 600 revolutions a minute. This current is transmitted through an overhead line from the old to the new factory, and after the pressure has been reduced in a transformer down to 110 volts, serves to operate the spooling, beaming and other preparatory machines, as well as to light the works, accessory rooms and offices by means of about 400 incandescent and four arc lamps. The direct-current generators which are provided for the lighting of the old factory feed about 600 incandescent and 10 arc lamps. Another overhead line transmits accumulator current required for emergency lighting from the power station in the old works to the new factory. All the overhead wires are protected both at the primary and secondary stations, as well as halfway between, against atmospherical discharges by horn lightning arresters, which have proved useful in view of the very frequent thunderstorms.

No less than 113 different machines are at present operated by electricity [illegible] transmission or through [illegible] preparatory machines such as warping [illegible] machines, brushing mills, combing [illegible] spooling machines with motors of one-quarter to one-third horsepower, and a winding machine and large warping machine with motors of [illegible] and 3½ horsepower, respectively. Furthermore there is a pump in the boiler house, two [illegible] water pumps and an economizer direct coupled to a worm wheel, which are operated by motors ranging from 3½ to five horsepower. The silk coming works are operated in a group by a 10-horsepower motor, with slip-ring armature and oil starter.

The motors of from one-quarter to one-third horsepower are synchronous machines with short-circuited armatures. Braking-band clutches and resilient belt disks are used in connection with the belt transmissions and a toothed wheel with patent braking-wheel clutch in the case of the geared machines. The latter kind of drive has been exclusively used in connection with the warping and beaming machines. The motors are free to swing in a jack having in its upper part a bearing to support the shafting of the labor-saving machinery. On this shaft is mounted a toothed wheel with brake-band clutch, the inner part of which (comprising a braking disk) is fixed by adjusting screws to the shaft of the machine, while the toothed rim is clutched to the braking disk by means of a band-brake. The tension of the brake hand being controlled by a spring, the clutch, while safely transmitting the normal torque and that produced in the starting of the beaming machine, will yield in the case of any higher forces. To the motor shaft is mounted a rawhide pinion gearing with the large toothed wheel. The swinging arrangement of the motor in the jack [illegible] same type of motors, but act through a belt transmission. As these spooling machines should start with especial smoothness in order to avoid any tearing of the silk threads, the belt disk connected to the large toothed wheel at the motor has been made resilient so as to deal with the shock exerted by the motor on suddenly starting at full speed and to cause the spooling machine to start smoothly.

All the motors work with high efficiency. Individual operation is the more convenient, as some preparatory machines (beaming and warping machines), whenever new pieces are to be fed, have to be stopped at intervals. Another advantage of individual operation in the case of spooling machines is the more uniform working of the silk.

The above plant has been in operation for more than a year with entire satisfaction.

Block Lighting Proposed in Cleveland.

A number of business men are considering the advisability of establishing light plants to serve small blocks of territory in the business district of Cleveland. Mr. Springborn, the director of public safety, has the names of these gentlemen and knows something of the detailed plans.

Baker Street and Waterloo Tube Railway in London.

One of the most recent additions to the tube-rail way system of London is the Baker Street and Waterloo Street Railway, which has just been opened for traffic. While the tube railway is no more a novelty, this particular line possesses many features which are radical departures from designs heretofore carried out. A comprehensive description of this interesting piece of work appeared recently in the Tramway and Railway World of London, which has reprinted the article in pamphlet form.

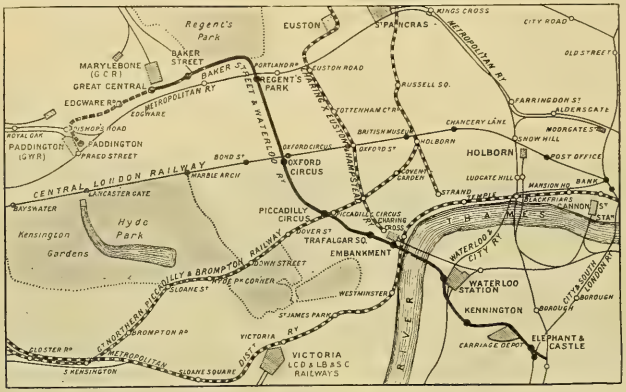


FIG. 1. MAP OF BAKER STREET AND WATERLOO RAILWAY AND ASSOCIATED LINES.

Some of the facts as set forth in this pamphlet will be found of interest.

Fig. 1 is a map showing the location of the Baker Street and. Waterloo line and its relation to the other London railways, it being indicated by the heavy black line. The total length of the line will be 5¼ miles, although the portion from Edgeware Road to Paddington has not yet been completed. There are 12 stations on the line, as indicated on the map.

As in other railways of this class, each track is a separate circular tunnel which is lined throughout with cast-iron segments bolted together. There are three internal diameters of the running tunnels—11 feet 8¼ inches on straight-away track and slight curves, 12 feet on curves of not less than 10 chains radius and 12 feet 6 inches on sharper curves. At passenger stations the tunnel is 21 feet 2½ inches in diameter. Lifts are installed at all stations as well as large ventilating fans to insure a pure atmosphere in the tubes. The cars are built entirely of non-combustible materials, steel being the chief element.

The track arrangement may be gathered from

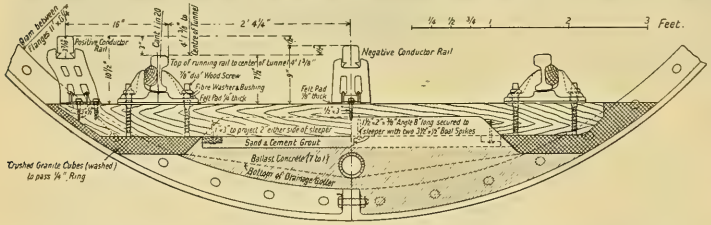


FIG. 2. SECTION OF TUNNEL AND TRACK OF BAKER STREET AND WATERLOO RAILWAY.

the section shown in Fig. 2, from which it will be seen that the bottom of the invert is filled with a bed of concrete with sloping sides in which the ties are firmly set. The running rails are of the standard 90-pound bullheaded British railway type. Positive and negative conductor rails are used and are of practically square cross-section. They weigh 85 pounds to the yard. The chemical composition of these rails is as follows: Carbon, 0.05 per cent.; manganese, 0.19 per cent; sulphur, 0.05 per cent.; phosphorus, 0.05 per cent.; silica, 0.03 per cent., the balance being iron. The electrical conductivity is very high and the resistance is said to be only 6.4 times that of pure copper.

The positive conductor rail is carried on specially shaped insulators, mounted on the ends of the sleepers, close to the wall of the tube, while the negative rail is placed centrally on a lower type of insulator between the track rails. The positive insulator is of peculiar shape, and has been designed to lie close to the curve of the tube. The clearance between the flanges of the segments of the tube and the conductor rail is only 2¼ inches. The insulators are of vitrified earthenware, manufactured by Doulton & Co., and are fastened to the sleepers by malleable-iron clips with felt pads below them. The negative rail insulator is a square, solid block with a groove in the center for the rail, and it is held down in a similar way.

The conductor-rail joints have each four bonds, two long and two short, on each side. They are of the flexible plaited-wire type, and were supplied by the American Steel and Wire Company. The short bonds are placed inside the loops of the long ones. The total cross-section area of the four bonds is 1.4 square inches.

Vibration trouble, sometimes complained of by residents near underground railways, has been entirely prevented. During the experimental running of the trains, tests were made by an expert, who used a seismograph which magnifies earth tremors 300 times. This instrument was employed both on the surface and on the ground of a chamber immediately below the street, at points directly above the railway, and even to such a delicate recorder the vibration caused by passing trains was scarcely perceptible.

Power for the operation of the Baker Street and Waterloo line is obtained from the Chelsea power station of the Underground Electric Railways Company of London. This station has an ultimate capacity of 80,000 horsepower, and was described in the Western Electrician of February 25, 1905. The chief sub-station for the Baker Street line is at Charing Cross, which was also described in that issue. Besides the Charing Cross sub-station, there are two others, one in the depot at St. George's Circus and the other at Baker Street.

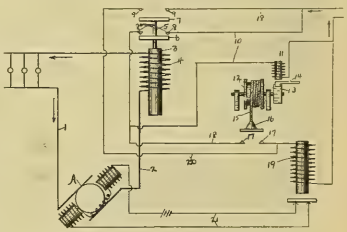
One hundred and eight cars have been ordered and 95 are now ready. Six cars go in a standard train—a motor car at each end and four trailers between. The cars are 50 feet over all, 33 feet between truck centers, eight feet eight inches in width and nine feet 5⅜ inches high. Both longitudinal and transverse seats are used. The trailer cars seat 52 passengers and the motor cars 46.

Two standard General Electric motors, type 69, of 200 horsepower each, are mounted on the driving truck of each motor car, the Sprague-Thomson-Houston multiple-unit control being used. One of the recently developed features of the equipment is an electrically operated carbon-break circuit-breaker for protection of the motor circuit on each motor car.

It is of much interest to collect into one view the numerous systems for the distribution of energy in various forms which are installed along the entire length of the railway. First, there are the high-tension feeder cables, which run along the tunnels to the sub-stations; second, the conductor rails, two to each track, which supply the current for working the trains; third, the 220-volt three-phase circuits for supplying the incandescent lamps in the tunnels; fourth, the 550-volt circuits for the lifts and for the arc lamps in the stations; fifth, the entire system of telephone circuits; sixth, the electrically continuous track rail in each tunnel for the signaling system; seventh, the negative main for the same purpose, and eighth, the compressed-air pipe running from end to end of the railway, which supplies aid to the pneumatic motors for the signals and points.

Two-speed Controller for Electric Light and Power Circuits.

Controlling devices capable of acting with two different speeds under different conditions are desirable, among other places, in electric power and lighting systems, and especially in systems of this kind employing very large currents. In these systems when the current in one or more of the circuits becomes unduly great it is necessary to exercise some control over these circuits, so as to prevent injury from overload currents. Common expedients are to open the circuit itself or to open the exciting circuit of the generator supplying such circuit. In either case the overload current is caused to subside, and injury or damage is averted. Where the overload current is not largely in excess of the normal current, or where it acquires its excess size in a slow manner, it is sufficient and desirable to open or control the circuit slowly. But where the overload current is greatly excessive or where it acquires its size very rapidly it is desirable to open or control the circuit instantaneously. A two-speed device to perform this duty



TWO-SPEED CONTROLLER FOR ELECTRIC LIGHT AND POWER CIRCUITS.

was patented recently by Mr. George N. Eastman of Chicago and assigned by him to the Mineralac Company of the same city.

A diagrammatic view of the arrangement is shown in the illustration herewith.

(A) is a generator of the direct-current type. A main circuit leads from this generator to the translating devices. The two-speed controller comprises a magnetic core (3) provided with a coil, which is included in the generator circuit. This core is provided with a rod, carrying two contact plates or disks. The disk (6) is adapted to make contact with a pair of contacts upon a moderate elevation of the core. The disk (7) is arranged to make contact with a second set of contacts upon a larger elevation of the core, the disk (6), however, still remaining in contact with the contacts (88) during the rise of the core to place the contact (7) against the contacts (99), the contacts (88) being mounted in spring material, so as to permit the elevation of the disk.

Contacts (88) are included in a local circuit, containing a relay (11), which is arranged to control a slowly acting circuit-closing device, the form shown consisting of a rotary drum, provided with a vane, which is engaged by an arm, which serves as an armature for the relay. The drum carries a coil of cord, which is, of course, lowered as the drum revolves. On the end of the cord is a metal contact plate, which is adapted on the uncoiling of the cord to drop upon and make contact with contacts in a trip-coil circuit (18), containing a trip coil (19). The contacts (99) are included directly in the trip-coil circuit, a conductor (20) being extended around the contacts (17) so as to make a trip-coil circuit for the contacts (99), closed throughout except at the contacts. Thus it will be seen that when the overload current is only moderately excessive or acquires its excessive size slowly the core will be slowly elevated, thereby causing its disk (6) to connect with the contacts

(88), and close the local circuit (100) and close the relay (111) to elevate the auxiliary pawl (112) to the drum, so that the weight descends and moves connection with the contacts (115) to close the trip coil circuit. The unwinding of the cord on the drum requires a moderate amount of time, thus causing a delay in the operation, which results in a slow action. If, on the other hand, the under-load current is greatly exceeded or acquires its size rapidly, the core will rise higher quickly, and while the contact (6) will close the coil circuit (10) the contact (7) will also close the contacts (9 9) at practically the same time, whereby the trip coil circuit (90) will be closed and the trip coil energized before the mechanism is in operation by closing the circuit (10) has time to operate. In this way the trip coil will be instantaneously actuated under condition of great overload and slowly actuated under conditions of moderate overload.

Chicago Drainage Canal Water Supply Likely to be Unrestricted.

Predictions based on developments in the Senate committee on foreign relations are to the effect that no limitations will be put on the amount of water that may be diverted to the Chicago Drainage Canal. Senator Cullom of the Senate committee said that it was the sense of himself and his colleagues that the canal should have all the water it required. "I'm against any limitation with respect to the canal," Senator Cullom said. "Neither myself nor my colleagues can understand the proposal which contemplates giving private corporations all the water they want for industrial purposes and failing to allow Chicago all the water it needs to conserve its health. Therefore, I think it may be safely anticipated the committee will refuse to adopt the recommendation of the American members of the International Waterways Commission."

As was noted in the Western Electrician last week, the International Waterways Commission recommended that the flow of the canal be restricted to 600,000 cubic feet a minute, which is apparently the capacity provided for by existing law.

President R. R. McCormick of the board of trustees and Isham Randolph, chief engineer of the Sanitary District, addressed the committee.

Another thing affecting the situation at Chicago is the introduction of a bill in the House of Representatives by Representative Burton of Ohio which accepts the recommendations of the American members of the International Waterways Commission to the extent of prohibiting the diversion of any more water from Niagara Falls than is now being withdrawn. The bill does not attempt to regulate the inflow at the Drainage Canal, however, but confines its cure to the treatment of the conditions existing in close proximity to the Falls. After prohibiting the increase by the manufacturing establishments of the quantity of water now being diverted by them, the bill provides that these establishments can operate only upon permits granted by the secretary of war, and the secretary is prohibited from issuing permits to new companies.

There are now between 4,200 and 4,300 licensed automobiles in Chicago. Perhaps three per cent. of these are electric vehicles.

The Pennsylvania Railroad's Extension to New York and Long Island. Long Island City Power Station. III

FIG. 9. ELECTRICAL OPERATING GALLERY IN LONG ISLAND CITY POWER STATION.

battery has a discharge rate of 300 amperes for one hour and is controlled from the operating gallery. It is normally kept floating across the excitation bus. In order to charge the battery a 125 kilowatt booster, driven by a 15 horsepower induction motor, is located in the operating gallery next to the motor driven exciter above mentioned. This motor-driven booster used to charge and discharge it can be seen in Fig. 9, placed next to the motor-driven exciter.

Switchboard Apparatus.

The generators are designed to run in parallel on either of two sets of main bus-bars, called the "working" and the "auxiliary" bus, only one set of which is generally in use. The switches for the outgoing feeders are arranged in groups of six (three only of each group being installed at present), these feeders being tapped from an intermediate or "group" bus. In order to distribute current to the feeders, therefore, it is first necessary to connect a group bus to either the working or the auxiliary bus, and this is done by providing each group with two selector circuit breakers, one for each of the two sets of main bus-bars. Thus any generator or any group of feeders can be connected at will to either set of main bus-bars.

The cables are run through the turbine foundations into the basement where taps are taken off for the generator potential transformers, whence small wire leads run in conduits to the instrument

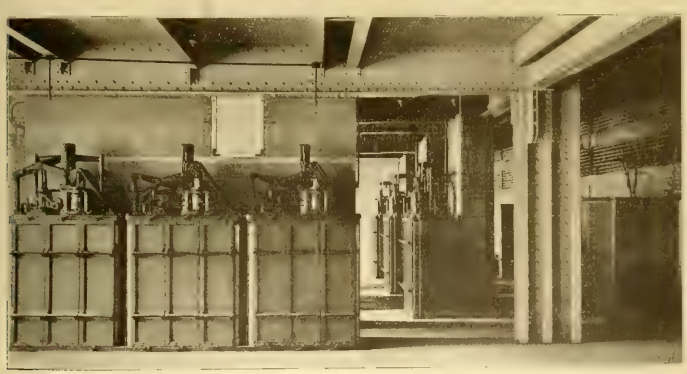


FIG. 10. FEEDER GALLERY, SHOWING OIL CIRCUIT-BREAKERS FOR FEEDERS AND GENERATORS.

[illegible] the three-story bus structure [illegible] the auxiliary bus being displaced to a similar structure along the south side and directly opposite the main bus. Ranged along the main sides of these bus structures and facing each other are two lines of Westinghouse type C oil circuit-breakers. The two smaller breakers on either can directly opposite each other are the generator selector circuit-breakers, and the two larger ones are the feeder group selector breakers. These successive pairs of feeder selector switches are mounted underneath the floor by group bus-bars, and, there being a selector switch at each end of this group bus-bar, the group bus can be joined to either the main or auxiliary station bus. The taps generator leads are connected to similar sets of cross-connecting bus-bars joining the generator selector switches, thus enabling any generator to be thrown on to either set of bus-bars by closing the proper selector switch. The feeders are tapped from the group bus joining two specific feeder selector switches, six feeders being tapped from each auxiliary group bus, and each feeder having its separate circuit-breaker. The feeder circuit-breakers are therefore installed in groups of six, three of each group being now installed, the remaining three being omitted until future completion of the equipment.

There are frequent openings in the working bus-bar structure, it being closed by glass windows set in iron frames. A general view of half the bus structures of the generator and the feeder selector switches ranged along them is shown in Fig. 11.

The bus structures are laid out in sections, the first section in the completed half station containing the selector circuit-breakers for the future 2,500-kilowatt lighting generators and the outgoing feeder circuits. The second section is the one now installed, and includes three pairs of generator selector switches and three pairs of feeder group selector switches. Room is left in the station for the further extension of the bus structures toward the easterly end of the gallery, to an extent that will enable the installation of three more pairs of generator selector switches, and three more pairs of feeder group selector switches.

All of the circuit breakers are Westinghouse type C oil switches, with remote electrical control, worked from the main operating gallery on the upper floor. The main generator circuit-breakers are of 600 amperes each, the generator selector breakers of 600 amperes capacity, the feeder group selectors of 1,200 amperes capacity, and the feeder switches of 600 amperes capacity. The generator switches are four-pole, in order to provide for an extra connection to the neutral point of the generator winding and a neutral bus which is provided. All the other oil switches are three-pole.

Some of the features of these oil switches are

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CONTENTS OF THIS NUMBER.

Electrical Operation in Silk Factories. By Dr. Alfred Gradenwitz. Illustrated 311
Block Lighting Proposed in Cleveland 311
Baker Street and Waterloo Tube Railway in London. Illustrated 312
Two-speed Controller for Electric Light and Power Circuits. Illustrated 312, 313
Chicago Drainage Canal Water Supply Likely to Be Unrestricted 313
The Pennsylvania Railroad's Extension to New York and Long Island—Long Island City Power Station. Part III. Illustrated 313, 314, 315
Location and Care of Lighting Fixtures 315
American Society of Mechanical Engineers to Meet in Chattanooga 315
Editorial 316
The Prevention of Pole Rot. By Charles H. Coar 317, 318
Electrical Show in Salt Lake City 318
Franklin Celebration in Philadelphia 318
Milwaukee Convention of the Institute 318
Death of Lemuel Bannister 318
Electrical Show in Fond du Lac, Wis. Illustrated 318, 319, 320
Some Important Considerations in Electric Illuminating Engineering. By Douglas Burnett 320
Electrical Conditions in Wisconsin Cities 320
Protection from Lightning 320
Books Received 320
Questions and Answers 321
Initial Charging and Complete Discharge of Storage Batteries 321
Difference Between Synchronous and Asynchronous Motor. 321
Bunsen's Photometer 321
Trials and Dangers of the Lineman. By R. G. Grayne. Illustrated 321
Municipal Operation in Europe Disappointing 321
Air Brakes for Electric Cars 322
Chicago Traction Matters 322
Iowa Electrical Association 322
Electricity for the Egg-eating Hen 322
World-wide Telephone Rates Disclosed by Canadian Parliamentary Inquiry. Part I 323
Chicago Telephone Rates 323
Portable Telephone Service for Detroit 323
General Telephone News 323
Ohio Telephone Notes 324
Indiana Telephone Items 324
Telephone News from the Northwest 324

DEPARTMENTS.

Correspondence 324, 325, 326, 327
Great Britain 324
New England 324
New York 324, 325
Southern States 325
Texas 325
Mexico 325
Ohio 325, 326
Indiana 326
Michigan 326
Illinois 326
Northwestern States 326
Pacific Slope 326, 327
Personal 327
Electric Lighting 327
Electric Railways 327, 328
Power Transmission 328
Publications 328
Societies and Schools 328
Miscellaneous 328
Trade News 328, 329
Business 329
Illustrated Electrical Patent Record 329, 330

DATES AHEAD.

Texas Independent Telephone Association (annual meeting), Waco, Tex., April 25th, 26th and 27th.

American Electrochemical Society (general meeting), Ithaca Hotel, Ithaca, N. Y., May 1st to 3d.

American Society of Mechanical Engineers (annual convention), Read House, Chattanooga, Tenn., May 1st to 4th.

Southwestern Electrical and Gas Association (annual convention), Galveston, Tex., May 16th, 17th and 18th.

Indiana Independent Telephone Association (annual meeting), Claypool Hotel, Indianapolis, May 17th and 18th.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

Canadian Electrical Association (annual convention), Clifton House, Niagara Falls, Ont., June 19th, 20th and 21st.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

THE NEWS comes from California that the telephone repeater has been invented again. David C. St. Charles, an engineer of that state, has, according to the veracious daily papers, invented a repeater "which will make it possible to telephone from San Francisco to New York. The combining of the echo in nature with the sounding board of a violin furnished the clew to the discovery, according to a statement of St. Charles." This is just a little bit indefinite, but let us hope there is something tangible behind the story. Alleged "telephone repeaters" that fail to repeat are numerous; one that really did the work automatically would mark a tremendous advance in the art of telephony.

JUST as the Western Electrician is going to press, we learn with horror and dismay of the terrible calamity which afflicted San Francisco on April 18th. An earthquake, followed by fire, appears to have wrought a great disaster, in which the electrical as well as all other interests in the city have suffered enormously. At the present writing there appears to be no electric or gas lighting service; the street cars are not running, and, owing to burst water pipes, there is no water to extinguish the fires that are raging. Perhaps a thousand persons or more have lost their lives. In the face of such a visitation words are weak. But we assure the electrical men of San Francisco and their fellow citizens that the sympathy of the electrical men in the rest of the country is sincere and profound. If any outside assistance will mitigate the disaster, it will be forthcoming in profusion.

WHILE the garish and malodorous gasoline car continues its triumphal march through the highways of the world, the quiet, graceful, serviceable electric automobile is not without its moments of triumph. Such an occasion is reported from London, where, after May 1st, the "petrol" machines will be excluded from Hyde Park, although the electric vehicle will still be allowed to wend its elegant and unobtrusive way along the drives in that well-known pleasure ground. This decision on the part of the authorities has, as might be expected, aroused much opposition among owners of gasoline automobiles, but to no purpose. The noise, rush, fumes and smell of the gasoline machine are absent in the electric type, and for this reason the discrimination is made. It is gratifying to note that the merits of the electric machine receive this recognition, for it must be confessed that the proportion of the electrics among the total number of self-propelled pleasure vehicles is not as large as might be wished.

ONE of the first things that will be taken up, probably, by the committee on gas, oil and electric light of the new City Council of Chicago will be the consideration of the report on electric-light rates made by the old committee just before the expiration of the aldermanic year. The old committee recommended, after several conferences with representatives of the Chicago Edison and Commonwealth electric companies, that ordinances be passed fixing the net maximum kilowatt-hour rate at 14 cents for the next two years and 12 cents for the next three years thereafter. But further, in the language of one of the proposed ordinances, "Such maximum or full rate may be charged to a consumer only for a consumption of electricity not exceeding the equivalent of 30 hours' use per month of the consumer's maximum demand, as shown by a meter or meters to be installed by the supplying company. For all electricity taken by a consumer in excess of the equivalent of 30 hours' use per month of such maximum demand the maximum rate (commonly called a 'secondary' rate as applied to such longer use of electricity), to be charged by either of said companies, shall not be more than nine cents a kilowatt-hour during the first year of said five-year period, not more than eight cents a kilowatt-hour during the second year of said period, not more than seven cents a kilowatt-hour during the third year of said period, and not more than six cents a kilowatt-hour during the fourth and fifth years of said period."

These rates are considered to be equivalent to a flat rate of nine cents a kilowatt-hour. The present net maximum rate is 16 cents a kilowatt-hour as the "short-hour" rate and 10 cents a kilowatt-hour as the "long-hour" rate. These rates are, of course, subject to certain other discounts where current is taken in large quantities. As New York has a flat rate of 10 cents a kilowatt-hour, what is practically a nine-cent rate should be acceptable in Chicago. The new Council will do well to adopt the report and pass the proposed ordinances.

THE CONSPICUOUS success of the Chicago Electrical Show last January has given an impetus to the electrical-show idea among central-station men and electrical manufacturers and dealers. We report two such shows in this week's issue at such widely separated points as Fond du Lac, Wis., and Salt Lake City, Utah. Another will probably be held in La Crosse, Wis., in two or three weeks, and several others are in contemplation. The idea of holding these local shows for the education of users and possible users of electric light and power is a good one and deserves careful attention in all parts of the country. These displays need not necessarily be large, elaborate, expensive affairs, but they should by all means be bright and attractive, with popular features, such as light, music, novelties and demonstrations. A bit of radium, mercury-vapor lamps, X-ray apparatus, wireless communication, or something not often met with in the daily experience of the ordinary visitor, should be secured if possible. Electrical experiments, even of the simpler sort, are always interesting, and a section of a telephone exchange in service invariably attracts attention. Exhibits should be shown in operation where possible. The idea is capable of infinite expansion.

A CORRESPONDENT in a western state brings up an interesting point. "What," he asks, "is the outlook in relation to gasoline and vapor-lamp competition? If the use of denatured alcohol without revenue tax is allowed, at what cost can it be made, and can it be used to give a cheaper light than gasoline? Under present conditions we cannot reduce the price of current below a certain figure, and the penurious nature of the small country merchant cannot always appreciate the quality and convenience of electric light if it 'costs more than gasoline.' Hence we will all welcome a means of reducing the cost of electric light, to make a customer of every store or house on the line, instead of one in every four or five, as at present."

Advocates of the removal of the internal-revenue tax from denatured alcohol to be used in the arts argue that such a course would be of great industrial benefit. We do not believe that any opposition to electric lighting lies back of the bill, but perhaps such an incidental possibility is worth taking into consideration. Should Congress pass the bill now under discussion it is not likely that any very immediate effect would be felt. It might be years before alcohol would be sufficiently reduced in price to compete with other liquid fuels. And it is as a cheap fuel for motors that the tax-free alcohol is mainly advocated, not as a cheap illuminant. Moreover, in view of the high fire test now required for kerosene sold for illumination and the restrictions thrown about naphtha and gasoline vapor lamps by the underwriters, owing to the danger of fire, it does not seem likely that alcohol vapor lamps with mantles, even with free alcohol, would introduce any element of competition which is not now experienced.

Electricity furnishes the best and safest agency for illumination now known. Improvements are constantly taking place in the art of electric lighting, so that the service rendered may be cheaper and better. Possibly a future improvement to lower the cost of producing current will be the employment of alcohol engines to drive the generators. In many western states, where grain is the principal product of a fertile soil and where coal is comparatively dear, such a situation, with no tax on denatured alcohol, is conceivable. At any rate, we believe that electric lighting will more than hold its own against all other illuminants. Occasionally there are flurries, such as that caused by the introduction of acetylene, the spread of the "gas arc," and the like, but the progress of the electric light has been steady and constant ever since its introduction. We have no fear that it will remain for alcohol, taxed or untaxed, in its natural state or denatured, to inflict a serious injury.

The Prevention of Pole Rot.

By Charles H. Case

One of the principal causes of depreciation in aerial distribution systems is pole rot, which has been comparatively neglected up to within a few years ago, though many companies, and also the Agricultural Department of the United States, have conducted extensive experiments with the view of finding some efficient method of lessening the depreciation from this cause. The rapid increase in the price of good pole timber has done much to stimulate the adoption of methods which would lengthen the useful life of poles. The idea of preserving wood is old, and many different preparations have been utilized for this purpose, including chloride of zinc, zinc and tannin, bichloride of mercury, sulphate of copper, wood creosote oil, dead oil, coal tar and various commercial preparations, usually combinations composed from, or containing, some of the above-named ingredients. Treatments composed from coal tar and creosote oil are far more successful, all things considered, and are undoubtedly more generally used in some form or other than any of the other-named preparations. With the exception of iron poles used in street-railway work, wooden poles are almost exclusively used in electric systems, and may be chosen from any of the following-named timbers: Red and white cedar, sap and hard pine, cypress, juniper or red wood and chestnut.

Cedar of good quality has a capacity to resist the attacks of insects and fungus growths to a greater extent than any other wood used for poles in this country. Heart-sawed pine poles have an average life of from eight to nine years, while sap pine, though readily secured in suitable sizes, is rarely used, because of its rapid decay, its natural life being scarcely more than three years.

The accompanying table gives the approximate life of the different kinds of timber used for poles in this country:

Kind of Pole.	Average Natural Life.
Red cedar	10 to 30 years.
White cedar	10 to 25 years.
Chestnut	8 to 12 years.
Heart-sawed pine	8 to 9 years.
Cypress	5 to 8 years.
Sap pine	3 to 5 years.

The facilities and cost of obtaining the various kinds of timber for poles in the United States has much to do with the selection, and for this reason the poles used in one section of the country will differ from those used in a different portion. For instance, in the southern portion of the United States, red cedar and cypress are used quite extensively, because these trees grow in that portion of the country, and for this reason are better suited to the climatic conditions in some ways.

Different conditions to be met with have caused many different methods of either preserving the poles or arranging them so that they can be readily replaced when necessary, due to loss of strength. An instance wherein much ingenuity was shown is in connection with the New Orleans Drainage Commission lines, a large portion of which was constructed through swampy country, an ideal spot for the production of rot. It was found that the poles set in the ground after the customary manner in this line had to be reset in a very short time, and it is well known that piecemeal resetting of poles is very expensive, in that the work is here, then there, necessitating the transportation of both tools and men, and also that the old construction has to be taken down. All this consumes extra time, to say nothing of the inconveniences the consumers are put to during shutdowns. Because of this, and to obtain greater strength, the engineering staff having charge of the construction of the above-mentioned line adopted a plan which consisted of setting a wooden box, of slightly larger inside dimension than the poles, in the earth a sufficient depth. This box was then completely surrounded by a concrete filling or jacket. As soon as this was set the box was withdrawn, and the hole thus left in the concrete formation was used to place the pole in. The poles used were square-cut timber and the hole was left slightly larger than the pole, the unfilled space being filled later with clean sand, thereby preventing any looseness when the pole was in place. The poles thus set could be easily withdrawn, the sand scooped out of the hole, and a new pole substituted. Poles so placed necessarily have a very strong but not permanent setting.

The construction of lines in the Oriental countries often necessitate the use of precautions which are not met with in European or American practice, and which in some instances appear needless at first thought. It is said that the wild animals in some portions of the Oriental countries do great damage to the poles by [illegible] that it often [illegible] of a [illegible] wooden [illegible] the animal [illegible] ing them [illegible] winter. It [illegible] tank [illegible] countries [illegible] life of poles.

Salt has proven to be a good preservative of poles, and has been used to [illegible] Salt Lake City, Utah, where the [illegible] ness of salt makes the plan feasible. [illegible] to throw a liberal application of the [illegible] dirt, as it is being tamped in about the pole, and the scheme appears to be effective about that part of the country.

One of the first schemes used in preventing pole rot consisted of charring the base of the pole with the flame of a blow torch or other [illegible] after which the charred portion was [illegible] tarry compound. The idea in this scheme, as in others devised later, was to prevent the rot from setting in at the wind and water line or at that point where the pole enters the earth, as this portion is first attacked, due to the combined action of the soil and atmospheric elements. There are a few good commercial preservatives on the market which, as before mentioned, have a creosote formation of some kind for their basis.

The principal preservative property of creosote oil appears to be due to its naphthalene, which is deposited into the pores of the wood, together with the antiseptic acids always found combined with the dead oils of coal tar. One objection to the use of creosoted poles is due to the tarry acids contained in the creosote oil, principally carbolic acid, which makes the handling of the poles very disagreeable, because of its irritable qualities to both the flesh and sight. A thoroughly creosoted pole is also lowered in resistance to such an extent that linemen can no longer depend upon the poles to insulate them when handling high potentials. Compounds having a larger percentage of creosote or carbolic acid lower the resistance of treated poles considerable, while treatments with a larger amount of naphthalene and a smaller percentage of creosote or carbolic acid do not materially lower the resistance of the poles.

A complete creosoting plant for the treatment of poles and railroad ties was installed several years ago by the Augusta (Ga.) Railway and Electric Company, which seemed to give good satisfaction. The plant consists of a long steel cylinder six feet in diameter by 102 feet long, being provided at each end with heavy cast-iron heads securely supported on hinges and arranged to be clamped against fiber gaskets of the cylinder in a secure manner, so as to resist a hydrostatic pressure of 150 pounds to the square inch. The cylinder has a narrow-gauge railway laid through it, with the tracks extending beyond the ends, to the pole yards, where sufficient space is provided for handling the poles. Inside the cylinder there is laid a series of one-inch pipes from end to end along the bottom between the car rails. These pipes are arranged to be supplied with steam at a temperature of from 400 to 500 degrees.

There is also connected to the cylinder a 14 by 10 by 18-inch direct-acting oil-pressure pump which obtains its oil supply from a large tank buried in the earth beneath the cylinder. The poles are loaded on to a train of cars adapted to run into the cylinder, and are drawn in by means of a wire rope. The cylinder doors are then securely bolted and live steam is turned into the interior of the cylinder, until a pressure of 80 pounds to the square inch is reached, which is maintained while the steam is being circulated through the series of heating pipes arranged along the bottom of the cylinder. This steaming process is continued for a period of from four to six hours, depending upon the size and kind of timber being treated. The steam pressure is then drawn down and the vacuum pump is started, which creates a vacuum in the cylinder containing the timber, which has now attained a temperature of approximately 350 degrees. The effect of evacuating is to season the green timber by drawing the sap and air from its pores.

Seasoning is facilitated by the steaming to which the timber has been subjected, which causes the sap to dissolve, and raises its temperature to far above the boiling point, due to the reduced pressure which the vacuum has caused. It is said that sap is immediately volatilized upon application of a vacuum, which has the effect of causing the ex- [illegible]

[illegible] culating [illegible] drippings from the treated timber. The steam in the [illegible] the [illegible] The [illegible] cylinder and the [illegible] prepare the [illegible] the treatment [illegible] pores having [illegible] the high [illegible] first [illegible] ranging about 200 degrees [illegible] expulsion of the sap [illegible] vacuum in addition to the high [illegible] production of [illegible] strongly [illegible] It is essential during the [illegible] poles that all the work be done [illegible] the treatment, otherwise much of the benefit would be lost, since rot will readily begin in such places as have been laid bare. Therefore, the poles should be trimmed, roofed and the gains cut, and such other necessary operations as are required for finishing a pole should be performed prior to treatment. Should it become necessary to cut into the pole after the treatment, the portion affected should be thoroughly saturated with hot tar or creosote as soon as possible.

It is not the customary practice to thoroughly creosote poles in this manner, because of the equipment necessary and also because the treated timber is not as readily handled or worked. Creosoted timber often becomes very brittle, this [illegible] cially true of pine, and [illegible] climbing or working upon [illegible] is increased. The weight [illegible] siderably, also a factor not to be lost sight of in construction work.

Untreated timber has about the same strength as treated timber at the first stages, but the treated timber maintains its strength much longer than the untreated, due to the non-existence of rot effects.

It is said that the cost of thoroughly creosoting poles in a plant as outlined above ranges from $1.50 to $2 each and that their life is increased thereby from four to six times, a fact which leaves no grounds for arguments as to the feasibility of treating poles when viewed from a financial standpoint. Sir William Preece is authority for stating that creosoted poles have been set in England for 30 years without showing the least indications of rot.

The most used and best suited means of treating poles where limited means are available [illegible] of thoroughly saturating the poles, prior to setting them, for a distance of about three feet at that portion which will be about two feet under the earth and one above it, when the pole is set. Creosote, or any good tarry compound, can be used for this purpose, and all that is required is the material and a brush to apply it, which may be done at the place where the pole is to be used. It is the best practice to shave the pole where the creosote is to be applied, so that it may be painted directly onto the sound timber, instead of to old bark or peelings, as would otherwise be the case in most instances. It is also good practice to treat the roof and cross-arm gains of poles in the same manner; some companies even apply the preparations to the knots, but this is hardly necessary ordinarily.

To treat a pole in this manner would increase its cost from [illegible] to 15 cents, and its usefulness will be increased, at the very lowest estimate, from 100 to 200 per cent., which is effecting a large

gain when compared with the original outlay required to bring about this result. If tar be used for this purpose, its bad feature, that of adhering to everything it comes in contact with, may be overcome by sprinkling it with lime after the tar has been applied to the pole. Banking the earth about the poles will reduce rot at the earth line considerably, but this line would be constantly changing, due to the banking settling or washing away. This, of course, would aid in preventing rot, but only in a minor way. It has occurred to the writer that, in many instances, it would be beneficial to place in the pole holes, prior to setting the poles, a quantity of crushed rock upon which the pole could rest, thereby furnishing it some aid in circulation at its base, which would hasten the seasoning process Green timber should never be set, but should be allowed to season before use. The increase in the cost of wooden poles has furthered the use of iron poles, which, however, are not used to any great extent in any other than street-railway work, but the scarcity of good timber and the rapid depreciation of the poles now in use are factors which will compel the use of iron for this purpose to a greater extent in the near future.

At all events, the subject of preventing pole rot is worthy of investigation, and those having new construction in view will be amply repaid for investigating this matter, and can receive, upon request to the Agricultural Department of the United States, a comprehensive and able treatise on the subject called "Metal Railroad Ties."

Electrical Show in Salt Lake City.

The first exclusive electrical show in the Rocky Mountain region was held in Salt Lake City during the week ended April 7th. It was given by the electrical interests of Salt Lake City, with the Utah Power and Railway Company as the principal mover in the enterprise. Nearly every dealer in electrical appliances in the city was associated in the movement. In the Aztec Building, where the show was held, the illumination was brilliant. An electric tower on top of the building was hung with streamers of electric lights. Archways in various colored electric lights extended from the entrance of the building west to Main Street.

It was the purpose of those giving the show to enlighten the public as to the many uses of electricity, and incidentally to advertise their wares. From the opening night the building was thronged daily with interested visitors who were given an opportunity to see all kinds of electrical appliances and machines, and to witness demonstrations of the usefulness of the various devices. These included various electrical kitchen utensils, electrical radiators, stoves, flatirons, broilers, fans, motors for operating wash machines, sewing machines, etc., and many other devices. There were exhibited a large range of sizes of generators of various makes, and motors ranging from 50 horsepower down to one-tenth horsepower.

Among the exhibits was an electrically lighted map of the system of the Rocky Mountain Bell Telephone Company, showing 125 lights for the different exchanges of that company in the states of Idaho, Wyoming, Montana and Utah. The Utah Independent Telephone Company had a new switchboard and exchange representing the newest appliance of the kind. The Independent company also showed a mercury arc rectifier for transforming alternating current to direct current, used in charging storage batteries.

There was a suite of rooms illustrating a kitchen, dining room and sitting room in which electricity is used for many purposes. Mrs. A. M. Walden was present and gave demonstrations in electric cooking, a series of luncheons being served.

A large lamp post was erected at the side of the street in front of the building, and from it a number of 32-candlepower incandescent lights were displayed to demonstrate the advantages of side lighting of this nature for streets, which is being considered for the paved districts of Salt Lake.

Among the mechanical attractions were the instruments belonging to the University of Utah for measuring electricity in every form and for standardizing meters and other measuring instruments.

Arc lights and electric signs of many designs made the place exceedingly light and attractive. Those who attended the exposition were, to a large extent, residents of Salt Lake.

Franklin Celebration in Philadelphia.

The Philadelphia celebration in honor of the bicentenary of Benjamin Franklin is scheduled to be held by the American Philosophical Society April 17th to 20th. Mayor Weaver of Philadelphia, in speaking of the celebration, said: "Benjamin Franklin was one of the greatest men that the American colonies produced, and while he was born in Boston, he was distinctively a Philadelphian, and did more for the city than any other man that ever lived here. I respectfully ask all the citizens of Philadelphia to join in celebrating the two-hundredth anniversary of the birth of this splendid citizen and philanthropist, printer and philosopher, scientist, statesman and diplomatist. The city will decorate the City Hall by flags during the day and by electric illuminations at night."

During the exercises it is expected that the University of Pennsylvania will confer the degree of LL. D. on Edward VII., Andrew Carnegie, William Marconi, Prof. A. A. Michelson of the University of Chicago, and others.

Milwaukee Convention of the Institute.

As heretofore announced in the Western Electrician, Milwaukee, Wis., is to be the scene this year of the annual convention of the American Institute of Electrical Engineers. Instead of being held late in June, as customarily, the convention this year will be held May 28th to June 1st to enable members who so desire to go on the European trip the last of June. The Hotel Pfister will probably be the headquarters of the convention.

The programme, as at present arranged, is as follows:

Monday, May 28th—Address of welcome; address by President Schuyler Skaats Wheeler; "Repulsion Induction Motor," by Maurice Milch, Schenectady, N. Y.; "Direct-current Motor Design as Influenced by the Interpole," by Charles H. Bedell, Bayonne, N. J.

Tuesday—"Experiences with Lightning and Static Strains on 33,000-volt Transmission Systems," by Farley Osgood, New Milford, Conn.; "Cell-type Lightning Arrester," by E. E. F. Creighton, Schenectady, N. Y.; "Protective Apparatus for Lightning and Static Strains," by H. C. Wirt, Schenectady, N. Y.; "Short-circuit and Ground Currents in Alternating-current Systems," by Charles P. Steinmetz, Schenectady, N. Y.

Wednesday—"Magnetic Properties of Electrolytic Iron," by Charles F. Burgess, Madison, Wis., and A. Hoyt Taylor, Madison, Wis.; "Measurement of Temperature by Electrical Means," by Edwin F. Northrup, Philadelphia, Pa.; "The Educational Value of an Electric Test Car," by T. F. Morgan, Urbana, Ill.; "The Art of Inventing," by Edwin J. Prindle, New York, N. Y.; "Shunt and Compound-wound Converters," by W. L. Waters, Milwaukee, Wis.

Thursday—"Economics Derivable from the Use of Relatively Small Waterpowers of Low Head in the Middle West," by Dugald C. Jackson, Madison, Wis.; "Oscillations and Surges Against Ground in Alternating-current Systems," by Charles P. Steinmetz, Schenectady, N. Y.; "Relative Merits of Various Types of Booster Control," by Joseph Bijur, New York, and Lamar Lyndon, New York; "Safety Devices for Steam Engines, Turbines and Motors," by Charles M. Heminway, New York.

The Milwaukee local committee consists of John I. Beggs, chairman; W. E. Dodds, W. F. Johnson, H. H. Cutler and Charles W. Burkett.

The two-hundred-and-sixth regular meeting of the Institute will be held in the assembly room of the New York Edison Company, 44 West Twenty-seventh Street, New York city, on Friday, April 27th, at 8:15 in the evening. The following papers will be presented and discussed: "Standardizing Rubber-covered Wires and Cables," by John Langan, New York; "Comments on Present Underground Cable Practice," by Wallace S. Clark, Schenectady, N. Y.

On May 15th the annual meeting of the Institute will be held at New York.

Death of Lemuel Bannister.

Lemuel Bannister, prominent in the affairs of the Westinghouse Electric and Manufacturing Company of Pittsburg and the Westinghouse Electric Company of England, died at the Imperial Hotel in New York city on April 13th. He had been ill for three years with a cancerous affection of the throat and had traveled far and wide in the hope of finding a cure. Up to three years ago he was vice-president of the English Westinghouse company. He then lived in London, but when his health failed he retired from business. Mr. Bannister was about 67 years old. He leaves a widow, Frances Kenyon Bannister, and a nephew, Lemuel Bannister of Boston.

For several years Mr. Bannister was first vice-president and general manager of the Westinghouse Electric and Manufacturing Company, ranking next to Mr. Westinghouse himself. In earlier life he had been admitted to the bar and had practiced law. He had considerable aptitude for mechanics and was the inventor of the Bannister rocking grate. But it was in business affairs that he achieved his greatest distinction. He was a man of great strength of character—a man who made himself felt—but nevertheless suave and courteous, an industrial diplomat. His ability and force made him a tower of strength to the Westinghouse interests, and although of late years he had rather retired from the field, owing to his health, his death will be keenly regretted.

Electrical Show in Fond du Lac, Wis.

With characteristic enterprise the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., last week conducted an electrical and gas show in Fond du Lac. Armory E, where the show was held, is a spacious and conveniently arranged building near the business center of the city. Even in this large building it was difficult at times to accommodate the large throng of enthusiastic people who came to learn of the increasing uses of electricity and electrical appliances in every-day life. From Monday evening, when the show opened, until the close on Saturday night, April 14th, the building was well filled with visitors every afternoon and evening. No admission was charged, the entire expense being borne by the railway and light company.

Some time ago the Eastern Wisconsin Railway and Light Company determined to increase its output of electricity and gas in the city. The company controls the electric and gas lighting of Fond du Lac and the local street railway, besides a fine interurban railway to Oshkosh, 20 miles distant. An illustrated description of the street and interurban property was printed in the Western Electrician of October 8, 1904. A new-business department was organized with Mr. L. E. Holderman at its head. On January 1, 1906, the rates for electric light and power and for gas were considerably reduced, bringing their use within the reach of all.

Further to popularize the use of electricity and gas Mr. Holderman and General Manager N. C. Draper decided to give a show at which to exhibit the modern electrical and gas devices and appliances and demonstrate their uses as applied to commercial and domestic practice. Local electrical men were invited to participate and exhibition space was offered to manufacturers and dealers throughout the country. Space, power and light were furnished free by the company. The result was gratifying. The local public was made familiar with things which will be of much use to them and of which most of them formerly knew but little. For the success of the show much credit is due Mr. Draper and Mr. Holderman, also Mr. Thomas Le Pine, superintendent of the gas department.

Extending across the walk over the Armory entrance was a large electric sign bearing the words "The Electric Company. Gas." Within the building the illumination was the most effective ever seen in Fond du Lac. The general illumination of the building was by 1,600 incandescent lamps and 17 Nernst lamps—12 three-glower, four four-glower and one six-glower. For the incandescent lamps one extra 20-kilowatt and one 10-kilowatt transformer were placed in the company's commercial light circuit and a three-wire system was carried around the balcony of the building.

Adding to the brilliance of the picture were a large number of electric signs and many novel electrical devices of illumination. In front of the booth of the Eastern Wisconsin Railway and Light Company were some large electric signs made by the Federal Electric Company and the Haller Machine Company of Chicago. In this booth the General Electric Company exhibited its product. Mr. J. B. Tingley of the Chicago office was in charge. In this booth was shown the luminous electric radiator which throws a mellow light and is particularly serviceable for the quick heating of a sick room, bedroom, or the like, because it throws heat the instant the current is turned on. Electric flatirons, coffee percolators, chafing dishes, glue pots, water heaters, frying pans, little electric stoves, cereal cookers, fan motors and fans, G. E. incandescent lamps and enclosed fuses were among the things shown by the General Electric Company. In this booth two demonstrators were at work showing the uses of the various devices. Many dainty esculents were electrically prepared and presented to visitors to show the practicability of electricity in the kitchen. "Noark" fuses, made by the H. W. Johns-Manville Company, were also shown in this booth.

H. L. Wallichs, electrical contractor of Fond du Lac, and dealer in electrical supplies, showed a line of electrical supplies. His booth was particularly attractive because of the rich electrical glassware and fixtures shown. Mr. Wallichs built for the occasion an attractive electric sign and a huge electric ball made of 150 incandescent lamps. The sign and the ball flashed intermittingly. A revolving electric wheel of vari-colored bulbs attracted attention.

F. O. Bichel of Fond du Lac, electrical contractor and dealer in electrical supplies, displayed his name in colored lights in the rear of his booth, with sloping walls, bearing white lights, spreading open to the front of the booth.

In the booth of L. A. & W. F. Briggs of Fond du Lac and Beloit, electrical contractors and dealers in electrical supplies, were shown electric flatirons, fans, motors, heating pads, etc. A washing machine was shown in operation, driven by an electric motor. An expert gave demonstrations in the art of sewing on an electrically driven sewing machine. An electric "chaser," built by Mr. W. F. Briggs, attracted attention.

The largest and most complete exhibit at the show was that of the Westinghouse Electric and Manufacturing Company. Besides the large booth at the west wall of the main exhibit room the company

had an elaborate exhibit of motor driven machinery. On entering the building attention was at once attracted to the word "Westinghouse" appearing in the shape of an electric sign made of nearly 200 incandescent lamps and hung over the booth. The booth was made the headquarters for out-of-town electrical men during the week. Mr. E. M. Bischoff of the resale department of the Chicago office was in charge of the exhibit and was one of the most popular men at the show. He was assisted by R. E. Schaulin and M. Q. Brunton of the Chicago office. In the booth were shown single-phase motors with phase splitters; direct-current and alternating-current 1906 pattern fan motors, 12 and 16 inch; high tension automatic oil circuit breakers; oil switches; copper knife switches for low tension work; integrating wattmeters; set of portable instruments of precision; switchboard instruments, lightning arresters, etc. There were also shown about 40 styles of Sawyer Man incandescent lamps and a line of the new type F circuit breakers for either alternating or direct current as low as eight amperes.

In the Westinghouse booth were also the exhibits of the Nernst Lamp Company and the Cooper Hewitt Lamp Company, in charge of Mr. J. B. Griffith of Chicago. The exhibit was lighted by two alternating-current 110-volt multiple arc lamps, three four-glower and 10 single-glower Nernst lamps and a Cooper Hewitt mercury-vapor lamp. The latter attracted much attention, many of the visitors having never seen this type of lamp.

The motor-driven-machine exhibit of the Westinghouse company was in a separate room and was very interesting, all the machines being shown in operation. The company installed a small power plant, shown in the accompanying picture. Current was taken from the mains of the Eastern Wisconsin Railway and Light Company. One unit in the plant consisted of a 500-volt direct-current motor driving a 125-volt direct-current generator supplying current for the direct-current motors in the power exhibit and for fan motors, mercury-vapor lamp and for the Cutler-Hammer exciter for the alternator. The other unit is a 50-kilowatt three-phase 60-cycle 1,100-volt alternating-current generator driven by a 500-volt direct-current motor. Current from the alternator was transformed down through a set of two single-phase transformers to 200 volts three-phase, the current supply being for the various induction motors in the exhibit. Another transformer of 1,100-100 volts supplied current for the single-phase motors and Nernst lamps. From the secondary of the transformers the current was carried to the low-tension switchboard shown in the picture, on which were mounted the instruments, switches and rheostats for the control of the entire exhibit.

One of the accompanying pictures shows some of the motor-driven machines in the Westinghouse operating-machine exhibit. A vertical drill press made by the Marshall & Huschart Machine Company of Chicago was driven by a one-half-horsepower three-phase 60-cycle 200-volt Westinghouse induction motor revolving at 1,700 revolutions per minute. A punch and shear from Joseph T. Ryerson & Son of Chicago was run at 250 revolutions per minute, driven by a three-horsepower three-phase 60-cycle 200-volt motor running at 1,120 revolutions per minute.

The Ewing automatic house-tank pump from Ewing & Co. of Chicago attracted considerable attention. It consisted of a 110-volt two-wire direct-current motor direct connected to a centrifugal pump. The motor is automatically started and stopped through the medium of a spring resting on a diaphragm which is actuated through the pressure in the tank. A small No. 83 enterprise coffee mill was direct-driven by a one-quarter-horsepower direct-current 500-volt motor.

The Reporter Printing Company of Fond du Lac had on exhibition a Golding job press driven by a one-quarter horsepower [illegible] motor. Charges [illegible] Cutler Hammer [illegible] printed a [illegible]

A Gould [illegible] minute was [illegible] three quarter [illegible] R. Westinghouse [illegible] per minute. [illegible]

FOND DU LAC ELECTRICAL SHOW.—HUGE MODEL USED IN TEACHING CUSTOMERS HOW TO READ A METER.

sent a triplex pump which was geared to a one half-horsepower three-phase 60-cycle 200-volt Westinghouse motor, type CCL. A residence mangle, made by the Troy Laundry Machinery Company of Chicago and New York, was direct driven by a one-quarter-horsepower 110-volt type R motor. A double coffee mill for granulating or pulverizing, made by Henry Troemner of Philadelphia, was driven by a one-half-horsepower type CCL motor. A cream separator from the Vermont Farm Machinery Company of Bellows Falls, Vt., in which the cylinder revolves at 9,000 revolutions per minute, was operated by a Westinghouse one-sixth-horsepower 110-volt type R direct-current motor.

In the power exhibit, the General Electric Company also showed a complete line of 500-volt direct-current motors ranging in size from one-quarter horsepower to 15 horsepower. The company also exhibited a line of overhead construction material. The Cutler-Hammer Company showed various types of controllers and rheostats, among which was demonstrated the operation of the open-tank automatic motor-starting switch.

One striking feature of the show was "the largest meter in the world," constructed of wood by Mr. Holderman. It was built for the purpose of teaching customers how to read a meter. A train of gearing was operated by a small motor, and a demonstrator was in charge. The face of the meter is about six feet in diameter. It is an enlarged reproduction of a Westinghouse type B instrument. The relative size of the two is shown in the picture.

Among the other electrical exhibitors was the R. Haas Electric Manufacturing Company of Springfield, Ill., the Worthington Automobile Company of Fond du Lac and the Central Electric Company of Chicago, the last named displaying a Universal extension and portable desk lamp.

[illegible] Thursday evening the electrical [illegible] banquet at the Ewing Hotel to Mr. H[illegible]

Already the company is beginning to [illegible] results of the show. People [illegible] electrical appliances at the show, as well as a large number of gas stoves. The company distributed advertising literature at the show, which, with the demonstrations given, are bringing in many requests for a representative to call. The company is well pleased with the results.

It is probable that a similar show will be held in La Crosse, Wis., in about three weeks, the date having not yet been selected.

Among the electrical men who visited the Fond du Lac show, most of them being present at the banquet, were the following-named:

Acker, John L., electrical contractor, Sheboygan
Arndt, Phil, Green Bay Gas and Electric Company, Green Bay
Bischoff, E. M., Westinghouse Electric and Manufacturing Company, Chicago
Briggs, L. A., L. A. & W. E. Briggs, Racine
Brunton, Mott Q., Westinghouse Electric and Manufacturing Company, Chicago
Ellis, A. K., Wisconsin Traction, Light, Heat and Power Company, Appleton
Ewer, Edward P., Sheboygan Light, Power and Railway Company, Sheboygan
Griffith, A. E., Central Electric Company, Chicago
Griffith, J. B., Nernst and Cooper Hewitt Lamp Companies, Chicago
Hill, C. J., Winnebago Traction Company, Oshkosh
Korst, P. H., Janesville Electric Company, Janesville
Loed, Irving P., Waupaca Electric Light and Railway Company, Waupaca
Maitland, James, Stevens Point Light Company, Stevens Point
Mohr, Frank F., H. W. Johns-Manville Company, Milwaukee
Obrizht, N. F., Western Electrician, Chicago
Pagel, H. J., Sheboygan Light, Power and Railway Company, Sheboygan
Rooske, F. W., Monarch Electric and Wire Company, Chicago
R[illegible] W. W. Kerr & Rot[illegible], Appleton
Saran, Curtis, Central Construction Company, Oshkosh
Schaefer, R. F., Westinghouse Electric and Manufacturing Company, Chicago
Sterling, H. C., municipal electric-light plant, New London
Thompson, C. L., Central Construction Company, Eau Claire

Power Plant Supplying Alternating Current and Direct Current

Various Motor Applications Shown in Operation

SOME OF THE EXHIBITS AT FOND DU LAC ELECTRICAL SHOW.

Tingley, J. B., General Electric Company.....Chicago
Utley, P. L., Watertown Gas and Electric Company.. ..... Watertown
Voth, William B., Sheboygan Light, Power and Railway Company ..... Sheboygan
Wales, A. C., Nernst and Cooper Hewitt Lamp companies ..... Chicago
Walker, William, Oshkosh Gas Light Company....Oshkosh
Westermeyer, A., Sheboygan Light, Power and Railway Company ..... Sheboygan
Wilson, H., Oshkosh Gas and Electric Company....Oshkosh

Some Important Considerations in Electric Illuminating Engineering.[1]

By Douglass Burnett.

There are certain questions of general policy which have developed within the last few years as a result of which the central-station service has been made more and more satisfactory to the users of electric lights. For instance, experience has shown the desirability of furnishing free incandescent lamp renewals and the first equipment of lamps, and of inspecting the condition of lamps, all with the object of improving electric-lighting service. The writer personally knows of a case in which the condition of incandescent lamps in use by the customers of a certain company was very bad, the company declined to furnish any lamps without selling them; a more liberal policy has resulted in an improvement of the service of fully 100 per cent.

The same company found that there were many cases in its territory in which excellent results came from the use of five-light incandescent clusters, and many people were found to be entirely satisfied with the results who had considered the cost of wiring as prohibitive. For instance, there were a dozen or more public market houses in different parts of the city, each occupying from one to three small city blocks, and each occupied by from 200 to 900 separate stalls owned or leased by individuals who formerly used gas lighting. One market building had about 25 electric-light customers using pendant drop lights and another building two or three arc-light customers. The regular arc was tried, also the low-energy arc lamp and the pendant-drop incandescent lamps, but the use of much service could not be established without the loaning of the five-light clusters. These clusters generally pay for themselves in one or two months on the revenue obtained, and now there is a considerable percentage of the stalls wired up and using the current. The point of this is that this particular device best met the particular conditions and the customers of the company were very quick to discover the fact.

Some of the questions which have arisen in the recent experience of the writer and some illustrations of his point of view are given.

For show-window lighting is it not best to recommend against the use of high-power lights, such as arc lamps, Nernst lamps or chandeliers? Is it not best to recommend against the use of cone reflectors set into a false ceiling on account of the poor distribution of the light? Notwithstanding the display value of the lights, should not we recommend against the use of border lights in show windows, and is it not the trough reflector the best one that we can adopt? To the writer the answer seems perfectly plain, though some of the central-station companies do not seem to agree.

Is it good practice to light a department store with chandeliers having about 20 incandescent lamps each, in order to get a certain effect of display, or is it always better to use arc lamps? The writer has known of one large department store, the proprietor of which very much prefers the chandelier method.

In department stores is there not a certain minimum height of ceiling at which incandescent lamps should be used in preference to arc lamps for the purpose of avoiding the glare and of shortening the fixture?

In the basement of a store where crockery and glassware are displayed, is it not important to have the lights arranged over the aisles instead of over the center of the tables in order to bring the source of light over the customer's head and to do away with shades?

For store fronts, should we not recommend against arc lights in the doorways and in favor of incandescent lights in the windows?

If a department store is lighted throughout with a type of lamp which does not give the true color values compared with daylight, and if the proprietor wishes a few arc lamps for matching colors, is it advisable to assent and thereby interfere with the scheme of lighting?

For a millinery store where goods of delicate colors are shown, are not arc lamps preferable to incandescent lamps on account of the color value of the arcs?

Is it ever advisable to use arc lamps at a silversmith's showroom or a jewelry store? The writer knows of one individually equipped silversmith's shop with about a 30-foot ceiling, in which the white light of Nernst lamps is very much preferred by the proprietor. The writer's opinion has been that it would be better to stud the ceiling with incandescent lamps, or else use clusters in such a case in order to increase the number of points of light, and in order to get the yellowish light with which people are most accustomed at home. This seems to be specially true of jewelry stores.

For drug stores, is it not always advisable to use incandescent lamps for general lighting on account of the average store being small, and so that the scheme of general lighting will fit in with the decorative lights around the soda fountain?

With concentric ceiling diffusers for arc lamps, what rule should be followed for spacing the lamps when five-ampere 120-volt direct-current lamps are used, and what rule for 7½-ampere lamps?

Is it not always advisable to use an opalescent ball globe for arc lamps in interior work in order to remove the glare; but if porcelain shades are used, should not convex shades be selected in preference to concave, for the reason that the streaks of light formed by the concave globe will spoil the appearance of many goods displayed? For instance, it will make clothes and suitings appear as if they had been through a fire or had been water-soaked.

For office lighting, should not every desk or reading light either be placed on the ceiling near the wall, or shaded, in order to take away the direct glare?

Is it ever advisable to use a strong source of light, such as an arc lamp or a Welsbach cluster, when the place is only large enough for a single one of such lamps, and in such a case is it not very much better to use small-light units such as incandescent lamps?

Is it not best to use a studded ceiling in a ballroom in order to increase the sparkle on the jewels worn by the guests, and is not concealed or cove lighting to be specially avoided for this purpose?

In an art gallery, should not all the light be shaded and trough reflectors used for paintings to secure even illumination? And on the contrary, for art galleries with statuary, should not high-power lights be used to intensify the lights and shadows?

For theater lighting, is it not important to place any lamps that are in view of the audience around or on the balconies against the face of the balconies toward the stage and to carefully avoid the use of stalactites and low hanging chandeliers on account of the glare, and for the purpose of increasing the impression of the space being large?

These points just cited with reference to illumination have been put in the form of questions so that if there is any doubt it may be cleared up, and some of them are given for the reason that there are certainly many people connected with lighting propositions whose attention has not been drawn to the proper treatment of them.

The writer is quite aware that some central-station companies have made it a practice in special cases to have a lighting engineer in the employ of the company lay down the lighting plans, with the expectation that they will be adopted by the customer, but in such cases the location and arrangement of the lights and the type of the lights selected is largely a question of individual opinion, as there is nothing to show what standard practice throughout the country requires as represented by the decision of any particular set of experts. Such plans have been prepared in our own office and our customers have very much appreciated the service we have performed, but we desire to have a check on the accuracy of our recommendations. These are special cases. Generally the customer says to the electric-light man that he thinks he will wire for so and so many lights, or the electric-light man recommends that he use such and such lights disposed in a certain way, but another electric-light man in the same company may recommend very differently. We need to get an authoritative expression of opinion as to just what rules shall be laid down for guidance in such cases.

A list or schedule of the different classes of buildings to be lighed should be prepared, as, for instance, office buildings, department stores, small retail stores, wholesale dry goods, notions, etc., factories and railroad stations; and the subheads should be given, showing the different classes of rooms in these different buildings. For each class a statement should be made showing which type of lighting is not suitable and giving the reasons. Also showing what is in general practice considered the best arrangement of the remaining classes of lights. For instance, arc lights are hardly considered acceptable for furniture stores and carpet stores, and neither are they to be accepted for general office work; neither are incandescent lamps best suited to department-store lighting.

And that brings up the question of just what is a suitable standard for the arrangement of arc lights in department stores. Generally a new department store of any considerable size is laid out with rows of columns at right angles from 15 feet to 25 feet apart, and this architectural consideration requires that each arc lamp should be located in the center of a bay. There have been cases in the writer's experience in which the location of arc lamps as given by the architects had to be changed very considerably in order to secure the best results. We say that an arc lamp should be located 12 feet from the floor, with one lamp to every 225 square feet to 400 square feet of floor space, using the 500-watt multiple arc as the basis.

One question to be considered is as to whether to make our rules on a basis of the number of candlepower or watts per square foot or per cubic foot, or whether to specify the foot-candle as the unit of illumination. Already some very good results have been secured by laying out the illumination on the basis of from one to two watts a square foot. But this basis neglects the efficiency of the lamp unit, since one watt a square foot from the arc lamp would give a very different volume of light from the same figure as applied to an incandescent lamp.

1. Abstract of a paper presented before the Illuminating Engineering Society, New York, April 12, 1906. Mr. Burnett is manager of the electrical department of the Consolidated Gas, Electric Light and Power Company of Baltimore, Md.

Electrical Conditions in Wisconsin Cities.

The National Board of Fire Underwriters has made an investigation into the electrical conditions of a large number of cities in Eastern and Southern Wisconsin. At Marinette the standard for inside electrical wiring has been considerably improved of late. The inspector has concluded to make an annual reinspection of the business district for the purpose of detecting unauthorized extensions or alterations. During the coming summer the outside wiring will receive attention.

At Green Bay the traction company has absorbed the lighting company, and it is believed that much of the confusion existing in the overhead electrical wiring will be eliminated. The balance of the pole lines on the main street will be removed during the summer and the inspector has promised to require certain changes in the alleys, where considerable obstruction to the work of the fire department exists.

The electrical inspector appointed at Fond du Lac pursuant to the provision of the electrical inspection ordinance recently adopted is doing good work. The new wiring, while not in full compliance with National Code requirements, will grade very fair, and is greatly improved in character over that formerly installed. The present chief of the fire department favors municipal supervision and gives the inspector, who is the electrician of the fire department, every opportunity possible to properly perform his duties. Some of the less reliable contractors were inclined to ignore the ordinance, but this opposition was easily disposed of with the co-operation of the lighting company, which refuses to supply current to equipments not having the approval of the inspector.

The lighting company at Kaukauna has extended its lines to Little Chute, and many buildings at the latter point have been wired. The workmanship together with material and devices used is not in entire conformity with the requirements of the National Electrical Code. The village trustees favor the appointment of an electrical inspector.

Menasha has recently completed the installation of a street-lighting plant which in time may be enlarged to take care of commercial lighting. The service corporation furnishing current is said to be unpopular, owing to the high rate charged for light, and many of the mill owners supply electricity to their own homes from the mill plant.

At Appleton most of the old and defective wiring in the mercantile district has been removed. In some instances unauthorized additions are made to approved wiring, but current is not supplied to any new installations without the approval of the city inspector. The lighting company is co-operating in the effort to bring all wiring into strict compliance with code requirements. Outside wiring conditions are not satisfactory. Pole lines and service wires interfere with the placing of ladders by the fire department. The Bell Telephone Company is contemplating the installation of an underground system in the business district. The Independent company has so far refused to equip subscribers' instruments with protectors, and the local fire insurance agents' association will endeavor to secure the necessary improvements. An inspection service has been inaugurated by private persons to cover the monthly examination of electric wiring in many of the paper mills located in the Fox River Valley. It also includes the necessary repairs to make such wiring safe and reliable.

Protection from Lightning.

The committee of the National Electric Light Association appointed to consider the question of protection from lightning and other static disturbances asks its central-station friends to "get busy" and help it out with data and information. The committee desires to determine how complete is the protection afforded by the existing types of lightning arresters, and how greatly this protection is is affected by special conditions of climate, etc. As the protection is measured by freedom from interruption to service, and by freedom from injury to apparatus, the report will deal chiefly with these points. Alex Dow of Detroit is chairman of the committee, but communications should be addressed to Robert S. Stewart, secretary, 814 Penobscot Building, Detroit, Mich.

Books Received.

"Elementary Electrical Engineering in Theory and Practice." By J. H. Alexander. Published by Crosby Lockwood & Son, London (D. Van Nostrand Company, New York). Price, $2.

"Single-phase Commutator Motors." By Franklin Punga. (Translated from the German by R. F. Looser.) Published by Whittaker & Co., London. (The Macmillan Company, New York.) Price, $1.75.

QUESTIONS AND ANSWERS.

Initial Charging and Complete Discharge of Storage Batteries.

N. C. K. wishes to know how to go about charging his storage battery for the first time, and also how the battery may be discharged completely without danger of injury.

ANSWER.

With a voltmeter and ammeter in circuit, start charging with a small current, which should be about one third the normal output and be continued for about four hours. Then increase to normal current and leave this on for about 20 consecutive hours or until the positive plates get a dark brown color, unless the cells begin to boil and the electrolyte get milky. It is a good plan to continue the charge still longer at a lower rate, gradually reducing the current.

Some care should be exercised in discharging a cell to put it out of service. If the cells are to be put out of commission for several weeks the plates should not be allowed to stand in the electrolyte unless a small charge and discharge be given at intervals, say once a week. When they are to be unused for a considerable length of time they should be charged slowly, then discharged for a couple of hours at normal rate. Then the electrolyte should be drawn off and the tanks immediately filled up with pure water. The discharge is then continued at about one-half normal rate until the voltage becomes very low, say one half volt. The plates must then be washed thoroughly in running water, allowed to soak 24 hours in water and then dried. In order to get the cells to discharge with the pure water for an electrolyte they must be short-circuited.

Difference Between a Synchronous and Asynchronous Motor.

M. L. L.: Please explain the terms "synchronous and "asynchronous motor." What is the difference between the two machines?

ANSWER.

A synchronous motor is simply an alternating-current generator, with a few modifications, which is run as a motor on an alternating-current circuit. This form of motor must be brought up to the voltage and frequency of the circuit from which it is to be operated, in other words "synchronized," before it will run from the circuit as a motor. An asynchronous motor, or induction motor, as it is more generally termed, is one in which the armature or rotating element has no commutator or slip rings, and whose coils are closed upon themselves, with no connection to the outside source. In this rotating element, or rotor as it is called, currents are induced from the field or stator, which is connected to the alternating-current circuit. The current in the stator sets up a rotating magnetic field which reacts upon the induced current in the rotor, causing it to turn.

Bunsen's Photometer.

An operator of a small electric-light plant would like to know how to make a photometer with which he can get approximate results, but which will be inexpensive to build.

ANSWER.

The type of photometer known as the Bunsen is one which may be used with a fair degree of accuracy. It consists of a board five or six feet long on which is marked a scale. Transversely of this board is a square sheet of paper with a grease spot in the center, which may be supported in any convenient manner so as to be moved back and forth along the scale. At one end of the scale is fixed a standard incandescent lamp and at the other the lamp to be tested. Regulating resistances are placed in series with the two lamps, and current is taken from a storage battery, if possible, so as to keep the pressure as nearly constant as possible. Wattmeters are also connected to the lamp circuits to determine the lamp's efficiency. The paper is then moved back and forth along the scale until the grease spot can no longer be seen from either side, which shows that the light on the two sides is equally strong. Then measure the distances from the respective lamps to the paper. Suppose the standard lamp is x, or two feet, from the paper, and the other lamp, y, or four feet from the paper. The candlepowers of the lamps are in direct proportion to the squares of the distances; therefore if cp is the unknown candlepower the following equation will obtain, if the standard lamp is 16 candlepower:

$$16 : cp :: x^2 : y^2, \text{ or } 16 : cp :: 4 : 16,$$
$$\text{or } 16 : cp :: 1 : 4.$$

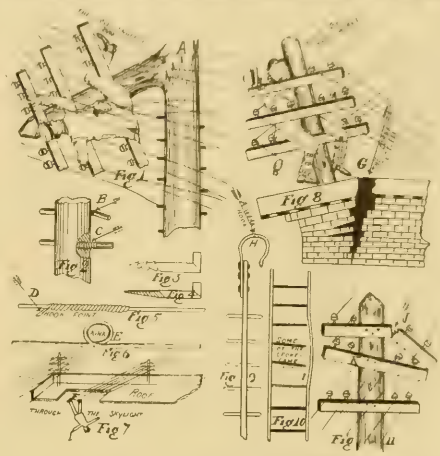
Therefore the [illegible] the standard [illegible]

The watt p[illegible] other word[illegible] reading.

Trials and Dangers of the Lineman.

By R. G. [illegible]

When the weather is calm, and bu[illegible]ing steadily in the [illegible] or telegraph company, the lineman [illegible] very hazardous one [illegible] compared with that of the linemen of the electric-light and [illegible] company. But when the [illegible] ing its line and [illegible] the suburbs, the lineman of the company is not only an exceedingly busy man, but is exposed to various dangers. The writer has [illegible] to sum up a number of experiences of linemen, relative to daily dangers to which they are exposed on the poles and building tops and to illustrate, by a few simple sketches, some of these dangers and their causes.



TRIALS AND DANGERS OF THE LINEMAN.

Notification is received at the central station of a break in the communication at a certain point. If the weather is calm, the usual system of testing between poles until the trouble is located is performed readily. But perhaps a storm is in progress. Not long since it was necessary for a lineman to ascend a tall pole during a high wind, and while he was at work the pole snapped under his weight and the weight of ice adhering to it and the wires. Fig. 1 shows the nature of the break in the pole as at (A). The cluster of wires was fortunately amply strong to support the top and the man, and as the top of the pole fell, the lineman gripped the cross-arms with his legs and arms, and ultimately made the ground in safety by getting back to the main pole.

Not only do poles break off occasionally, but the various types of wood and metal rungs on the poles often prove dangerous to the lineman. Usually he is in a hurry, and does not take time to examine the rungs closely. The first thing he knows a rung snaps off as at (B), Fig. 2, and unless the man's wits are about him he may get a fall. In some places the rungs are hardwood pins screwed into a bore tapped into the side of the pole at proper intervals, as at (C). Not infrequently the threads on the pin or the threads in the bore are defective and the pin is permitted to work free and prove a menace to the lineman. There are, of course, various types of metal steps and improved devices employed, some of which are feathered at the points, as in Fig. 3, so as to afford a gripping property for the step when it it is driven home; or the metal step may be turned with a screw end, as in Fig. 4.

Then there are defective splices and kinks in wires to bother linemen. On one occasion the wire was being drawn along the poles, and a poorly made union, with a projecting hook point, as in Fig. 5, at (D), caught the clothing of the lineman and almost pulled him off his perch. Sometimes, instead of a projecting point of wire, it is simply a kink in the wire, as (E), Fig. 6.

Covered and partly concealed skylights are a source of annoyance to the lineman. Some of these skylights are practically unseen when there [illegible] of lines.

[illegible] modern lineman is furnished with various climbing devices for roof service nowadays, and often he [illegible] along with the wagon on important jobs. But at other times he works alone and depends upon what he can find [illegible] reaching difficult places [illegible] of building. One lineman [illegible], his hook and pole [illegible] place at one building where he had some work to do at a difficult point of access. He adjusted the large metal hook over a dividing wall and proceeded to ascend. When part way up the hook broke off at (H), Fig. 9, and the man had a fall. Devices of this description which are placed about a building for use sometime in the indefinite future are not, as a rule, to be relied upon.

The conventional fire bucket and the fire ax "for use only in case of fire" usually prove to be be poor devices for real service. They may have been good and strong at one time. But, as years pass without use, they rust and weaken, and when put to service often fail. I recall that a lineman used a fire ladder on the side of a building [illegible], rather than go to the bother of taking the ladder from the repair wagon which was at hand. When part way up the ladder, the metal spikes commenced slipping from their sockets, which one side of the ladder expanded, as at (I), Fig. 10. The ends of the rungs had simply rusted out in process of time. Then there are frail cross-arms to look out for. Many men have received injuries by trusting too faithfully in a cross-arm. Some men are careful, especially after they have had a fall, and make sure that the cross arm is strong enough for a support before they get astride it. Others take the chances, with the result that the cross-arm may snap off, as at (J), or depress, as at (K).

Municipal Operation in Europe Disappointing.

M. S. Hopkins, former general superintendent of the Columbus (Ohio) Railway and Light Company, just returned from a European trip, says that he was disappointed with what he saw of the street and electric railway service in Italy, France and England. The service would not be tolerated in America, he said. The properties are all owned by municipalities and he saw enough to convince him that the plan is not what it should be. Everything is adapted to the use of the classes and no attention is paid to the masses. Competition in America is what has brought the service to such a high grade, but in the old countries there is no competition, consequently improvements are very slow in coming. Tram service is insufficient, the cars are dirty and no effort is made to please patrons. He said that the plan of doing away with grade crossings is about the only thing he saw that is an improvement in the operation of the roads in those countries.

J. W. Sarcad and F. W. Hollman of Spokane, Wash., are seeking a franchise for an electric-light plant in Odessa, Wash.

Air Brakes for Electric Cars.

With the increasing use of heavy cars and higher speeds in interurban service comes the necessity of efficient braking apparatus which is comparable with that used upon steam lines. In a paper upon "Air Brakes for Electric Cars," read by Mr. W. S. Bartholomew before the New England Street Railway Association, a thorough analysis of the situation is made, and the requirements of different classes of service with the proper apparatus for each are set forth, the author confining himself to the apparatus of the Westinghouse Air Brake Company, with which he is connected.

Mr. Bartholomew divides the service up into eight classes, as follows: Single-car train; two-car operation (one motor and one trailer), the motor car to be operated singly most of the time; two-car train, both cars to be operated together the major part of the time; two and three-car trains, all motor cars; two and three-car trains, one or two non-motor cars; trains of four or more cars, each equipped with motors and complete air-brake equipment; trains of four or more cars, part motor cars and part non-motor cars; trains of any length hauled by completely equipped electric locomotive.

For single-car operation it will no doubt continue to be standard practice to use straight air brakes, as the variations of the weights of the cars and the variations of speeds at which each car is likely to be operated are such that the air-brake apparatus is required to have the extreme of flexibility in every direction.

In the event of the cars being very heavy, and the maximum speed reaching a rate of 50 to 65 miles an hour, it is absolutely necessary to have an additional braking effort to stop the rotation of the armatures at these high speeds, and to stop the heavy vehicles approximately within the distance that the stop would be made at a lower speed or with a lighter vehicle. While such additions and refinements have not generally been added to the straight air-brake equipment, the demand is beginning to be felt, owing to the fact that these conditions of operation are becoming more general. In other words, what would serve properly for handling a car in the ordinary service requirements of the brake might not serve to prevent an accident in an emergency at maximum speed. In order to meet such a situation it is necessary to arrange the brake valves so that in ordinary service applications (to make the regular stops), the maximum pressure in the brake cylinders would not be reached so promptly, whereas in an emergency the maximum pressure should be secured in the shortest possible instant, because it is ordinarily impossible to add braking effort to the wheels at high speeds sufficiently to cause them to slide, the coefficient of friction being extremely low at that time. If the same braking effort were used at slower speeds in the ordinary service requirements of the brake, flat wheels would inevitably result, so that two separate conditions must necessarily be met with the same brake valve. With the lighter cars and slower speeds that obtained at the time of the earlier adoption of the straight air brake, no special necessity existed for such an arrangement.

Referring to the operation of two-car trains, an air-brake apparatus may be used to advantage which is but one step away from the straight air brake, which has just been discussed. Such an equipment would contemplate the handling of the motor car continually by "straight-air," just as would be done if the trailer proposition were not to be considered, and when a trailer car is added, it is also handled by "straight-air" during the application and release of the brakes in the ordinary service requirements of operation, so that all of the flexibility of operation incident to "straight-air" is secured.

The conditions of operation just described, having the operation of the motor car as a single car during such a large part of the time, makes it advisable to use a combination arrangement which would have the straight-air features most prominent; but also embody that factor of safety in an emergency whereby the brakes are applied automatically just as though the complete automatic equipment were used. With such an equipment, a second hose line is added, and on each vehicle is placed a small triple valve. The valve body is much shorter than the usual triple valve, as there is no travel of the slide valve except to secure an emergency application. The main reservoir pressure is connected to the slide-valve chamber. The piston is at rest against the graduating spring, so that no movement of the piston can take place without sufficient differential to compress the graduating spring. The function of this triple valve, therefore, is to apply the brakes automatically only in the event of a rupture in the hose connection or piping, or in the event of the emergency position of the brake valve being used.

The brake valve in connection with this equipment is in reality the special feature of the equipment, as it is a composite valve through which straight-air applications are made in the ordinary service requirements, and an automatic application of the brakes by a reduction of the pressure in the second hose line only in the emergency position of the handle

Referring to the third method of operation, viz., a two-car train consisting of a motor car and a non-motor trailer. In this event the conditions mentioned cover the two cars being operated continually together. This, therefore, would eliminate the necessity of having a straight-air brake pure and simple for the handling of the motor car singly, and if certain features were added to the automatic equipment in the matter of a straight-air release of the brakes from the brake cylinder of the head car, and if the brake applications could follow each other immediately without danger of depleting the pressure in the auxiliary reservoirs, the conditions could be better met with automatic brakes than with straight-air.

An equipment for this class of service consists of a very simple brake valve in the release position of which a wide-open connection is made from the feed valve to the brake pipe, so that the feed-valve pressure is on top of the rotary at all times and not the variations of main-reservoir pressure. The applications of the brakes are made in the regular automatic way by the reduction of the pressure in the brake pipe, both in service and emergency.

The fact that this equipment is purely automatic, and requires the movement of the triple valve during each application, makes it essentially an equipment for train service; in other words, this equipment is to be recommended for use on two-car trains where the cars are likely to be operated together the major portion of the time.

Referring to the fourth and fifth methods of operation, it may be said that these approach, and in fact, are, train operation in the full sense of the word, and, therefore, completely away from the necessity of any straight-air-brake features as ordinarily understood, unless it would be to facilitate the handling of one of the motor cars singly, if such operation should seem to be necessary.

An equipment for this purpose is essentially an automatic brake, and is designed for either a single pipe line or with an additional control pipe line, if desired, depending upon the operating conditions of the road on which it is to be installed.

The equipment also consists of a very simple brake valve, in the release position of which a wide-open connection is made from the control line beyond the feed valve to the brake pipe, therefore securing feed-valve pressure on top of the rotary, preventing the overcharging of the brake pipe, and, consequently, of the auxiliary reservoirs on the front cars of the train. This particular features cannot be made too much of, as it is a very important point in connection with the handling of short trains, and especially single cars with automatic brakes. It is always essential to have a quick response of the brakes at all times, and this cannot be done with the ordinary method of having main-reservoir pressure on top of the rotary valve, especially with the quick-recharge triple valves. With this feature the flexibility and quick response incident to straight air in the application of the brakes can be secured, and this feature, in connection with the quick recharge of the auxiliary reservoirs, and also in connection with the graduated release feature, makes it possible to handle short trains with automatic brakes with a flexibility and safety not possible heretofore. The applications of the brakes are made in the regular automatic way, by the reduction of pressure in the brake pipe, so that the triple valve moves both in service and emergency positions.

In the sixth and seventh methods of operation the same conditions are found as just described, except that the train may be extended in length to any number of cars desired. As the trains increase in length the time of serial action increases, unless special arrangements are made in the air-brake equipment to offset the length of the train. This condition of operation would call ordinarily for the standard automatic quick-action air brakes, but the trains being electrically operated bring in the new conditions of having each unit self-accelerating, and each motor car equipped complete with compressor, brake valves, etc., made it necessary to provide for the division of pump labor and arrange to use each independent aid supply on the motor cars for securing refinements in the air-brake equipment not possible in steam-railroad operation.

Two equipments are used for this class of service. These equipments are automatic air brakes of the highest type, with all of the additions and refinements which the present passenger-car-train operation requires. The particular conditions which necessitated the development of these equipments were mostly found upon the elevated railroads in this and foreign countries.

Some of the worst accidents on the elevated railroads heretofore have been due to the fact that one application after another of the brakes could not follow in quick enough succession with the standard automatic air-brake equipment, and as the trains are continually being operated on closer schedule, it became apparent that some improvements were necessary. Not only this feature has been incorporated in these equipments now being described, in the matter of quick recharge of the auxiliary reservoirs, but other and perhaps equally important features have been included. The graduations of the release of the brakes have not heretofore been possible with automatic-air-brake equipments, but with the present equipments this is possible to any degree desired. As five-pound graduations of the release can readily be secured, and as the trains can be handled smoothly with 10-pound graduations of the release, it is manifestly evident that the necessary flexibility in this respect is found in these particular equipments.

The next matter of importance is the quick-service feature, which is an arrangement of ports in the triple valve to secure the use of brake-pipe pressure to aid in raising the brake-cylinder pressure in service applications of the brakes and reduce the time of serial action through the train, whereas this feature has heretofore been confined to the emergency application of the brakes only. With this feature the time of the serial action of the service application of the brakes through the train has been reduced at least half, so that longer trains can be handled with greater smoothness and facility than could be done with the former equipments. This feature also materially reduces the amount of free air required, and, of course, reduces the compressor labor proportionately.

The method of operation in the case of electric locomotives is the standard for steam railroads and covers the handling of a train with a locomotive at the head end, and consequently one source of air supply. The standard automatic air-brake equipment will serve for train operation of this kind for many years to come, especially as far as the cars are concerned.

Chicago Traction Matters.

The first act of the new City Council of Chicago relative to traction matters was directly opposed to the programme of Mayor Dunne and his municipal-ownership advisers. The council directed the committee on local transportation to proceed to frame ordinances providing for the "immediate unification, improvement and rehabilitation of the street-railway service." This move was made in the form of a resolution presented by Alderman Foreman and three-fourths of the aldermen approved it.

This is directly opposite to the mayor's ideas expressed in his message to the council, in which he says that while the test of the Mueller certificates in the courts is under way he may ask the council to take steps toward putting into operation the "contract plan" which he outlined in his message of July 5, 1905, or some similar plan, for the taking over of the street-car lines. He commends this plan because of "its manifest superiority as a means of accomplishing the object with which we are charged—namely, the earliest possible installation of good service and the establishment of municipal ownership of the entire street-railway system of Chicago by construction, purchase or condemnation."

The mayor, with his special traction counsel, went to Washington, D. C., this week to ask an extension of the time when the river tunnels must be lowered. The matter involves the conversion of the cable street railways to electric traction and has a bearing on the traction question. Secretary of War Taft will give his decision in the matter probably next week.

Iowa Electrical Association.

[Special Dispatch to the Western Electrician.]

Des Moines, April 18.—Good attendance and enthusiastic conventions for both the Iowa Electrical Association and the Iowa Street and Interurban Railway Association seem assured. The electrical association held its first session this morning, and the first portion of the programme was carried through successfully. President Austin Burt of Waterloo presided and gave a short address which was full of pertinent remarks. The routine business was then gone through with, after which J. R. Cravath, with his report on electrical progress for the last year, and the reports on the subject of increasing business in towns under 5,000, were listened to. Many street-railway men have already registered for their convention, which begins tomorrow. About 16 manufacturers have exhibits, which are rapidly taking form, and the Kirkwood Hotel presents an animated appearance. H. W. Y.

Electricity for the Egg-eating Hen.

Edward J. Shanahan of Tribes Hill, N. Y., believes that he has solved the vexatious problem of the egg-eating hen, and he has received a patent on an electrical device for breaking hens of this expensive habit. A battery is connected to the primary of an induction coil. The secondary of the coil has its terminals connected, respectively, to a conducting egg receptacle and to a conducting plate upon which the fowl must stand to eat an egg. The receptacle and plate are insulated from each other. An egg is placed in the receptacle, and when the fowl comes to partake of the forbidden fruit it is subjected to a shock which it is believed will cause it to dislike eggs ever after.

World-wide Telephone Rates Disclosed by Canadian Inquiry.—I.

Telephone systems in operation in Canada have been the subject of some criticism, and in order to get at the causes for dissatisfaction the House of Commons at Ottawa appointed a select committee to report regarding the various public telephone systems in operation in the Dominion and elsewhere. This was on March 17, 1905. This committee consisted of Sir William Mulock (president) and Messrs. Grant, Johnston, Maclean, Monk, Roche, Smith, Zimmerman, Bergeron and Goeffrion. Since that time the committee has entered energetically into the work and has collected data not only on the telephone situation in Canada but in all parts of the world as well, the whole forming perhaps the most complete record of the kind ever published. In August, 1905, the first installment of the report was published, consisting of 36 pamphlets containing 1,438 pages of closely printed matter. In the issues of the Western Electrician dated August 26 and September 2, 1905, some of the most important facts set forth in the report were published. Now comes a second installment of the report, bringing the total number of printed pages up to 2,047.

While it is not practicable to attempt to give a complete outline of the second portion of the report, it nevertheless contains a great mass of information from which portions may be selected which will make interesting and valuable reading.

In brief, the second installment of the report consists principally of communication from various telephone companies and government telephone systems in answer to questions sent them by the committee. These communications are some of them very complete and contain exact figures as to their operating conditions. The following is taken from among the reports of these various authorities:

Canada.

The number of Bell telephone exchanges in Canada in January, 1905, was 490, having connected to them in round numbers 77,000 telephones. Montreal, with a population of 267,730, had 14,995 telephones, and Toronto, with 208,040 inhabitants, came next with 12,714. From these figures the numbers diminished all the way down to as low as one telephone line in some of the smaller towns which could hardly be said to have exchanges, the line probably connecting with an exchange in another town.

Some interesting figures relating to rates in different parts of Canada were contained in the report.

The Yukon Telephone Syndicate, Ltd., of Yukon Territory, charges business subscribers for a direct line $240; for a two-party line, $180; three-party line, $120 per annum. The $240 and $180 rates cover free service between Dawson City, Klondike City, Magnet, Grand Forks and Bonanza and Eldorado creeks; also half-toll rates to other points. The cost price of wall telephones is $17; freight and duty brings the total cost to $37.50. The Yukon syndicate is owned practically by two people, the third stockholder having only one share. Up to date $175,605 has been spent on the system, and the dividends in eight years amounted to $104,000.

The Telephone Company of Prince Edward Island makes the following rates per annum: Charlottetown, business direct lines, $45; two-party lines, $30; residence direct lines, $45; two-party lines, $20. Summerside, business, $20; residence, $15. Elsewhere, business or residence, $15. Toll rates within 10 miles, 15 cents; beyond this, 25 cents, with a discount of 20 per cent. to subscribers.

In York County, N. B., a new company has been started in competition with the New Brunswick Telephone Company. The new company is building extensions in York County in a substantial manner and putting on the latest improvements and appliances known to the business. Its main line is to be No. 12 copper wire, continuous circuit of two wires for long-distance business, and for local circuits two No. 9 copper wires will be used, making metallic circuits throughout. The instruments used are to be the newest and best made. All the people are asked to take stock for purposes of extension of the system through their individual territory, thus participating in profits as well as privileges and making the system thoroughly mutual. The company is charging $15 per annum for farmers' telephones, with free use of circuits, and a small switching charge in addition for long distances outside of the circuits, which average 35 to 50 miles.

In the municipality of Matsqui, B. C., a peculiar condition exists. The municipality is about 10 miles long by about eight miles wide, and has just one telephone line running through its center, or nearly so, east and west, and in the whole length it has but one telephone the public can use, one installed at the postoffice at Abbottsford (which is the Canadian Pacific railway depot). At first the charges were for short distances 10 cents; later the minimum price was 25 cents. This was considered exorbitant and deterred many from its use. The Municipal Council [illegible] benefit to the [illegible] public would [illegible] public could [illegible] charge had not been thought [illegible].

Egypt.

The reconstruction and [illegible] by the sudden [illegible] the consequent [illegible] have combined to place the [illegible] Telephone Company of Egypt in a [illegible] tion, and that coupled with the peculiar [illegible] obtaining in that country, render [illegible] at the present juncture somewhat [illegible], and not of a nature upon which to base [illegible] for the establishment of similar undertakings in other parts of the world.

With regard to rural telephones there is at present no appreciable demand for such a service in Egypt, as there is no large class who would patronize them, nor are the distances sufficiently great. The company is, however, installing for the government an extensive system of provincial telephones, joining up the chief towns of provinces with the outlying towns and villages, these lines being used by the government for administrative purposes.

The rates of the Telephone Company of Egypt vary according to many circumstances from about $38.96 upward, all for unlimited service, within an area extending roughly to the outskirts of the towns, say two to 2½ miles. In Alexandria, Port Said and Suez continuous service is given. Other exchanges close at midnight and open at 7 a. m. Open Sundays everywhere. The fee for local conversations to non-subscribers is one piastre (five cents) per communication of any reasonable length. The long-distance fees on the Cairo-Alexandria trunk line are five piastres up to three minutes, and 10 piastres up to eight minutes, equal to about 26 cents and 52 cents respectively.

About 160 miles (Cairo to Alexandria) is the greatest distance spoken over. All instruments are made by L. M. Ericsson & Co., Stockholm, and are of their standard magneto pattern. The local systems are now in course of conversion from overhead earth circuits to metallic circuits in drycore underground cables, with overhead distribution. The change is about half completed. The only trunk line at present existing in Egypt is owned and maintained by the Egyptian government and leased to and worked by the telephone company. It is metallic circuit of No. 11 copper. Payment of long-distance charges is covered by deposits from subscribers and by cash payments of the time of speaking from call offices. The system at present in use is the ordinary magneto, with multiple switchboards.

Portsmouth, England.

In the corporation of Portsmouth, England, the subscriber's instrument consists of a magneto of any ordinary construction provided with a ring-off key. This key when in normal position connects the subscriber's instrument to the metallic circuit, but when pressed down it connects the metallic circuit directly to earth so long as it remains pressed.

Each subscriber's metallic circuit contains at the switchboard an indicator of ordinary construction and a four-point spring-jack. When the answering plug is inserted in the spring-jack the line indicator is cut out of circuit, and the metallic loop is in direct communication with the two circuits of the plug. The second or rear plug when out of use sits on and presses down a switch which connects the two conductors of the flexible cord joining the two plugs to a second switch which is worked by the operator's finger. When the rear plug is sitting on its switch and the button of the second switch remains unpressed the metallic circuit into which the answering plug has been inserted is directly on to the operator's telephone. If in this position the finger switch is pressed the operator's telephone is cut out and a magneto generator is brought into circuit by means of which the operator is enabled to ring the bell of the subscriber into whose jack the answering plug is inserted. The consequence of this arrangement is that the mere insertion of the answering plug puts the operator in communication with the calling subscriber without any further movement. After ascertaining his wishes she lifts the rear plug from its position and inserts it in the jack of the subscriber called for. The lifting of the rear plug from the switch cuts off the operator's telephone and brings into circuit a ring-off indicator.

[*To be concluded.*]

The Independent telephone interests of Oklahoma and Indian Territory have been organized under the name of the Oklahoma and Indian Territory Telephone Association. Mr. H. Furman of Geary, Okla., is president, and Mr. I. T. Hine of Purcell, I. T., is secretary and treasurer.

Chicago Telephone Rates.

[illegible]

Portable Telephone Service for Detroit.

The Michigan State Telephone Company is preparing to make $[illegible] worth of improvements in its system in Detroit. Permits have [illegible] to lay conduits in 200 streets and alleys and 12,000 new telephones are to be installed. A plan is being worked out to provide portable telephones for automobile owners, doctors, grocery-wagon drivers and others who are about the city a great deal. At three or four hundred places about the city and in the suburbs will be metal plates with holes at the bottom for inserting plugs and making the telephone connection. These plates will be of the bell shape, which is the symbol of the Bell company. The service will be only to regular telephone subscribers and at a small additional cost. Directories of the portable telephone stations will be provided. The connection plates will be placed on telephone poles, sides of buildings or, when necessary, on small posts. Detroit will be the first city in the country to have a general portable telephone service.

GENERAL TELEPHONE NEWS

The Home Telephone Company has made application for a franchise in Springfield, Mo.

The Johnson County Telephone Company of Smartville, Neb., has been incorporated with a capital stock of $50,000.

Gilles Elliot, Fred Morrison and Martin Dotty have incorporated as the Pecatonica Mutual Telephone Company of Pecatonica, Ill.

The Michigan State Telephone Company has bought the Parma Independent exchange, but some of the subscribers, desiring an Independent service, will put in a board of their own.

The programme for the National-Interstate telephone convention in Chicago on June 26th to 28th is being prepared. The various committees will meet at the Auditorium Hotel on June 25th.

J. P. Jensen, for several years manager of the local telephone exchange at Little Falls, Minn., of the Northwestern Telephone Exchange Company, has been transferred to the Owatonna (Minn.) office of the same company.

The Illinois Western Telephone Company has purchased the telephone exchange at Camp Point. It also recently purchased the exchange at Golden, Adams County. This gives the Illinois Western system more than 5,000 telephones.

Among the recently incorporated telephone companies are the following-named: Solon Telephone Company, Douglas, Neb.; Mountain Park Telephone Company, Mountain Park, Okla.; Ranchmen's Telephone Company, Deerhead, Kan.; Cimarron Valley Telephone Company, Ripley, Okla.; Rose Hill and Augusta Mutual Telephone Company, Augusta, Kan.; Silver Creek Telephone Company, Silver Creek, Neb.

The Detroit and Cleveland Navigation Company is arranging to operate a Clark space-telegraph system on the steamer Western States of the Detroit-Buffalo line. A 10-kilowatt station will be installed by the Clark company at Buffalo about May 15th. Commercial messages will be accepted and delivered, it is said.

Ohio Telephone Notes.

At a hearing before the council committee on telephones at Cincinnati a few days ago, both the Bell and the Independent interests were represented. From what can be learned, it was a warm session. Manager Kilgour of the Bell presented a large number of letters from business men and citizens saying that they want but one system in the city. On the other hand, the representatives of the Queen City company presented a list of telephone users in the state, showing that several counties in the southwestern part of the state have very few Bell telephones, while there are many Independent telephones over the territory. Mr. Kilgour questioned the correctness of the figures given, and finally invited the members of the committee to visit St. Louis, Louisville, Cleveland, Philadelphia, Pittsburg, Buffalo, Baltimore, Toledo, Columbus, Indianapolis and some other cities to investigate the claim that people have found an advantage in having both systems. The Queen City offered to bear half the expense if the committee made its investigations within the states of Ohio, Indiana, Kentucky and West Virginia, but other cities were insisted upon and the offer was withdrawn.

An increase of capital stock from $75,000 to $200,000 has been made by the Sandusky Telephone Company, recently acquired by James S. Brailey, Jr., and his associates. A bond issue of about $100,000 will also be floated. With the money thus secured important extensions and improvements will be made to the plant, which now has only about 1,000 subscribers.

The Greenspring Mutual Telephone Company of Greenspring has been organized by about 200 farmers in the vicinity of that place. It is said the new company will compete with the Greenspring Telephone and Electric Company, which has had the business so far.

The Sandy Valley Telephone and Electric Company of Sandy Valley has been incorporated with a capital stock of $50,000 by R. A. Kayler, A. S. Hillhouse, W. M. Meeker and others.

H. Friedman, Harry McCall and others have incorporated as the Home Telephone Company of Hamersville. The capital stock is $10,000. C.

Indiana Telephone Items.

The Home Telephone Company of Wabash is arranging to erect a new business block for its own use, and to install a $10,000 central-energy multiple switchboard. The company has 1,200 telephones in service. The Central Union Telephone Company has but 20 telephones in service and is proposing to abandon the local field if the Home will handle its toll business. The Home company refuses, however.

A trunk line will be built by the Russiaville Independent Telephone Company into Kokomo within a short time, according to officials of that company. The line will be attached to the local Independent line, and the Russiaville subscribers will be given free communication to Kokomo.

Mayor McCormack of Columbus, Ind., gave the Citizens' and Central Union telephone companies 20 days' notice to remove their wires from the city poles. This notice having been ignored, the mayor and chief of police, with a force of men, proceeded to cut down all the company's wires, but were restrained temporarily.

Independent telephone men from all parts of Indiana and from adjoining states will meet in Indianapolis May 17th and 18th for the annual meeting of the state association. George W. Beers of Ft. Wayne is president and C. S. Norton of Indianapolis is secretary of the association.

The Central Union Telephone Company has approved plans for a new exchange building in Columbus. S.

Telephone News from the Northwest.

The Nelson Telephone Company of Nelson, Minn., has filed articles of incorporation with $10,000 capital.

E. R. Jones is to be manager of the local telephone exchange at Brainerd, Minn., which has just been sold to the Northwestern Telephone Exchange Company.

E. M. Irish of Akeley, Minn., has sold the local exchange there to a stock company.

The People's Telephone Company has moved into its new exchange building at Superior, Wis.

The local telephone system at Howard, S. D., has been sold to the Dakota Central Telephone Company.

The local telephone system at Albany, Minn., will be merged with the Northwestern Telephone Exchange Company's system.

The Akeley (Minn.) Telephone Company has filed articles of incorporation with a capital stock of $15,000. H. H. Thomas is president and Bert Rodman secretary and treasurer. R.

Extensive improvements are making in the equipment of the old Michigan Traction Company of Kalamazoo, now owned by the Michigan United Railways. A tunnel near the city limits of Kalamazoo has been lowered to admit the larger interurban cars, and through service between Kalamazoo and Jackson is now maintained.

CORRESPONDENCE.

Great Britain.

London, April 4.—Each week the feeling is gaining ground that the action of the government in regard to the London electric power bills will result in another futile session, and that not one of the bills will be passed into law. To start with, it is now over a week since it was decided to send the bill of the London County Council to a committee, and while practically suspending all the others, to give their promoters a locus to appear before the committee dealing with the County Council bill. The only step since taken has been to announce merely that the committee shall consist of five members selected by the House and four selected by the ordinary committee of selection. This means that no work can be commenced before Easter. In the meantime, the promoters of one of the other bills—that which proposes to give a supply primarily for railway purposes from a power station 50 miles away from London—are making great efforts to effect a compromise with the London County Council. In order to get their bill through at all costs, they have refused to allow it to be suspended, and will practically force a second reading, in order to settle the matter without delay. With a view to overcome the opposition of the London County Council, the promoters of this bill have offered to insert a clause by which no supply may be given for any other purpose than railways, canals, etc., without the consent of the County Council. But with something in the nature of a hint of help from the government, this offer has not been accepted, and the bill will be opposed strongly. The promoters of the bill which very nearly became law last year are curiously quiet and have accepted the decision of the government regarding the London County Council bill with a readiness that has awakened suspicion in the minds of the municipalists. Although last in the field, the municipal scheme has obtained the whip hand, so to speak, by a fortuitous circumstance, for with the composition of the House of Commons as last year, it is doubtful whether the bill would have gone as far as it even now has. Even so, many regard it as a certainty that the House of Lords will throw the scheme out should it ever go so far. But that is unlikely.

The difficulties of the Hull Corporation in regard to the sale of its telephone undertaking are to be brought before Parliament. A sub-committee has been appointed to consider the best means of doing this, and in the meantime the five authorities which are the proud possessors of such undertakings are wondering what steps will be taken either to buy them out now or extinguish them at the expiration of their licenses. At present the postmaster-general will only offer them 60 per cent. of their capital expenditure.

The discussion which is now taking place at the Institution of Electrical Engineers should rank as one of the most important contributions to the subject ever made. Already two whole evenings have been devoted to the subject, and another is yet to come. Although the subject matter has been the general one of the electrical equipment of collieries, it seems to have turned, with a little feeling, on to the relative efficiency of steam and electric winding. Mr. W. C. Mountain, a partner in a firm of electrical engineers in the Newcastle colliery district, has been the heretic, for he has solemnly produced figures to prove that electric winding is some two or three times as expensive as steam winding, and that, for the present, the former has no chance. In fact, the position he indicates seems to be an unassailable one for steam winding for some time to come. The array of tables of figures produced by Mr. Mountain, on the one hand, and by several of his critics, on the other, somewhat bewilder the not too technical and statistical mind, and the discussion requires following carefully and deeply to be understood aright. But, really, electrical engineers ought to be grateful to Mr. Mountain, for it should be easy to see that he has the good of the profession at heart, and his paper is a gallant effort to awaken greater interest in a field of application of electricity which hitherto, here, at any rate, has never been properly developed. Unless I am much mistaken, Mr. Mountain will be thoroughly satisfied that the object of his paper has been achieved to the full, if only for the information it has been the means of extracting from others, which would probably have never otherwise come to light.

The bill which has been introduced this year giving the state further powers of control over wireless telegraphy until 1912 is being rapidly passed through its various stages. No further restrictions are imposed upon "wireless" experimenters, but the control of the state is extended until 1912 under the present conditions. If no unsatisfactory records come to hand then, probably the measure will be made permanent. An effort was made to reduce the period from 1912 until 1908, but no good reason was adduced, and it was unsuccessful.

The report of the National Physical Laboratory for 1905 has just been published. Considerable work has been carried out in the physics department, including the completion of an ampere balance, a series of determinations of the electromotive force of a cadmium cell in terms of the international ohm, experiments on the voltameter, and many other matters. An investigation has been carried out on behalf of the Institution of Gas Engineers on the relation between the candlepowers of the Pentane, Hefner and Carcel lamps. The state will grant an additional $25,000 for buildings, and also increase the annual grant by $2,500. A private donation of $5,000 has also been made to the laboratory.

The present capital commitments of the London County Council amount to over $105,000,000, and future proposals are as follows, among others: Tramways and street improvements, $20,000,000; electric power-supply undertaking, $12,500,000. There are also a large number of proposals as to tramways, etc., which have not yet been approved, and which also run into many millions of dollars. The North London tramways have now actually been taken over by the council, which is now absolutely the one tramway authority in London. It is estimated that it will take four years to convert the northern lines to electric traction. G.

New England.

Boston, April 12.—Vermont capitalists are considering the feasibility of building an electric railway connecting Hartwellville, Vt., with the Hoosac Valley street railway, a distance of 10 miles.

The Massachusetts railroad commissioners have authorized an issue of four per cent. first-mortgage bonds, maturing in 50 years, and amounting to $200,000, by the Old Colony Street Railway Company.

It is stated that William L. Mauran of Providence, R. I., and his associates have secured control of the Westerly Railway and Lighting Company, a holding Connecticut company, which controls the Westerly (R. I.) Gas and Electric Light Company, the Mystic (Conn.) Electric and Gas Lighting Company, the Pawcatuck Valley Street Railway Company and the Westerly and Hopkinton Street Railway Company. The H. B. Rust Company of Providence will superintend the enlarging and improving of the Westerly plant.

The proposition to build an air-line electric road between Boston and New York has brought out a statement from Charles S. Mellen, president of the New York, New Haven and Hartford Railroad Company, in which he says that engineers are planning a new express air line for that company, over which a train can be run from one city to the other in four hours, and in less time should the power be changed from steam to electricity.

The Boston Elevated Railway Company has received five carloads of steel for its elevated structure between Guild Street, Roxbury, and Forest Hills in this city, and is setting up the machinery necessary for handling the uprights. The work of building the structure will probably be under way before the end of the week.

The Massachusetts legislative committees on street railways and railroad, sitting jointly, have referred matters suggested by the special recess committee's report to a sub-committee of eight. These subjects refer to a general revision of the laws governing electric-railway companies, including their control by steam-railroad companies.

The New York, New Haven and Hartford Railroad Company has sold four per cent. debenture bonds maturing in 50 years and amounting to $15,000,000, part of the proceeds to be used for completing the electric railway between Woodlawn and Stamford, Conn.

An international telegraph tournament is to be held in Tremont Temple on June 8th. Andrew Carnegie has donated a solid silver cup 23½ inches high, which will be a trophy of the championship of the world for fast sending, fast receiving and accuracy, the person receiving the most points to be the victor. Clarence H. Mackay, president of the Postal Telegraph-cable Company, has donated four cups for first and second prizes in "team" work. There will be contests for broker and railroad operators. The proceeds will be used for the endowment of a free hospital bed.

The Underwriters' Laboratories has established a branch station at 93 Water Street, in charge of Franklin H. Wentworth, who has been conducting a test of electric car heaters at the Edison Illuminating Company's Head Place plant.

The legislative committee on public lighting has requested "leave to withdraw" on a petition for legislation authorizing the construction, purchase or lease of electric plants by cities, provided a majority so vote. B.

New York.

New York city, April 14.—Franchise terms have at last been agreed upon between the legal representatives of the Atlantic Telephone Company and Harry P. Nichols, chief of the Bureau of Franchises of the Board of Estimate. Under the agreement the company will pay to the city an aggregate of $3,000,000 as a minimum for a 25-year grant. The matter will be laid before the Board of Estimate on April 20th for its action. Final action by the Board of Estimate cannot be had until the Court of Appeals passes on the constitutionality of the act of 1905 transferring the franchise-granting

power from the Board of Aldermen to the Board of Estimate.

Plans are being made in a number of localities in the vicinity of New York to establish automobile omnibus lines this summer, and arrangements are also under way to run from half a dozen to 10 motor 'buses from this city to the race track. The 'buses that will be used for this purpose will be small cars holding 10 persons. No attempt will be made to make the trip a sightseeing run. The 'buses will start from fixed points and parties may hire the entire cars if they choose.

A marconigram from mid-ocean announced the fact that Maxim Gorky, the noted Russian author and revolutionist, was a passenger on board the Red Star Liner Kroonland.

A bill was passed in the Senate at Albany April 10th, introduced by Senator Barnes, authorizing the New York and Queens Electric Light and Power Company to commence an action against New York city for nearly $1,000,000. From January 1, 1903, the city refused to make contracts with a number of the lighting companies, among them the New York and Queens Electric Light and Power Company, which supplied current for lights in streets and public buildings in the Borough of Queens. After the expiration of the contract on this date the company continued to supply the current, and the city used it as before on the theory that it would pay for it according to a price which would be determined by a court decree or commission named to fix the compensation. The company did not bring its action for three years, and the purpose of the bill is to make the city pay for the current supplied at the contract price as it existed before the contract expired.

A four-hour train service from New York to Boston is promised by the New York, New Haven and Hartford Railroad as soon as the company's plans for the shortening of its lines between the two cities have been completed. These plans have already made good progress. The recent issue of $5,000,000 of bonds by the New York and Boston Air Line was in furtherance of the scheme for a shorter line from this city to Boston.

Many new trolley lines of the New York City Interborough Railway Company will be opened on May 1st. The work on the company's other lines will be pushed forward as rapidly as possible. The New York City Interborough Railway Company has franchises for more than 40 miles of street surface lines and will furnish a comprehensive system of crosstown lines in the Borough of the Bronx and feeders to numerous stations of the rapid-transit system in Manhattan and the Bronx.

Elihu Thomson, president of the International Electrical Congress at St. Louis, has reported to the American Institute of Electrical Engineering that the balance of the funds of the congress is $2,052.06. This sum is offered to the Institute for its library, to be made a separate perpetual fund, the annual proceeds of which are to go for the purchase of international electrical literature. At the last meeting of the board of directors of the Institute the gift was formally accepted and resolutions adopted to the effect that the money shall constitute the "International Electrical Congress of St. Louis (1904) Library Fund." The proceeds are to be devoted to the purchase of non-American electrical literature. C. I. C.

Southeastern States.

Charlotte, N. C., April 14.—The city of Richmond, Va., has filed a petition, amounting to $170,000, against the Richmond Traction Company, for alleged damages, alleging this amount of damages to water pipes, etc., due to electrolysis.

The Mercantile Trust Company of New York has filed suit against the Sedalia (Mo.) Electric Light and Water Company, to recover the value of the first-mortgage bonds issued by the electric company, amounting to $200,000.

The financial end of the merger of the public utilities of Norfolk, Portsmouth and Berkeley, Va., are completed, including over 115 miles of electric lines. Middendorf, Williams & Co., John L. Williams & Sons and Chandler Bros. & Co. of Philadelphia are the promoters of the huge deal. The Norfolk Railway and Light Company is to be acquired through lease. It is given out that interests of the United Gas Improvement Company of Philadelphia are behind the merger. The new corporation will be known as the Norfolk and Portsmouth Traction Company, with $6,000,000 capital in stocks and $8,000,000 in bonds. There will be an immediate issue of $3,500,000 in bonds and $5,000,000 stock. The president is R. Lancaster Williams of Richmond and Baltimore, and E. C. Hathway general manager, these gentlemen having held similar positions with the Norfolk Railway and Lighting Company.

An effort is being made to have United States mail boxes attached to the street cars of Macon, Ga., chiefly for the benefit of the suburbanites.

The Columbia Electric Street Railway Company has offered gratuitous insurance to employes who have been with the company a year. The company only requires that those taking advantage of the offer waive the right to bring suit in case of accident, it is said.

At the annual meeting of the New Orleans (La.) Railway and Light Company President Foster reported that [illegible] traction [illegible] house, completion of [illegible] and other [illegible] year were $[illegible].

Among the [illegible] electric railway from [illegible] Point and [illegible] Company, backed by Philadelphia [illegible] secured a franchise from High Point [illegible] ville.

The Charlotte Consolidated Construction Company has been examining the [illegible] engines, with the view of [illegible] gas engine for generating electric [illegible] proximately 1,000 kilowatts.

J.

Texas.

Austin, April 14.—J. H. Hill, general [illegible] of the Galveston, Houston and Henderson Railroad has been directed by the board of directors to make an investigation of the proposition to convert the road into an electric line. The road runs between Galveston and Houston, a distance of 50 miles, and does a heavy passenger business.

Harvey T. D. Wilson of Houston is promoting the construction of an electric railway to connect that city with its principal suburbs. He has interested a number of St. Louis men.

The Consolidated Construction Company of New York has made a proposition to the city of Austin, through the City Council, to rebuild the dam across the Colorado River which was washed away several years ago. The dam furnished the power for operating the electric light and power plant, water works plant, etc. It is estimated that the cost of rebuilding the dam would be about $1,000,000. The company agrees to receive its payment at the rate of $86,500 a year. The city of Austin has submitted a counter proposition which is open to all bidders. It provides that anyone who will reconstruct the dam will be paid at the rate of $60,000 a year. This proposition is predicated upon the basis of the dam costing $800,000.

T. B. Enochs of Kansas City, Mo., is at the head of a syndicate which proposes to build an electric railway from the coal fields in the Caballero Mountains to Clint, passing through El Paso. The proposed road will be about 60 miles long. M. W. Stanton of El Paso is the local representative of the syndicate.

J. C. Houser, who promoted the building of the interurban electric line between Temple and Belton, has taken steps toward building an interurban road between Temple and Marlin, a distance of about 25 miles.

The Lawton, Denton and Dallas Electric Railway Company, recently organized for the purpose of building an electric railway between Dallas and Lawton, Okla., is making good progress in financing. The line, if built, will be the longest in the Southwest, the distance between the two places being about 150 miles. The temporary officers of the company are: President, J. W. Lowery; vice-president, J. T. Chambers; general superintendent, C. S. Henderson; general manager, S. E. McCullin.

The construction of the La Porte branch of the proposed Houston-Galveston interurban electric railway is in progress. The right-of-way for the main line between Houston and Galveston has been secured and the construction at both ends of the line will soon be commenced. J. O. Ross of Houston is president.

J. V. Watkins, promoter of the proposed interurban electric railway between Palestine and Corsicana, announces that the construction of the line will be commenced about April 15th. H.

Mexico.

City of Mexico, April 9.—The Guanajuato Electric Light and Power Company is preparing to extend its electric transmission lines to the towns of Ocotlan, Jamay and Ribera Castellanos. This is an American company, which operates a large hydro-electric plant at El Duero. It is already furnishing lights and power to Guanajuato, Leon, Irapuato and La Barca.

An electric-light and power plant is to be installed at Santa Cruz de Bravo by the federal government. The town was until recently the capital of the Maya Indian tribe.

The American Gas Company has purchased the electric-light and power plant at Merida. The price paid was $1,600,000.

The machinery for the large hydro-electric plant which is to be installed on the Piaxtla River by the owners of the Guadalupe de los Reyes mines has arrived. The plant will have a capacity of 5,000 horsepower and will cost about $800,000. Robert McDoble, electrical engineer of San Francisco, has charge of the construction work.

R. H. Springer of Chicago is at the head of a party of engineers who are making a survey for a proposed electric railway that is to traverse a rough country, but a rich mining district, where a number of large mines are operated. It will be for both freight and passenger service. The syndicate which Mr. Springer represents recently obtained options to purchase large tracts of land situated adjacent to the route of the proposed road. It is [illegible]

Ohio.

[illegible] J. A. Robinson [illegible] of the [illegible] and Lake [illegible] Robison is pr[illegible]

For the purpose of [illegible] Sandusky [illegible] the Sandusky, Fremont [illegible] with a nominal capital [illegible] tance to Clyde is 16 miles [illegible]

From May 7th to 10th the [illegible] Interurban Trainmen's Association [illegible] Lorain when 150 delegates are expected. The association was formed by a merger of the conductors' and motormen's associations [illegible] is expected that the [illegible] meeting.

In exchange for a 25-year franchise with the privilege of building a double track on certain streets, the Cleveland and Southwestern [illegible] posed to the Village Council of Elyria [illegible] the share of the town for an [illegible] East River Street, widen the East River bridge to 46 feet, with a six-foot walk on either side, and keep the streets over which the lines pass in good condition.

Lake Shore Electric officials state that no negotiations have been conducted toward uniting that road with the others that are supposed to make up the line that the New York Central is planning between Chicago and New York.

Columbus people interested in the Ashtabula Public Service Company expect to put in a lighting and heating plant that will furnish light and heat in abundance at Ashtabula. Some of the men interested in the proposed plant are R. H. S[illegible], J. K. Henry, A. J. Stahl, C. E. Bonebrake and C. E. Myers.

The proposed Consolidated Gas and Electric Company, which is to take over the gas and electric plants of the Cincinnati Gas and Electric Company, acquired by an eastern syndicate on a 99-year lease a few days ago, is planning for extensive improvements in the electric as well as the gas department. Plans have been partially formulated for an immense electric plant on the river front, which will be double the capacity of the present plant. The machinery will be made up of units driven by turbine engines, and each will have a capacity of 18,000 kilowatts. The terms of the lease are that a company with a capital stock of $[illegible] shall be organized under the laws of Ohio. Norman G. Keenan, president of the old company, will also be president of the lessee company and have the management and entire charge of the business. The guarantee is $3,000,000 in cash and the expenditure of $2,000,000 in betterments during the next five years. A certain amount of the stock will be offered the shareholders of the old company, and it is said that a majority of the board of directors will be Ohio men. A. S. White and C. A. Lieb of New York conducted the negotiations for the lease.

The Town Council of Fostoria has promised the National Electric Lamp Company fire protection for its several factories in that place if the company would remain there. The company had made arrangements to look for a new location because of lack of protection.

F. J. J. Sloat, general manager of the Cincinnati Northern Traction Company, states that 20 new open cars and 15 closed cars have been ordered for the local lines at Hamilton. Ten interurban coaches have also been ordered. The company is ready to proceed with work on the extensions of the local lines and awaits the action of the council in the matter.

From New York comes a report that a company will be formed to build a direct line from Cleveland to Sharon, Pa., and from there to Pittsburg. The line will pass through Middlefield, Ohio, and connect with Warren and some other points, the

proposed Warren, Cortland-Jefferson line having been taken over. The Eledenbel Construction Company has already signed a contract to build the line from Middlefield to Sharon for the Cleveland and Sharon Traction Company. A company with a capital stock of $2,000,000 and a bond issue of the same amount, and known as the Cleveland and Sharon Electric Railroad Company, is to be organized to finance the project. C. F. Clendenin, James B. Cahoon and Norman C. Raff of New York, and George W. Birrell of Kinsman, Ohio, will be among the directors of the new company. O. M. C.

Indiana.

Indianapolis, April 14.—The Tippecanoe County commissioners have granted a franchise to the Lafayette and Logansport Traction Company for the construction of an electric railway through Tippecanoe County to the Carroll County line, the road to extend on to Logansport. James Murdock of this city represented the traction company. The company also received a similar franchise from the commissioners of Carroll County. The road is to enter Logansport at Park Avenue, and the company hopes to complete the line by next fall.

The secretary of war has granted the Indiana Union Traction Company a permit to construct a loop into Ft. Benjamin Harrison, near Indianapolis. The permit is revocable at the will of the secretary of war.

With the inauguration of its spring schedule during the last week the Schoepf-Morgan syndicate of traction roads claims the fastest trolley service in the world, now running daily on its Ft. Wayne, Van Wert and Lima line. The new Ft. Wayne cars are running daily on time at a rate of 32⅝ miles an hour, including all stops.

The advent of the interurban railways in Indiana seems to have instilled a spirit of pride in the farming community. The old shacks and sheds on farms along the electric roads have begun to disappear, the old fences are being replaced with new ones, new houses and barns are being built and old ones remodeled and modernized. The improvement of lawns is a noticeable feature. Lands near interurbans are more valuable, by $20 to $40 per acre, than farms remote from traction lines. Electrical development will soon bring other advantages to the farmers along the traction lines.

No public question in years has so interested Richmond people as the proposed sale of the municipal light and power plant, constructed by the city four years ago, at a cost of nearly $200,000. The owners of the stock of the Richmond Light, Heat and Power Company, which is a competitor of the city plant, have offered to pay the city dollar for dollar for money expended on the plant, assuming the bonded indebtedness. The offer, which was made through Mayor Zimmerman to the City Council, has been referred to a committee, and experts are at work estimating the cost. The people are divided on the proposition, and the matter is arousing a warm discussion.

Work has been started on the new municipal electric-light plant at Cannelton. The plant will be a one-story stone structure, 45 feet square. It is located on the site of the former plant destroyed by fire.

A reorganization of the Evansville Electric Company was effected during the week whereby Henry W. Marshall, Charles Murdock and Samuel T. Murdock of Lafayette, Ind., secured a controlling interest in the company. Charles Murdock was elected president to succeed James O. Parker, and Henry Marshall was elected secretary and treasurer, to succeed Judge Alexander Gilchrist. Herbert Moran retained his position as vice-president and general manager. Thomas Krutz of New York and William G. Krutz of Chicago are directors in the company, with the four officers mentioned.

The Remy Electric Company of Anderson has increased its capital stock from $50,000 to $75,000.

The Garrett Trolley Wheel Company of Garrett has been incorporated to manufacture trolley wheels. John B. Myer is president.

At Kokomo on April 7th an electric car approached a curve at a high rate of speed and was thrown over, killing James Bruff, a prominent architect and citizen. Every effort is being made to discover the cause of the accident. S. S.

Michigan.

Grand Rapids, April 14.—Within five years the city of Lansing will be getting the power for its municipal lighting plants from the Commonwealth Power Company, is the prediction of Commissioner Frank C. Brisbin of the water and electric-light board. It is said the electric-light and waterworks property will inventory $600,000. To save these departments from an annual deficit the city will be asked to pay $18,000 a year for city light and water.

The new municipal lighting plant at L'Anse has been out of commission, owing to the crumbling away of the concrete engine foundations. The damage is attributed to the fact that the foundations were put in during the winter months.

The Grand Rapids-Muskegon Waterpower Electric Company has awarded the contract for the construction of a second dam and electric plant at Croton with a capacity of 12,000 horsepower. To convey the electric current from this dam to the sub-station near Casnovia village a new pole line 30 miles long will be built. The pole line from the station in Casnovia township to Grand Rapids is finished. The company is nearly ready to deliver electricity in Grand Rapids.

The Thornapple Power and Electric Company of Grand Rapids has filed amended articles of incorporation increasing its capital stock from $1,000 to $100,000.

Promoters intend to establish an electric power plant at Atlas to furnish lighting and power for the city of Flint, 10 miles away, and for other surrounding towns. The river is dammed at that point to supply the motive power for a grist and flour mill, and the water fall is of sufficient volume, it is said, to run a power plant. It is proposed to purchase the mill and replace it by the new power plant.

The general offices of the Benton Harbor-St. Joe Railway and Light Company have been moved to Benton Harbor from St. Joseph. The office in St. Joseph will be retained for the accommodation of St. Joseph patrons.

In accordance with the wishes of the people of Kalamazoo, as expressed at the polls, for free interurban railways into the city, a franchise has been granted to the Kalamazoo, Elkhart and South Bend Traction Company. The council ignored a petition signed by 500 of the leading business men of the city, to admit the roads, and ordered that the question be submitted to the people at the polls. Four electric roads are seeking entrance to the city.

It is announced that the Battle Creek and Coldwater Electric Railway Company has bought and paid for all its right-of-way. It will run from Battle Creek, through Athens and Union City, to Coldwater, a distance of 37 miles, using the third-rail system. It is expected steel will be laid this summer.

The Common Council of Three Rivers has granted a franchise to the Michigan and Indiana Traction Company to build an electric railway through that place. This is the line which will connect Elkhart and Kalamazoo, passing through Constantine, Three Rivers and Vicksburg. Franchises have been applied for at the other villages along the proposed route.

In railroad circles it is reported that Matthew Slush, former president of the Detroit, Monroe and Toledo Short Line, is negotiating for the purchase of the Toledo, Ann Arbor and Detroit electric, now under construction and completed from Toledo to Petersburg, a distance of 15 miles.

Henry J. Wieck, administrator of the estate of the late Henry A. Wieck, shot during the street-car strike in Saginaw last June, has filed in the Circuit Court a declaration of suit against the Saginaw Valley Traction Company. The action is for $10,000 for the death of Mr. Wieck. The allegation upon which damages are asked is that the cars were at that time in incompetent hands. L. W. B.

Illinois.

Peoria, April 7.—Another new interurban railway is being planned to run from Peoria to Decatur. The road will be financed by R. D. Starbuck of Mattoon. J. M. Clokey of Decatur, G. A. Goode of Bearsdale, B. H. Faith of Warrensburg, R. H. Snyder and K. C. England of Mt. Pulaski, Thomas L. Clackburn and W. H. Evans of Lincoln, and G. A. Salle of Latham. They will construct a trolley line from Decatur to Lincoln through Mt. Pulaski. It will run parallel to the Peoria division of the Illinois Central Railroad. The section from Lincoln to Decatur will be built first.

The Illinois Traction Company is now planning to build to the southwest from Peoria. The company is now making surveys south from Abington to Macomb and on to Quincy. This will open a new field, as there is only one electric line in the territory between here and Quincy. That line is from Macomb to Industry, a distance of about 12 miles. From Macomb to Peoria the new line will run through Cuba and Canton.

Articles of incorporation of the Peoria, Pekin and Fremont Telephone Company have been filed. The capital stock is $2,500 and the incorporators are A. J. Davis, Walter H. Ames and S. A. Hayward.

The three coal mines at Lincoln have been sold to an eastern syndicate which will equip them with electricity. Thomas F. Holmes is superintendent of the citizens' shaft and has represented the owners in the deal.

The capital stock of the proposed electric railway between Canton and Lewistown is nearly all subscribed. The promoters have been holding meetings in the towns through which it will pass, and a great deal of interest is being taken in the various towns.

The steam turbine for the central power house of the Illinois Traction Company at Riverton, near Springfield, has arrived and is now being erected. The company announces that cars will be running betwen Springfield and St Louis within a month. The cars will contain a cafe and smoking apartment.

The contract for the electric-railway bridge of the McKinley syndicate at Peoria has been awarded to the Stroebel Steel Company of Chicago, and work on foundations will be started at once. Soundings have been taken at close intervals by a local firm. The piers are to be ready for the superstructure by August 1st and the foundations for the girder spans across the tracks on the Peoria side of the river and the piling on the other side are to be completed by October 1st. The contract for grading of the line from Bloomington west through Danvers and Mackinaw has been awarded to S. A. Tuttle and Brother of Decatur. Work is to commence at once and grading finished by August 1st. V. N.

Northwestern States.

Minneapolis, April 14.—Articles of incorporation of the Brookings (S. D.) and Sioux City Railway Company have been filed with a capitalization of $100,000, and it is proposed to build a trolley line between those two cities. Neil Stewart of Brookings is interested in the new enterprise.

The Kaukauna Gas, Electric Light and Power Company of Milwaukee, Wis., has been incorporated with a capital of $100,000 to succeed the Kaukauna Electric Light Company of Kaukauna, Wis.

The Milwaukee Electric Railway and Light Company is planning extensions to its system which will aggregate in cost about $150,000.

A survey is being made for a proposed electric line from LeMars, Iowa, to Spirit Lake, via Hartley and Primghar.

Engineer Hugh L. Cooper will begin work shortly on surveys for the proposed development of the Des Moines Rapids of the Mississippi River at Keokuk, Iowa.

The Electric Manufacturing Company of St. Paul has been incorporated with $150,000 capital. B. B. Downs is president and E. A. Reed secretary-treasurer.

The Newton and Northwestern Railway Company has let the contract to Shugart & Stevens for the construction of that portion of the proposed interurban line between Des Moines and Ames, Iowa.

John Crisler and associates have bought the Wisconsin Power Company's mill and power plant at Rice Lake, Wis.

The Minneapolis General Electric Company is to make reductions in its rates for lighting and power and is now conferring with the council committee on the subject.

John Anderson proposes to install an electric-light plant at Tyler, Minn.

Bonds for $350,000 have been voted at Aberdeen, S. D., for the erection and equipment of an electric-light plant.

J. E. Townsend, village clerk, will take bids until May 1st for a 15 to 20-year franchise for an electric-light system at Belle Plaine, Minn. R.

Pacific Slope.

San Francisco, April 12.—The Pacific Wireless Telegraph Company will open its stations in the Merchants' Exchange Building in San Francisco and in Oakland for the transmission of commercial business on April 14th. The management asserts that in the near future the users of this system will be placed in communication with all of the other stations from British Columbia to Southern California. No messages have been transmitted very long distances on this coast yet, but this company is working energetically to secure better results.

Leopold Michels, the local representative of the Eastern capitalists composing the San Francisco Coke and Gas Company, is authority for the statement that $1,500,000 has been set aside for an electric-light plant and underground distributing system to supply the central portion of the city. It will be a thoroughly modern plant, the generators being direct-connected to large gas engines. The company's engineers are now working out the details. The Mutual Electric Light Company having been purchased by the Pacific Gas and Electric Company, there is now no competition in the local electric-lighting field. The San Francisco Coke and Gas Company has built up a good business in gas lighting in a short time in competition with the older gas company and charges 75 cents a thousand, holding its patronage, although it is undersold in the competitive districts. Sixty miles of mains are in use and 30 miles more will be laid soon. The gasworks are at North Beach, and it is the intention to locate the electric-light plant near by for convenience in operating the gas engines. The manufacture of coke will soon be resumed, and a supply of gas can thus be secured that will be well adapted for use in gas engines. The San Francisco Coke and Gas Company has an authorized bond issue of $5,000,000, half of which has been placed by the Knickerbocker Trust Company of New York, which also financed the Stanislaus Electric Power Company. The latter company is constructing an electric-power transmission system, which will be extended to San Francisco within two or three years. According to Mr. Michels, when this transmission line reaches the city the San Francisco Coke and Gas Company will distribute its current for lighting and power purposes. Leopold Wallach of New York is prominently identified with the new lighting concern.

The reconstruction and extension of the Geary Street Railroad Company's line in San Francisco is to be commenced within a week. Bids have been opened by the public utilities committee of the Board of Public Work, and the $347,000 bid of C. E. Loss & Co. of San Francisco, well-known

electric-railway contractors, was found to be considerably lower than any of the three other bids. A modern underground conduit system is to be built, utilizing the present tracks on Geary Street. A municipal power house is also to be constructed. Much bitter discussion has taken place in the city over the proposition to introduce an underground conduit system. The United Railroad management, in opposing the demands of property owners on Sutter Street for the changing of the present cable road into a conduit system instead of an overhead trolley line, say that the poor sewerage system of the city would cause flooding of the conduits and failure of the system.

H. H. Andrews, representing an Eastern syndicate, has been granted a franchise to put in a power system at Baker City, Ore. Mr. Andrews will furnish power at Baker City and for many miles throughout that section.

The management of the Crockett sugar refinery at Crockett, Cal., will install electric motors for the operation of the big plant. Additional boilers will be installed for use in the power plant.

Ground has been broken for a new power station for the Seattle Electric Company at Georgetown, Wash., which will cost about $250,000 when completed. The company also has plans for the construction of large car barns, the total investment being upward of $400,000.

Contracts for machinery for the new power plant which will be erected at Bellingham, Wash., this year, have been let by the Columbia Improvement Company.

Manager T. A. Rendle of the Bartlett Estate Company states that the South Park and East Side Railway Company of San Diego, Cal., will change to electric traction. Construction will begin at once on the power house in South Park.

At a meeting of the trustees of Red Bluff, Cal., it was decided to grant a franchise to the Redding and Red Bluff Railway over Jackson Street. A.

PERSONAL

L. W. Daniels has been succeeded by J. W. Buncle as superintendent of the electric-light plant at Aitkin, Minn.

C. R. Cummings of Webster City, Iowa, has taken charge of the electric-light plant at Glencoe, Minn., as the successor of A. T. LeVesconte.

R. Borlase Matthews, formerly connected with the National Electric Company of Milwaukee, is now electrical engineer for the Edison Electric Light and Power Company of Amsterdam, N. Y.

Miss Nora Stanton Blatch has been elected to membership in the American Society of Civil Engineers, the first woman so distinguished. She is a granddaughter of Elizabeth Cady Stanton, and the first woman to win the degree of civil engineer in Cornell University.

Frank J. Boehm, who succeeded H. C. McKay as auditor of the Milwaukee Electric Railway and Light Company, has been appointed assistant secretary and treasurer of the company, to succeed the late George O. Wheatcroft. George W. Kalweit succeeds Mr. Boehm as auditor.

Linden G. White has been appointed superintendent of the Columbus Railway and Light Company of Columbus, Ohio. Mr. White succeeds M. S. Hopkins. Formerly Mr. White was assistant superintendent of the company, but retired to become manager of the Columbus Structural Steel Company.

Nathaniel Southgate Shaler, dean of Lawrence Scientific School of Cambridge, Mass., died April 10th at the age of 65 years. He was a graduate of Harvard and a veteran of the Civil War. Fifteen years ago he was made dean of the school. It was due to his efforts that the McKay bequest of $5,000,000 was made to the institution a year ago.

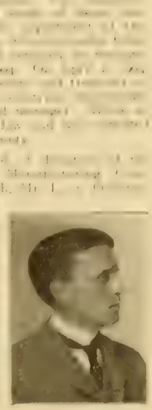
E. R. Conklin of Aurora, Ill., general manager of the Interstate Telephone and Telegraph Company, is expected to return from Europe soon. Mr. Conklin has been accompanied by Mr. Alfred Stromberg, the well-known Independent telephone manufacturer, and Mr. Francis Dagger, a representative of the Canadian government. Mr. Dagger recently visited Peoria, Ill., and inspected the telephone exchange there.

Mr. L. F. Bower, formerly manager of the electrical works of the Allis-Chalmers Company in Cincinnati, who was recently promoted to the position of comptroller of the company, has already assumed the duties of his new office, with headquarters at the general offices of the company, Milwaukee. Mr. Bower was born and spent the early years of his life in Berwick, Pa. He attended Wesleyan University, Middletown, Conn., from which he graduated in 1879. He engaged in commercial pursuits, but later was for three years principal of the preparatory department of Dickinson College, Carlisle, Pa. Returning to active business, Mr. Bower made several

L. F. BOWER.

important [illegible] secretary and [illegible] Telephone Company [illegible] times of [illegible] chines. When [illegible] concern was [illegible] pany in 1901 Mr. Bower [illegible] of the Scranton [illegible] he went to Cincinnati [illegible] the Allis-Chalmers Company [illegible] and in 1905 he was appointed manager [illegible] Scranton Mr. Bower [illegible] to the bar of Lackawanna County.

At a meeting of the board of directors of the Westinghouse Electric and Manufacturing Company, held Tuesday, April 10th, Mr. L. A. Osborne, formerly third vice-president of that company, was elected second vice-president to succeed Mr. Frank H. Taylor, resigned. Mr. Taylor, who is also a director of the company, will retain his seat on the board. Mr. Osborne, as third vice-president, had the direction of the engineering and manufacturing activities of the company. As second vice-president he will assume the direction of the commercial activities of the company, while retaining those of the engineering department. The new second vice-president is a graduate of Cornell University. He entered the employment of the Westinghouse Electric and Manufacturing Company in 1891 and has successively held the positions of assistant superintendent, assistant to the vice-president, manager of works, fourth vice-president and third vice-president.



L. A. OSBORNE

On account of the rapid expansion of the business of the Westinghouse Machine Company, the board of directors has decided to enlarge the executive organization by increasing the number of vice-presidents from two to four and has elected Mr. E. H. Sniffin and Mr. Arthur West to fill the new offices of third and fourth vice-president, respectively. Mr. Sniffin will be in charge of the sales department as heretofore, his field of work not being altered in assuming the new title. Mr. West, who has been chief engineer of the company, still retains that title and position. Mr. William A. Boles, in consequence of his election to the vice-presidency of the Westinghouse Foundry Company, has resigned his position as manager of works of the Westinghouse Machine Company in order that he may better serve the interests of the foundry company, of which he assumes the entire management. The Westinghouse Machine Company, however, retains Mr. Boles as consulting engineer, availing itself of his services and counsel on important work, which his ripe experience has made peculiarly valuable. Mr. Henry L. Barton, formerly general superintendent of the East Pittsburg Works of the Westinghouse Machine Company, has been appointed manager of works.

ELECTRIC LIGHTING

The Northern Light Company of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by E. M. Cloves, R. S. McConnell and Samuel H. Kleinman.

The city hospital at Memphis, Tenn., is to install an isolated electric-light plant, and this, too, in spite of the fact that it is furnished free gas to the amount of $1,000 a year.

The Home Light and Power Company has been incorporated in Galesburg, Ill. The capital stock is $15,000 and the incorporators are E. P. Robson, Henry Gardt and I. S. Callendar.

J. M. Bricker is local manager of the Somerset (Pa.) Electric Light, Heat and Power Company, which proposes to erect a central power station to furnish light and power to adjacent towns.

A. R. Coates is at the head of the Kaukauna (Wis.) Gas, Electric Light and Power Company, incorporated for the purpose of making improvements to the electric-light plant at that place. The capital stock is $100,000.

Tomlinson Brothers, owners of the Mena (Ark.) Electric Light and Power Company, recently completed the purchase of a new Allis-Chalmers steam-electric unit complete for installation at the power plant in Mena. The new outfit consists of a Reynolds Reliance-Corliss engine, a 115-kilowatt belted generator wound for three-phase, 60 cycles, 2,300 volts, and a four-kilowatt 120-volt direct-current exciter.

The Wickford Light and Water Company, having purchased all rights from Stillman Saunders, Brownie Lockwood, Walter Greene and S. P. Kelly, will establish an electric-lighting system at Saunderstown, R. I., that will be in operation soon.

Directors of the Cincinnati Gas and Electric Company are said to have unanimously ratified a 99-year lease of the plant and all the properties of the company to New York capitalists. The new com-

[illegible]

The Puget [illegible] Chehalis [illegible] 300 kilowatt [illegible] each of 16 [illegible] current for the generators. A [illegible] generator [illegible] equipment, which will be used for [illegible] power purposes.

ELECTRIC RAILWAYS

The contract for [illegible] electric railway, between [illegible] N. Y., and [illegible] Valley, has been let to the McGreevy [illegible] Company of Ithaca, for $45,000.

Brookings (S. D.) and Sioux City railway company has been incorporated with a capital of [illegible] 000 for the purpose of constructing [illegible] between the two places. Neel Stewart of Brookings is the promoter.

Directors of the Galveston, Houston and Henderson Railroad, between Galveston and Houston, Texas, have directed General Manager J. J. H[illegible] to make a report upon the cost of converting the road from steam to electric operation.

Work is about to be resumed on the [illegible] and Stock Yards branches of the South Side elevated railway in Chicago, after having been held up for several months on account of a strike on the part of the structural steel workers. The work will be done with non-union men.

Net earnings of the Chicago and Milwaukee Electric Railroad Company for the month of March and for the first quarter showed a substantial increase. The road earned $18,234 for the month, an increase of $3,088. During the first quarter the increase in net earnings was $20,408.

Mass meetings have been held at Ithaca, St. Louis, Beebe and other points in Michigan to meet Pittsburg capitalists and moneyed men of Detroit who propose to build an electric road from St. Louis and Ithaca to connect at St. Charles with the D. O. S. road, which the same capital will build this summer.

Work has been started on the actual construction of the Jonesboro branch of the Birmingham Railway, Light and Power Company's lines. Considerable material has been placed at Bessemer, and it is believed that the work can be rushed so that in a few weeks the operation of cars will be a possibility.

Dr. Milton G. McCorkley of Portland, Ore., is interested in a company to build hotel and sanitarium near Mt. Hood. In addition to the erecting of sanitarium, it is proposed to build an electric railway from Portland, a distance of 46 miles, extending up the mountain to a point where the snow begins.

E. M. Loveland of Ferndale, Cal., has a proposition for an electric railway in the Ferndale Valley, the first line to extend from Brizzily Bluff to Ferndale, thence to Loleta and across the Eel River. The residents of the valley are asked to provide a bonus of $14,000, and the project is meeting with encouragement.

The Walla Walla Traction Company of Walla Walla, Wash., has been incorporated with a capital of $3,500,000, for the purpose of constructing an interurban line connecting Walla Walla with surrounding towns and villages. Among the incorporators are Miles C. Moore, F. W. Paine and W. W. Baker of Walla Walla.

Rumors are to the effect that a high-speed electric railway is to be built between Chicago and New York upon which 10-hour trains will be run. The scheme is still in the future, but it is asserted that some of the right-of-way has been secured and that a line is mapped out which will be 200 miles shorter than the shortest steam line, no attempt being made to touch large cities out of the direct line. The road, if built, will be of especially strong

construction to withstand the stress of high speed which would have to average 75 miles an hour. Five years is the time set for the completion of the road.

It is said that arrangements have been completed for building the high electric-railway bridge by the Canon City, Florence, Royal Gorge and Interurban Railway Company of Colorado. This bridge will span the Royal Gorge at a point directly above the "hanging bridge" of the Denver and Rio Grande Railroad and will be over 2,600 feet above the bed of the Arkansas River.

It is reported that the United Railways Investment Company of San Francisco has completed the purchase in New York city of the 21,000,000 shares of stock of the Philadelphia Holding Company. This transaction gives to the United Railways Investment Company the control of all the street railroads in Pittsburg and Allegheny as well as control of the artificial gas, the electric lighting and 80 per cent. of the natural-gas business of Pittsburg. The deal was completed April 5th.

The Norfolk and Portsmouth Traction Company has been incorporated to improve the Williams interests in Norfolk, Va. A power house will be erected at a cost of $1,000,000. The plans of the new company are financed by Middendorf, Williams & Co. of Baltimore, J. L. Williams & Co. of Richmond, and Chandler Bros. & Co. of Philadelphia. The company will push a trolley line into Suffolk at once. This has been advanced as far as Churchland under the present management.

POWER TRANSMISSION.

A hydro-electric power plant is to be installed for the operation of the Guadalupe de los Reyes mines in the Cosala district of Sinaloa. The plant will have a capacity of 5,000 horsepower and will be situated on the Praxtla River. Robert McDoble of San Francisco has the contract for installing the plant, and recently started with six assistants for the site of the development.

The construction of a second dam and water-power electric plant, with a capacity of 12,000 horsepower, has been ordered by the Grand Rapids-Muskegon Water Power Electrical Company in Michigan. Work is to be started at once and the plant ready for operation within a year. The dam will be 650 feet long and will be built for a 35-foot head of water. J. B. Foote of Jackson, Mich., will be the engineer in charge. A new pole line 30 miles long will have to be built from the plant to Casnovia. The pole line from Casnovia to Grand Rapids has already been built.

PUBLICATIONS.

A folder from the Robert Instrument Company of Detroit, Mich., gives a very complete description, with illustrations, of the line of Robert battery-testing instruments, including voltmeter, ammeter and volt-ammeter. There are also included directions for the use of the instruments.

The Electrical Testing Laboratories of New York city has reprinted in pamphlet form the paper presented by Mr. Clayton H. Sharp before the American Institute of Electrical Engineers, November 24, 1905, upon the subject of "A Testing Laboratory in Practical Operation."

Circular No. 54 of the Dean Brothers Steam Pump Works of Indianapolis, Ind., deals with Atlantic type boiler feeders or pressure pumps. The circular gives comprehensive details of the construction of these pumps and tables of sizes which will be found of value in calculations for installations.

A small pamphlet entitled "Where Neatness Counts as Against 'Any Old Thing'" is to be had from the H. T. Paiste Company of Philadelphia. It contains some facts about the simplicity and neatness of the company's brass cap nuts. The company is mailing at the same time a new price list of its extensive line of electrical specialties.

"The Rise of a Great Company" is the title of a folder which is distributed by the Allis-Chalmers Company of Milwaukee. The folder is interesting in that it describes the growth and development of the company, and outlines the scope of its work in the many departments of manufacture which are embodied under the name of the Allis-Chalmers Company.

The Allis Chalmers Company is sending out a series of 50 multi-chrome cards giving views of Swiss scenery, as an advertisement of the Schindler bolting cloth, which it furnishes to its milling customers. The pictures are reproductions of Alpine views, and the cards, having no printed matter upon them, will form a very interesting and attractive collection when the series is complete.

A seasonable talk on "Spring Painting" is contained in a pamphlet which is being widely distributed by the Joseph Dixon Crucible Company of Jersey City, N. J. Graphite produced in the well-known Ticonderoga graphite mine is the basis of the paints manufactured by this company—the Dixon silica-graphite paint. The natural smoothness of the Ticonderoga flake graphite permits of the use of the greatest possible volume of pigment, and a material saving in cost of labor and brushes in application. Under average conditions for good coatings on metal surfaces, one gallon covers about 500 square feet for first coat, and about 550 square feet for second coat.

Volume VIII of the Transactions of the American Electrochemical Society has been issued, including a complete report of the eighth general meeting, which was held in Bethlehem, Pa., September 18-20, 1905. There is also contained in the volume a directory of members. The president of the association is Wilder D. Bancroft; secretary, S. S. Sadtler, and treasurer, Pedro G. Salom.

Benjamin W. Sands of Springfield, Mo., has issued in pamphlet form the lecture which he gave June 14, 1905, before the Photographers' Association of Missouri. The title of the pamphlet is "The Primordial Energy." The author spent some 10 years in study and experiment on this subject and has proved, to his own satisfaction at least, that all the various kinds of energy are but the different phases of magnetic vibrations, which he believes is the primordial force in nature.

Cincinnati is to have a fall festival and industrial exposition, to be held in Music Hall, exposition buildings and Washington Park on August 28th to September 22d. The Cincinnati Fall Festival Association Company, of which Otto Armleder is president, has issued a very handsome souvenir booklet which gives an outline of the various attractions. Among other things, there will be a comprehensive electrical show, open to everything pertaining to the use of electricity.

The Bliss Electric Car Lighting Company of Milwaukee, Wis., has issued a new bulletin (No. 30) on the Bliss system for electrically lighting railroad cars. This system is a belt-driven one, equipped with a form-three car generator. Twenty-five distinctive advantages of the system are first enumerated, after which follows a complete illustrated description of the equipment in all its details. The first experimental equipment was installed in 1899 and is still in operation.

The new volume of the Proceedings of the American Institute of Electrical Engineers for 1904 is an imposing book containing 846 pages. It contains all the papers and discussions at the New York and Chicago meetings and also at the annual convention in St. Louis. As a frontispiece there is a fine portrait of Mr. Bion J. Arnold, who was president of the association during 1903-4. The book as a whole contains a varied and valuable assortment of papers upon nearly every branch of the electrical industry and is an important addition to any library.

A very neat example of central-station advertising literature for the education of the public in things pertaining to electric light is the booklet issued by the Columbus (Ohio) Railway and Light Company, entitled "Edison Light, Right Light." The booklet sets forth in a non-technical manner the advantages of "right light" and something about the company and its facilities for producing this valuable commodity. It makes interesting reading which will demand the attention of those into whose hands it may fall. The booklet was prepared for the lighting company by the C. W. Lee Company of Newark, N. J.

SOCIETIES AND SCHOOLS.

The Massachusetts Institute of Technology offers summer instruction during the months of June and July, supplementing the work of the regular school year. Persons other than students are admitted to the courses if they possess the necessary qualifications. H. W. Tyler of Boston, secretary of the Institute, can give further information.

MISCELLANEOUS

Electric power for the Shinn tunnel near Granite, Colo., is being planned, the power to be developed from Pine Creek, about four miles below Granite. The waterpower is sufficient, it is said, to furnish current for other purposes besides the operation of the tunnel.

It is said that the real inventor of the induction coil was the Rev. Dr. Callan, professor of physics at Maynooth College, Ireland, and not Ruhmkorff, as is generally supposed. The invention dates back to the years 1836-37, and was for some time known by the name of Callan's coil. But Mr. Ruhmkorff, a Parisian maker of philosophical apparatus, manufactured a large number for sale and put them on the market in a highly finished form, for which reason the invention came to be called Ruhmkorff's coil.

The El Paso (Tex.) Herald tells the story of John Humphries, an American, who has just arrived in El Paso a physical wreck, after a 12-year confinement in a Mexican prison at Torreon. Mr. Humphries, employed by the Torreon Electric Railroad and Power Company in 1890, put on an extra voltage beyond what the company was permitted to carry, and a broken wire which fell to the street resulted in the death of four men. Humphries was arraigned and sent to the jail, where he lingered in solitary confinement. This was in 1894. His story of prison life is one of misery. The greater part of the time he says that he was without clothes and was compelled to sleep on the floor. He suffered sickness without the care of a doctor. He is being treated in the County Hospital at El Paso.

The Concrete Pole Company of Winnipeg, Man., recently completed the erection of a massive concrete pole to carry wires over the old Weland Canal. This pole is 150 feet in height, 11 inches square at the top, 31 inches at the bottom, and weighs 45 tons. It is designed to stand a horizontal pull at the top of 2,000 pounds, in addition to the wind pressure.

Prof. Frank A. Perret of New York had the opportunity of studying the volcanic disturbances at the recent eruption of Vesuvius with Prof. Matteucci. The action of the volcano as described by Prof. Perret was truly terrifying. The roaring was terrific and the volcano operated like a fountain, the main jet rising high in the air. Among the most terrifying of the phenomena were the electrical storms. "The claps of thunder were incessant, with a lurid play of lighting. The cause of the phenomena was friction from the ascending particles generating electricity, which displayed itself in incessant lightning and thunder claps."

TRADE NEWS

The A. Riemann Electric Company of St. Louis, Mo., has been incorporated with a capital stock of $5,000.

The Union Warehouse and Electric Company of Bay City, Texas, has been incorporated with a capital stock of $20,000.

The Joplin Electric Supply and Construction Company of Joplin, Mo., has succeeded to the business of the Electric Supply and Construction Company.

Sealed proposals will be received May 1, 1906, and then publicly opened for furnishing and installing lighting fixtures for buildings for the Army War College. Information on application. John Stephen Sewell, captain engineers, Washington Barracks, D. C.

The Menominee Electrical Manufacturing Company is about to begin work on the construction of its new plant in Menominee, Mich. The company's plant in Marinette has been running overtime to get the large number of orders reduced by the time of the removal this fall.

G. M. Gest of Cincinnati and New York, the expert subway contractor, has obtained control of the Rundle patented graphic chart system for recording underground and overhead-cable data. This system of charts has been adopted by the largest conduit users in the United States.

Joseph L. Berwanger and Robert Murray have formed a partnership to engage in the electrical business in Loganspori, Ind. They have leased a room at 322 Pearl Street and are prepared to do all kinds of wiring and repairs and will also carry a complete line of supplies and fixtures.

The Westinghouse Machine Company on April 11th in the United States Circuit Court for the District of New Jersey commenced another suit against the Allis-Chalmers Company, alleging infringement of turbine patent No. 788,830. This patent relates to the construction of the rotating element of the turbine.

Among the new electrical manufacturing companies recently incorporated are the Fox-Borden Manufacturing Company of New York, N. Y.; capital, $30,000; incorporators, F. Fox, F. M. Fox, New Rochelle, N. Y., and C. H. Borden, Stamford, Conn., and the Markle Electric Company of Terre Haute, Ind., capital stock $5,000; incorporators, A. R. Markle, E. L. Cooper and G. Gunderson.

C. A. Becker and A. C. Becker, comprising the firm of Becker Brothers, electrical contractors, at 367 Homer Street, Chicago, announce that they are prepared to take contracts for electrical installations of all kinds from house wiring to complete installations of lighting plants. These gentlemen have a wide practical and theoretical experience in their line and have the energy and ability to assure their patrons satisfactory results.

The new tariff for Argentina provides, among others, for the assessment of the following rates of duty: Carbons for arc lamps, 35 per cent. ad valorem; metallic wire or cables exceeding five millimeters in diameter for electricity, and all accessories for the installation of underground cables, five per cent. ad valorem; machines for installing public electric-lighting plants, and motors, five per cent. ad valorem; electric-railway appliances of all kinds, free.

Formation of the Pfannmueller Engineering Company of Chicago, incorporated to do a general engineering and contracting business, has been announced. The officers are: President, F. E. Pfannmueller; vice-president and consulting engineer, S. D. Boynton, M. E., and secretary and treasurer, E. M. Mills. The company will make a specialty of designing and installing complete power plants. The principal offices will be at suite 1134 First National Bank Building, Chicago, Ill.

The Marlboro Equipment Company has been incorporated in Marlboro, Mass., for the purpose of importing and exporting electrical goods. The capitalization is $3,000. Julius P. Watson of Concord

is president, Herbert Smith of Concord treasurer and clerk, and Eugene W. Godfrey, the remaining member of the board of directors.

Viele, Cooper & Blackwell of 49 Wall Street, New York city, is the name of a firm formed to carry on business as mechanical, electrical and hydraulic engineers and to do general contracting. The capital is $1,500,000. The directors are Maurice A. Viele of New York, Hugh L. Cooper of Stamford, Conn., and Francis O. Blackwell of Englewood, N. J.

The Westinghouse interests in Europe have formed an alliance with the Italian company headed by Dr. Finzi, and the new company, of which Dr Giorgio Finzi is director, is called the Electro Railways Works (limited) Company, with headquarters in Milan. The patents used in the single-phase system in Italy will be called the Westinghouse-Finzi patents. The Electro Railways Works Company will look after the installation and exploitation of the single-phase system in Italy under the patents of both Dr. Finzi and the Westinghouse interests.

The erecting department of the Westinghouse Electric and Manufacturing Company for Manhattan Borough, which, until recently, was located on the nineteenth floor of the Trinity Building, has been moved to the Fuller Building, corner of Twenty-third Street and Broadway. This change was made necessary because the department was in want of more space than it was possible to obtain at 111 Broadway, and also because the uptown location is more suitable and convenient for the construction work, most of the power plants being located within easy-reaching distance.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until May 8th for furnishing the Naval Home at Philadelphia with its annual supplies of electrical material. The schedule, number 456, is obtainable at the [illegible] upon application [illegible]. Sealed proposals [illegible] for furnishing [illegible] grounds, Washington, D. C. [illegible] supplies during the [illegible] information can be obtained [illegible] Charles S. Bromwell, Washington, D. C.

The Wagner Electric Manufacturing Company, of St. Louis, has purchased [illegible] outside the city, for a new factory, [illegible] completely outgrown the present quarters. [illegible] is at Hillside Station, on the main line of the Wabash Railroad, about 1,000 feet [illegible] limits and about one quarter of a mile [illegible] of the suburban power house at De Hodiamont. The transportation features are excellent. It is hoped that the new factory buildings may be occupied very early next year. The new buildings will be one or two stories in height, with abundance of light and air. The designing engineers for the new factory are Bremicke & Day of St. Louis, with Dodge & Day of Philadelphia in consultation on the subject of industrial organization. An interesting feature of the new plans of the Wagner Company is the engaging of the services of a doctor, on an annual retainer, who will give his services to all employes injured in the service of the company, without charge to them. Dr. H. T. Wells has already been engaged as the company's physician.

BUSINESS.

The Ellsworth Coal Company of Ellsworth, Pa., is a recent purchaser of a new lot of Allis-Chalmers electrical machinery built at the company's works, Cincinnati. The new equipment will consist of a 500-kilowatt direct-current rotary converter, four 14-horsepower type N motors and four 7½-horsepower type B motors. Charles H. Besley & [illegible] [illegible] 000 kilowatts [illegible]

The H. W. Johns-Manville Company, through its Philadelphia branch, recently [illegible] season's largest contracts for [illegible] pipe covering in the plants of [illegible] Blenheim, and the [illegible] In the plant of the former all of the [illegible] water pipes are covered with [illegible] J-M [illegible], and all steam pipes with the [illegible] J-M 85 per cent magnesia covering. In the [illegible] the entire heating system is covered with J-M [illegible] ply asbestos air cell covering, and [illegible] work with 85 per cent magnesia. In the placing of these contracts none but manufacturers of the highest reputation was considered, and the H. W. Johns-Manville Company is pleased on securing these orders in the face of such keen competition. The company will send a neat and attractive booklet entitled "Pipe and Boiler Insulation" for the asking

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 10, 1906.

817,152. Apparatus for Nickel Plating. Jonas W. Aylsworth, East Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed September 17, 1904.

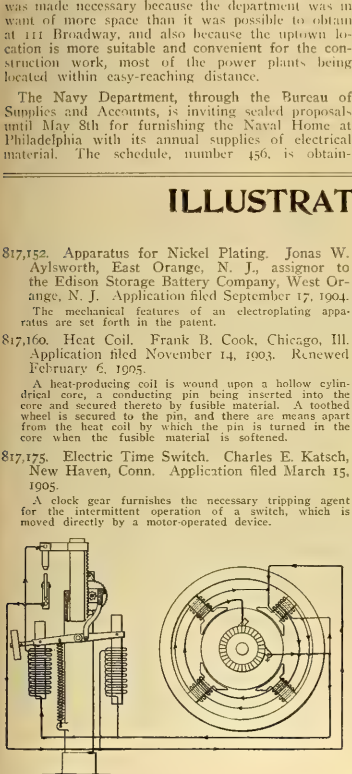
The mechanical features of an electroplating apparatus are set forth in the patent.

817,160. Heat Coil. Frank B. Cook, Chicago, Ill. Application filed November 14, 1903. Renewed February 6, 1905.

A heat-producing coil is wound upon a hollow cylindrical core, a conducting pin being inserted into the core and secured thereto by fusible material. A toothed wheel is secured to the pin, and there are means apart from the heat coil by which the pin is turned in the core when the fusible material is softened.

817,175. Electric Time Switch. Charles E. Katsch, New Haven, Conn. Application filed March 15, 1905.

A clock gear furnishes the necessary tripping agent for the intermittent operation of a switch, which is moved directly by a motor-operated device.



NO. 817,232.—ELECTRIC CIRCUIT REGULATOR.

817,210. Magnetic Friction Clutch. Harry A. Williams, Akron, Ohio, assignor to the Williams Electric Machine Company, Akron, Ohio. Application filed May 26, 1905.

A driving disk carries a magnetic coil and is associated with a driven disk, a pulley rigid therewith, an expansible ring connected with the driven disk, a lever and electrical connections whereby the ring is expanded by the lever.

817,212. Electric Furnace. Charles O. Wingren, Pasadena, Cal. Application filed August 21, 1905.

Combined with a metallic air-tight casing is a body portion and a removable cover secured thereto, the cover being provided with an upwardly extending dome and a portion of the top of the dome being transparent. Electrodes are insulated from and secured to the body. Resistance material is placed in the casing betwen the electrodes and the crucible in the resistance material between the electrodes.

817,222. Electric Switch. Harold E. Case, Bridgeport, Conn. Application filed March 24, 1904.

A contact for a knifeswitch comprises brushblades of unequal lengths, the lower end of the shorter blade having a seat for a contact wire. A chair formed of the longer blade is adapted to embrace the seat, while means secure the extreme lower end of the longest blade to the vertical body portion of both blades.

817,232. Regulation of Electric Circuits. Edgar A. Edwards, Cincinnati, Ohio, assignor to the Metropolitan Trust & Savings Bank, trustee. Application filed March 7, 1902. Renewed February 12, 1906.

A normally open constant-current circuit has a regulating magnet in shunt. A differentially wound dynamo supplies current to the circuit and means automatically close the circuit by current from the dynamo. (See cut.)

817,251. Automatic Stereopticon Apparatus. Marcus H. Killen, Chicago, Ill., assignor of one-half to Mark L. Killen. Application filed April 26, 1905.

Electromagnetic devices controlled by a clockwork mechanism operate to move the slides successively into position. Individual circuits control the opening and closing of the switch of the light circuit.

817,256. Electric Signaling for Trolley Railroads. Edward W. Lee, South Atlanta, Ga. Application filed January 31, 1905.

Two short copper strips are associated with two oval-shaped sides of a strip of wood fiber or other good insulation to form a circuit-maker and breaker. The device is placed on the under side of a short plank or block of insulation which will act as a watershed.

817,264. Electric Controlling Device for Cars. James H. K. McCollum, Toronto, Canada. Application filed March 1, 1905.

Combined with a brake lever and holdfast device and motor for controlling the device is an auxiliary controller provided with a finger and contact plate for throwing the current in and out of the motor.

817,281. Automatic Intercommunicating Train-reporting System. Elmer E. Steiner, Knightstown, Ind. Application filed July 14, 1905.

Two trolley wires for the signalling current run alongside the track, each train carrying a receiving instrument. Each train operates signals at certain points on the track as it passes by.

817,290. Electric-railway Switching Mechanism. Harry L. Young, Pueblo, Colo. Application filed October 5, 1905.

A trolley pole carries a main trolley mounted thereon. An auxiliary bridging trolley is in proximity to the main trolley and pivotally mounted on but insulated from the trolley pole, and an electromagnetic operating device is also mounted on the trolley pole and connected to the auxiliary bridging trolley.

817,293. Automatic Railroad Signal. James S. Anderson, Ames, Neb. Application filed December 26, 1905.

Details are described.

817,305. Electric Meter. Thomas Duncan, Lafayette, Ind. Application filed June 6, 1904.

An electric meter has a damping disk upon its spindle and a damping magnet in whose field the disk rotates, the damping magnet comprising a permanent magnet and an inclosing element of magnetic material establishing a portion of the main flux circuit parallel to the portion of the main flux circuit established by the permanent magnet. (See cut.)

817,322. Display Apparatus. Calvin Jackson, Reading, Pa., assignor to Howard J. Potts, Reading, Pa. Application filed May 31, 1905.

Electric incandescent lamps and their circuits play an important part in the apparatus.

817,320. Terminal or Coupling for Electric Cables. William Middleton and John Y. Middleton, Newcastle-upon-Tyne, England. Application filed June 5, 1905.

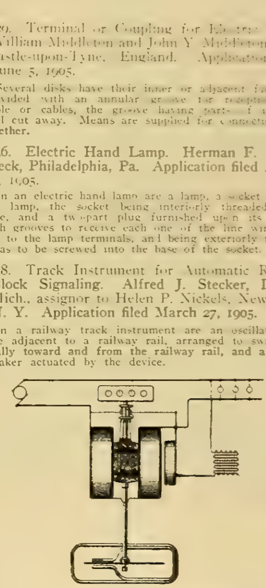
Several disks have their inner or adjacent faces each provided with an annular groove for reception of a cable or cables, the groove having parts of its outer wall cut away. Means are supplied for connecting disks together.

817,346. Electric Hand Lamp. Herman F. Stakelbeck, Philadelphia, Pa. Application filed August 9, 1905.

In an electric hand lamp are a lamp, a socket carrying the lamp, the socket being interiorly threaded at its base, and a two-part plug furnished upon its interior with grooves to receive each one of the line wires leading to the lamp terminals, and being exteriorly threaded so as to be screwed into the base of the socket.

817,348. Track Instrument for Automatic Railway Block Signaling. Alfred J. Stecker, Detroit, Mich., assignor to Helen P. Nickels, New York, N. Y. Application filed March 27, 1905.

In a railway track instrument are an oscillatory device adjacent to a railway rail, arranged to swing vertically toward and from the railway rail, and a circuit-breaker actuated by the device.



NO. 817,305.—ELECTRIC METER.

817,362. Automatic Time Circuit-breaker. Edmund T. Browning, Stockton, Cal., assignor of one-half to William E. Brown, Stockton, Cal. Application filed February 8, 1905.

The automatic feature is obtained through a clockwork mechanism.

817,366. Electric Switch for Electric-railroad Cars. Otto Frank and Peter J. McCaffrey, Brooklyn, N. Y. Application filed April 1, 1905.

The switch is controlled by pneumatic pressure, which actuates plungers in a piston. The admission of air to the cylinder is controlled by electrically operated valves.

817,389. Coin-controlled Telephone System. Egbert A. Reynolds, New York, N. Y., assignor to the Iron Telephone Company, New York, N. Y. Application filed August 10, 1904.

The subscriber's telephone instrument includes a coin receiver and a circuit-closer for closing the talking circuit in the line controlled by a coin received therein. Means are provided under the joint control of the central operator and the subscriber for expelling and returning the coin from the coin chute, the means included in one side only of the line.

817,390. Privacy Device and Busy Signal for Telephone Apparatus and Systems. Egbert A. Reynolds, New York, N. Y., assignor to the Iron Telephone Company, New York, N. Y. Application filed August 19, 1904.

Privacy apparatus for each instrument includes an electromagnet and means, operating when the line circuit is connected to the generator, for energizing the privacy device of any one instrument only with the attempted operation of its own instrument concurrently with another instrument.

817,392. Electric Time Switch. John E. Rogers, Elkhart, Ind. Application filed July 10, 1905.

Details are described.

817,396. Receptacle for Incandescent Electric Lamps. Albert P. Seymour, Syracuse, N. Y., assignor to Pass & Seymour, Solvay, N. Y. Application filed January 30, 1905.

The receptacle is provided with a porcelain cap having channels for the conductors. Wire terminals are fastened between the cap and body and fitting the channels. An outer lamp terminal is carried by the body of the receptacle.

817,399. Process of Magnetic Separation. Frederick T. Snyder, Oak Park, Ill., assignor to the International Separator Company, Chicago, Ill. Application filed December 20, 1902.

Magnetically separating ores is done by differentially reciprocating the ores within the influence of a magnet, periodically energizing and de-energizing the magnet, and maintaining synchronism between the reciprocations and the changes in the field of the magnet.

817,419. Process for the Electrolytic Manufacture of Metal Tubes. Otto Dieffenbach, Darmstadt, Germany. Application filed January 9, 1906.

Production of galvanic deposits is accomplished by mixing comminuted kieselguhr with a suitable electrolyte passing an electric current through the mixture and simultaneously producing a relative movement between the electrolyte and the cathode to dislodge the hydrogen bubbles and to smooth the metallic deposit by the action of the kieselguhr.

817,448. Poultry Appliance. Edward J. Shanahan, Tribes Hill, N. Y. Application filed July 7, 1905.

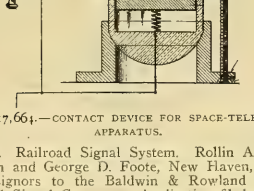
A device for preventing hens from eating eggs consists of a battery and transformer circuit. One secondary of the transformer enters a specially prepared egg receptacle and the other connects with a conducting plate on which the fowl stands but which is insulated from the egg receptacle.

817,449. Receptacle for Incandescent Electric Lamps. Albert P. Seymour, Syracuse, N. Y., assignor to Pass & Seymour, Solvay, N. Y. Application filed March 15, 1905.

Combined with a porcelain base are a porcelain cover substantially equal in length to the base and having marginal side walls to cover and protect the sides of the base, open insulating air channels between the walls and the base, wire terminals on the base, lamp terminals on the cover and metallic connections between the lamp terminals and the wire terminals, the metallic connections being adapted to secure the cover to the base.

817,457. Head Band or Support for Telephone Receivers. Kelley M. Turner, New York, N. Y. Application filed January 18, 1906.

A supporting band or holder for telephone receivers comprises a pair of curved spring sections pivoted together at their upper ends and a ring or fork adapted to receive and hold a telephone receiver and arranged to fold into the plane of the spring sections.



NO. 817,664.—CONTACT DEVICE FOR SPACE-TELEGRAPH APPARATUS.

817,463. Railroad Signal System. Rollin A. Baldwin and George D. Foote, New Haven, Conn., assignors to the Baldwin & Rowland Switch and Signal Company. Application filed August 10, 1905.

Essential features of the signal are a wheel or disk, a signal circuit arranged to be completed by movement of the wheel in either direction, a pair of operating magnets for moving the wheel in either direction, and a locking magnet for holding the wheel against rotation.

817,483. Electric Fuse-igniting Apparatus. James W. Howard, Connellsville, Pa., assignor to Howard Electric Blasting Machine Company, Connellsville, Pa. Application filed May 23, 1905.

A casing, a battery located therein, a key switch carried by the casing, connections for the line fuse wires also carried by the casing and an electric circuit including the battery, the connections and the switch are the essential features.

817,484. Insulating Screw Shell. Harvey Hubbell, Bridgeport, Conn. Application filed June 28, 1905.

A shell for receiving an incandescent lamp base is described.

817,497. Signal System. Joseph H. Lynch, Red Bank, N. J. Application filed October 25, 1905.

Automatic signal apparatus comprises a weight, bars adapted to project into the path of the weight, the bars being of different lengths, and means for closing electrical circuits by the descent of the weight.

817,498. Storage Battery. James R. Macmillan, Menomonie, Wis., assignor to the Northwestern Storage Battery Company, Chicago, Ill. Application filed April 1, 1905.

A storage-battery plate is composed of similar grid units firmly electrically connected only at their rims, of horizontal ribs for each unit and diagonally intersecting ribs for each unit, the ribs being quadrilateral and the upper and lower edges of the ribs of each unit being disposed in a common vertical plane. All of the ribs co-operate to form compartments for lodgment of active material, and thin webs extend from the edges of the ribs in the vertical planes.

817,555. Speed Indicator. Robert Hartmann-Kempf, Frankfort-on-the-Main, Germany, assignor to the firm of Hartmann & Braun A. G., Frankfort-on-the-Main, Germany. Application filed June 27, 1905.

Associated with a graduated scale are means for producing a continuous magnetic field, resonant bodies of magnetic material situated in the field and tuned to correspond with the scale, and means for displacing the lines of force of the field for the purpose of imparting periodic magnetic impulses to the resonant bodies.

817,593. Electric Water Heater. Frederic F. Shipp, St. Louis, Mo., assignor of one-half to James A. Howze, St. Louis, Mo. Application filed August 10, 1903.

A heat-radiating core is arranged in the interior of the apparatus which derives its heat from an electric current passing through a resistance wound on the core.

817,594. Electric Water Heater. Frederic F. Shipp, St. Louis, Mo., assignor to the Electrical Heating and Manufacturing Company, St. Louis, Mo. Application filed September 16, 1904.

Electrical water-heating apparatus comprises heat-radiating sections that are nonconductors of electricity and an electrical conductor coil wound throughout the sections, the sections being provided with notches at their ends, in which the folds of the coil are located.

817,597. Apparatus for Commuting Electric Currents Passing Through Lamps, etc. Campbell Smart, Swansea, England. Application filed September 19, 1904.

Switching mechanism for a combined arc-lamp and incandescent-lamp system includes means operating upon each alternate failure of current in the arc circuit to close the incandescent circuit. A controller is placed in the arc circuit.

817,606. Electric Brake. George R. Yancey, Louisville, Ky., assignor of one-fourth to William A. Keller and one-fourth to Karl Keller, Louisville, Ky. Application filed August 7, 1905.

Brake beams, an electric motor, a connection between the brake beams and the motor, including an elongated shaft, a shaft adapted to be rotated by hand, and a detachable connection between the two shafts are the essential parts.

817,642. Incandescent Lamp Cluster. Harvey Hubbell, Bridgeport, Conn. Application filed September 1, 1905.

A cluster for incandescent lamps made in two parts is composed of insulating material, each part having formed therein threaded half sockets which with the corresponding half sockets in the other part form sockets to receive the screw shells of incandescent lamps.

817,664. Contact Device. Andrew Plecher, Los Angeles, Cal., assignor to the Pacific Wireless Telegraph Company. Application filed December 27, 1904.

In a system of wireless telegraphy are a contact device comprising a tubular body of quartz glass having its ends suitably closed and the air exhausted therefrom, a silver rod in the tubular body electrically connected to the aerial line, a silver plate in the tubular body having an oxidized or sulphurized surface in contact with the rod, an iron base plate supporting the plate, a spring supporting the base plate, electrical connections connecting the spring to ground and a magnet exterior the glass body. (See cut.)

817,687. Magnetic Actuator. Daniel Bacon, Brooklyn, N. Y., assignor to the Magnetic Control Company, New York, N. Y. Application filed August 24, 1904.

A magnetic actuator comprises a driving shaft and a driven shaft, the shafts having telescoping concentric sleeves capable of independent rotation. A radial web extends from each of the sleeves and electromagnets are supported at the periphery of each of the radial webs, the pole-faces of the magnets upon each periphery being in noncontacting magnetic relation.

817,719. Electrical Circuit Controller. Harry W. Leonard, Bronxville, N. Y. Application filed November 30, 1901. Renewed December 20, 1904.

Combined with a rheostat are a separate switch, a device for causing a force to be suddenly applied at its full strength and thereby actuate the switch to either close or open the circuit, the switch and its operating device being capable of independent movement, and an arm on the rheostat contact lever for operating the actuating device.

817,720. Automatic Electric Circuit Controller. Harry W. Leonard, Bronxville, N. Y. Application filed January 26, 1903.

Automatic circuit-controlling apparatus consists of a resistance-controlling switch, a spring-actuated hammer arm, a locking device for holding the arm in its normal position and two electroresponsive devices arranged to release the arm under abnormal conditions to impart a blow to the switch and drive it to its starting position.

817,730. Electrical Friction Clutch. Harry A. Williams, Akron, Ohio. Application filed October 22, 1904.

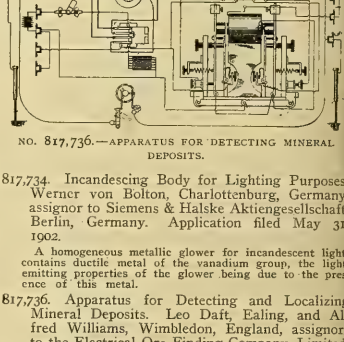
A shaft carrying a driving disk is provided with retaining blocks of nonmagnetic material. A series of recessed rings to engage the blocks, a pressure disk, a driven pulley carrying retaining blocks, a series of recessed rings engaging the blocks, the rings forming part of a magnetic flux, and electrical connections whereby the pressure disk brings the rings into frictional contact are the remaining parts.

817,732. Electric Incandescent Lamp. Werner von Bolton, Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Original application filed May 31, 1902. Divided and this application filed December 28, 1905.

An incandescing body for electric glow lamps consists of a homogeneous metallic wrought filament of tantalum.

817,733. Homogeneous Body of Highly Refractory Metals. Werner von Bolton, Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Original application filed January 5, 1904. Divided and this application filed September 29, 1905.

A metal derived from tantalum compounds and possessing the quality of being homogeneous and ductile is used as the basis of a lamp filament.



NO. 817,736.—APPARATUS FOR DETECTING MINERAL DEPOSITS.

817,734. Incandescing Body for Lighting Purposes. Werner von Bolton, Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Application filed May 31, 1902.

A homogeneous metallic glower for incandescent lights contains ductile metal of the vanadium group, the light-emitting properties of the glower being due to the presence of this metal.

817,736. Apparatus for Detecting and Localizing Mineral Deposits. Leo Daft, Ealing, and Alfred Williams, Wimbledon, England, assignors to the Electrical Ore Finding Company, Limited, London, England. Application filed October 14, 1902.

An apparatus for locating mineral deposits consists of a combination of a source of electricity, an inductor which is adapted to emit fluctuating electric impulses, two portable electrodes which are electrically connected, having the battery and inductor in series between them, and two other portable electrodes which are electrically connected. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on April 16, 1906:

401,270. Switch for Circuit Changer. William W. Griscom, Haverford College, Pa.

401,289. Secondary Battery. William Main, Brooklyn, N. Y.

401,290. Secondary Battery. William Main, Brooklyn, N. Y.

401,291. Process of Repairing Electrodes of Secondary Batteries. William Main, Brooklyn, N. Y.

401,296. Electrical Call Bell. Joseph G. Noyes, New York, N. Y.

401,317. Dynamo or Magneto-electric Machine. Ed. Weston, Newark, N. J.

401,322. Apparatus for the Application of Electricity to Propel Vehicles. F. Wynne, Westminster, County of Middlesex, England.

401,332. Automatic Cut-out for Secondary Batteries. S. C. C. Currie, Philadelphia, Pa.

401,334. Telegraphy. P. B. Delany, New York, N. Y.

401,343. Electric Wire Nail. C. A. Gildemeyer, Haddonfield, N. J.

401,348. Attachment for Electromagnetic Thermoscope. H. J. Haight, New York, N. Y.

401,366. Therapeutic Attachment for Galvanic Batteries. C. V. Osborn, Chicago, Ill.

401,405. Rheostat. N. Benardos, St. Petersburg, Russia.

401,417. Electric Lantern. C. W. Cox and T. E. Van Dyke, Philadelphia, Pa.

401,444. Incandescent Lamp. H. Lemp and M. J. Wightman, Hartford, Conn.

401,466. Secondary Battery. J. S. Sellon, Hatton Gardens, County of Middlesex, England.

401,472. Electric-railway Track Alarm. T. Taylor, Cedarville, Cal.

401,482. Electric Heating Apparatus for Railway Systems. M. W. Dewey, Syracuse, N. Y.

401,486. System of Electric Lighting. T. A. Edison, Menlo Park, N. J.

401,498. Wiring Structure for Electric Lighting. E. H. Johnson and E. T. Greenfield, New York, N. Y.

401,515. Underground Conduit for Electrical Railways. F. H. Reed, Jersey City, N. J.

401,526. Method of Operating Electromagnetic Motors. N. Tesla, New York, N. Y.

401,527. Cut-out for Incandescent Electric Lamps. E. R. Whitney, St. Johnsbury, Vt.

401,580. Method of Exhausting Electric-lamp Bulbs. J. W. Packard, New York, N. Y.

401,591. Electric Alarm Advance Car. H. Riesenberg, St. Louis, Mo.

401,606. Manufacture of Carbon Filaments. E. P. Thompson, Elizabeth, N. J.

401,607. Manufacture of Incandescing Carbon Filaments. E. P. Thompson, Elizabeth, N. J.

401,608. Distribution of Electric Currents. E. Thomson, Lynn, Mass.

401,616. System of Electric Locomotion. F. Wheeler, Meriden, Conn.

401,617. Electrical-measurement Apparatus. A. C. White, Boston, Mass.

401,631. Forming Curved Electrotypes. G. H. Benedict, Ellenville, and P. M. Furlong, Troy, N. Y.

401,632. Dynamo Armature. C. O. C. Billberg, Philadelphia, Pa.

401,639. Process of Electric Welding. C. L. Coffin, Detroit, Mich.

401,646. Incandescing Electric Lamp. T. A. Edison, Menlo Park, N. J.

401,668. Dynamo-electric Machine. E. Weston, Newark, N. J.

401,669. Dynamo-electric Machine. E. Weston, Newark, N. J.

401,682. Electrotherapeutic Spectacles. C. Brust, Schlossgasse, No. 62, Haidhausen, Munich, Germany.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVIII. CHICAGO, APRIL 28, 1906.

Art and Utility Combined in Italian Hydro-electric Plant.

The Brembo River hydro-electric power transmission development is one of the most important in Northern Italy. This interesting power plant was recently constructed by the Società Impresa Elettriche, Conti & Co. of Milan. The accompanying illustrations show the details of construction and the arrangement of the generators, turbines and transformers as well as the artistic decorative effects produced in this modern station.

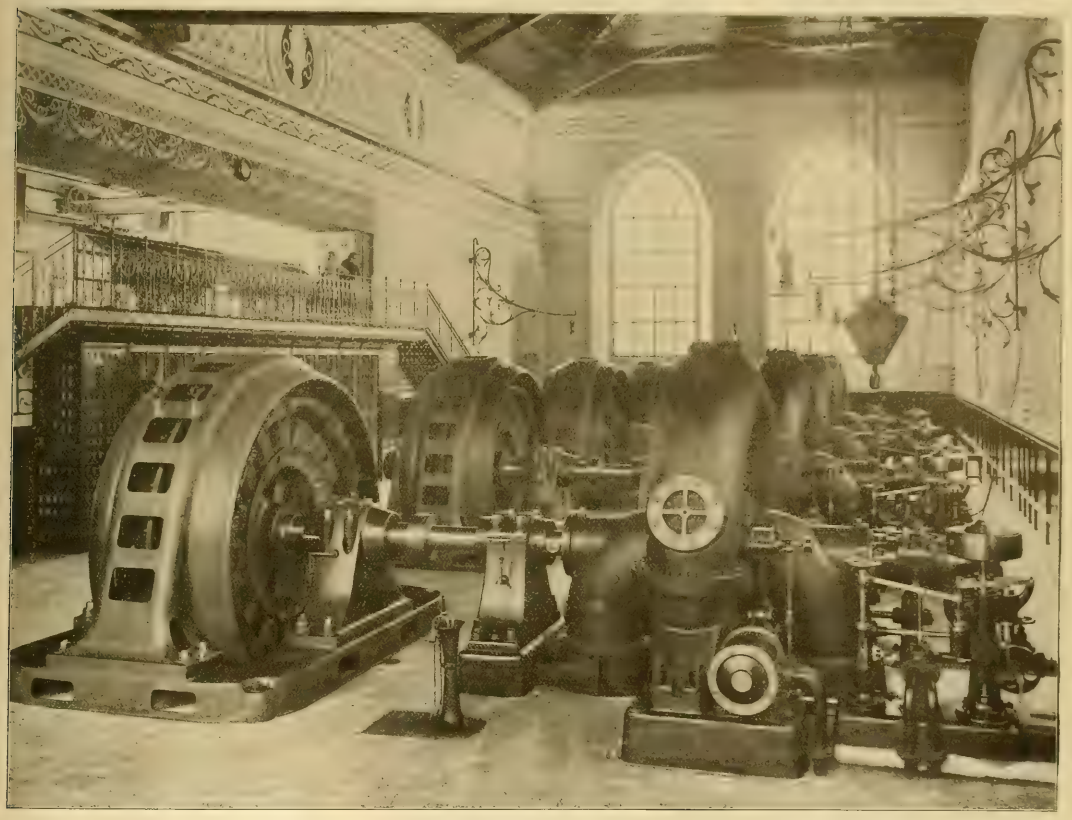


FIG. 1. HYDRO-ELECTRIC UNITS OF 2,000 HORSEPOWER EACH IN ITALIAN (BREMBO RIVER) POWER STATION.

There are four units installed in the generator and turbine room, as shown in Fig. 1, each having a capacity of 2,000 horsepower and operating under a head of about 55 meters. The turbines are of the Riva Monneret construction of the Francis type, with hydraulic servomotor regulation directly coupled to three-phase alternators, constructed at Milan by Gadda & Co., formerly Gadda & Brioschi, Finzi & Co. The current from this power station is raised from 2,750 volts, at which pressure it is generated, to 25,000 volts for transmission to the Monza district, where it is distributed throughout the Brianza section of the country and as far to the north of Italy as the Lecco-Erba power-transmission development. On the south the transmission lines conduct the current to Milan, where it is distributed by the power company, reaching as far in this direction as the transmission circuits of the Milan Società Edison.

There are three 600-kilowatt single-phase transformers in each of four sets, raising the pressure to 25,000 volts. They are of the air-blast type, the cooling air being supplied from motor-driven ventilating fans, as shown in Fig. 2. These transformers have an outer magnetic [illegible] to protect the main winding, the latter being [illegible] on the central core in vertical coils. The [illegible] supplied to the transformers from below through special conductors, and after passing through the coils and cooling them is carried out at the top of the transformer. These 12 single-phase transformers are all installed directly back of the high-tension panels and mounted on a concrete foundation. The 2,750-volt alternating current is supplied to these transformers from the main bus bars [illegible] forming the [illegible] and [illegible] alternators.

The power station is supplied from the River Brembo, which rises in the Orobian Alps. It has a hydrographical basin a considerable distance above the point where the power canal branches off, about 500 square kilometers in area. There is an abundance of water during most of the year, and it is practically constant on account of the many springs and lakes which are drained by this river. During the midsummer months and for a short period in midwinter there is a minimum flow, the difference, however, not being sufficient to be of serious moment.

As will be noted by the accompanying illustration (Fig. 3) of the exterior of the power house at Zogno, there are four main penstocks for operating the four Francis turbines of 2,000 horsepower each, and another smaller penstock for supplying water to the turbines driving the exciting generators. The water is supplied to the penstocks by a canal eight kilometers long, the total head being 58 meters at the plant.

Four turbines drive the rotors of the alternators directly coupled to the turbines.

In Fig. 4. There is another set of high-tension panels of 25,000 volts pressure facing toward the transformer sets, and the controlling board for both rooms is located underneath on an iron framework.

There are four panels for the four alternators, a central panel for the line ammeters and voltmeter, as well as panels for the different sets of transformers. The controlling mechanism for the 25,000-volt interrupters is mounted on six cast-iron columns, and at one end of the controlling switchboard is mounted the registering wattmeter, while at the other end is installed a switchboard for the two exciter sets.

The two exciter units consist of 150-horsepower turbines directly coupled to six-pole direct-current dynamos, each supplying 950 amperes at a pressure of 110 volts, these machines operating at a speed of 750 revolutions a minute. The current is conducted from these machines to the exciter panels and thence to the revolving fields of the alternators, which have a peripheral speed of 40 meters a second.

On account of the comparatively low tension

FIG. 2. STEP-UP TRANSFORMERS AND AIR-BLAST FANS IN ITALIAN HYDRO-ELECTRIC PLANT.

generated in the armatures of these machines, extra heavy insulation is not required, the open-gap armature type being utilized, having separately wound coils insulated throughout their length. It is stated that these coils are tested carefully before being placed in position, and are wound on frames and can be changed at a moment's notice without difficulty. The magnetic circuit is laminated within, forming a mechanically strong homogeneous ring, the projecting poles carrying boxes of copper sheets which are wound spirally, bronze pieces being used for bridging the spaces between the poles. The rotors of the alternators are coupled rigidly to the waterwheels, and the bearings are water-cooled and lubricated by an automatic system.

Current is conducted to the switchboard and transformers through three separate lead-covered cables, one being employed for each phase, and after passing oil switches enters the transformers of 1,800 kilowatts capacity. In order that overloads of short duration may not open the generator circuits, automatic circuit-breakers are employed having time relays, the retarding effect being obtained by a small safety fuse provided in parallel with the relay electromagnets. By this arrangement the electromagnets will not trip the circuit-breaker until the fuse has blown, and momentary overloads do not affect the continuous supply of current from the alternators.

Mount Vesuvius Eruption and Abandonment of Electric Railway.

By Frank C. Perkins.

The accompanying illustration shows the electric railway used up to the present time for conveying tourists to the crater of Mount Vesuvius, while the drawings show the details of construction of cars and electrical equipment. The eruption of Mount Vesuvius has become so dangerous that the electric railway has been abandoned, a portion of it having been destroyed, and streams of lava from the new craters have flowed for several miles, emitting terrific heat and threatening the surrounding towns, some of which have already been destroyed. The main stream of lava was several hundred feet wide and moved at the rate of 20 to 30 feet a minute.

Thousands of people have already lost their lives who escaped with the employes after passing the last night in darkness on account of the destruction of the electric lighting plant and gas works.

The electric railway around the mountain has been destroyed in several places as well as the funicular railway up the mountain side, portions of which have been entirely obliterated. Lava has been flowing several feet deep through the streets of Ottajano and many houses have fallen, while the villages Poggio, Marino and Somma, in addition to those mentioned above, have been abandoned.

FIG. 3. EXTERIOR OF ITALIAN (BREMBO RIVER) HYDRO-ELECTRIC STATION, SHOWING PENSTOCKS.

The earthquakes accompanying the eruption and the fire, smoke and ashes pouring from the craters were most terrifying to the unfortunate people of the towns along the railway, who stood watching the procession of crowded electric trolley cars carrying the people to Naples from Boscotrecase and Portici as well as the other places near the volcano. Thousands of refugees have reached Castellamaria and others hurried overland in the direction of Caserta, while the vessel Princess Mafelda left the Island of Capri with a large number of passengers, but was unable to reach its destination on account of the gases, ashes and stifling fumes, which enveloped it about a mile from the coast.

The whole cone of the volcano has been blown away, the summit being nearly 250 meters lower than it was before the eruption, while the outline of Mount Vesuvius has been altered to a large extent.

The volcano has been more or less active during the last year, many eruptions having taken place during the winter just past, presenting most interesting spectacles, particularly at night. The accompanying illustration was obtained by the writer during a visit in January, 1906. On the 24th of that month a blinding snowstorm was raging on the summit of the volcano, while the weather was most beautiful in the valley, with flowers in blossom and the orange trees hanging heavily with fruit. Explosions were accompanied by clouds of smoke and three streams of flowing lava threatened on this date to cut the route of

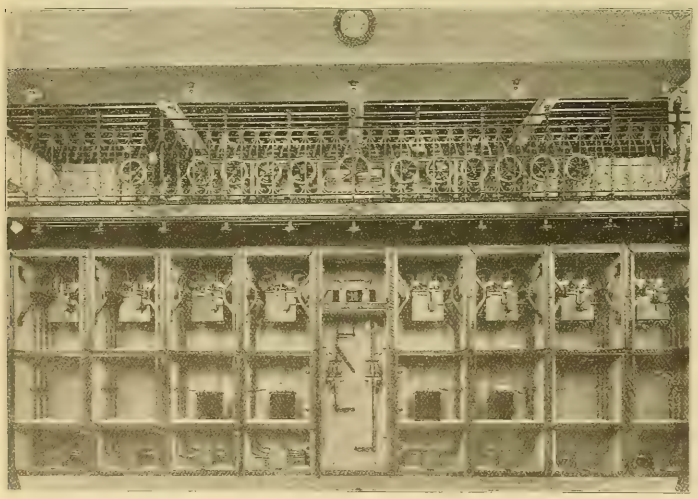
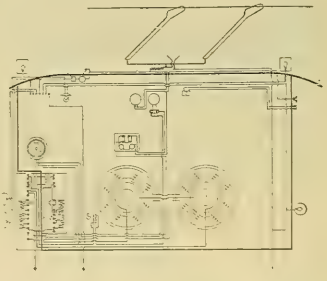


FIG. 4. SWITCHBOARD GALLERY IN ITALIAN (BREMBO RIVER) HYDRO-ELECTRIC STATION.



ELECTRIC CONNECTIONS OF MOUNT VESUVIUS ELECTRIC RACK-RAILWAY LOCOMOTIVE.

The number of hydro-electric plants in Northern Italy is rapidly increasing, and it is generally conceded that in a very short time Italy's "white coal" will be operating not only most of its shops and factories but also the main railway lines in that section of the country.

and there has been terrible devastation to the coast as well as the inland towns. Ottajano has a population of 20,000 people and Torre del Greco has a population of 30,000. Hot ashes and sand as well as cinders and molten lava are thrown to a height of several thousand feet, ruining the homes, gardens, vineyards and orchards in the vicinity of the volcano. Torre Annunziata, on the shores of the Gulf of Naples, one mile to the southward, as well as San Giorgia, Portici, Resina and Cremona, have been abandoned.

The electric railway passes the Royal Observatory, 2,000 feet above the level of the sea, which was in charge of the director, Signor Matteucci.

Robert Smith of Grand Rapids, Mich., has obtained a patent on an electric hammer for use in lettering in marble works. The inventor says that his device does away with the necessity of an air compressor and engine, and incidentally an expense of $600 in equipment. It is also asserted that it avoids the jar now incident to the machine lettering in marble works.

the electric railway. Lava was pouring from the crevice on the northwest side and dividing itself into three streams, while the rumbling below one's feet made manifest the internal activity, although it seemed to cause no apprehension to those operating the electric lines or the inhabitants living on the sides of the volcano. The until recently was one of the most interesting trips taken by the tourist, the jaunt from Naples to the top of Mount Vesuvius being taken with ease and comparative safety by the aid of electric power, and affording experiences unique in attractiveness and excitement.

Three different systems of electric traction were heretofore employed in conveying the traveler from Naples to the crater of the volcano. As far as Pugliano the journey was taken by means of ordinary electric cars or trams used in Italian cities, and from this point to the top of Vesuvius one portion is of rack and pinion construction, another is of ordinary adhesion traction, while the last section which passes up the steep side of lava deposit to a point 1,181.26 meters above sea level is a cable road. The cable road was constructed two decades ago for the highest section of the Mount Vesuvius Electric Railway.

The electric line from Naples passes through the Strada di Chiaja, showing the Italian city street life as well as the suburban life of the San Giovanni and Portici, and giving one a fine view of the Bay of Naples.

It began at the northern quarter of Resina, running through a most interesting cultivated section, with vineyards, orchards and gardens on every side, to the Royal Observatory, which was nearly

MAP SHOWING MOUNT VESUVIUS AND SURROUNDINGS

between Pugliano and the lower station of the cable road, has an electric-generating station provided at the foot of the rack and pinion section 249.6 meters above the sea level. The power sta

at a speed of 700 revolutions a minute. These electric generators supplied a current at 1,[illegible] volts at a normal pressure of 250 volts for operating the electric cars, the [illegible] and the electric rope railway of Mount Vesuvius.

This power station has been destroyed by the recent eruption, which also destroyed the observatory.

The electric locomotives used on the rack railway and the overhead electric construction of the Mount Vesuvius Railway were supplied by Brown, Boveri & Co. of Baden, Switzerland. On this electric locomotive two motors, each having a capacity of 85 horsepower, are used, and they operate at a speed of 700 revolutions per minute and are of the four-pole type, the magnets having a diameter of 235 millimeters. The armatures of these machines each has a diameter of 450 millimeters with 53 slots. The commutator in each case has 105 segments.

The rack locomotive weighs somewhat over 30 tons and operates at a speed of from six to eight kilometers an hour, drawing a load of more than 10 tons. The locomotive is provided with emergency as well as hand brakes, together with automatic brakes, which are so arranged that the current is also shut off when the speed exceeds the limit decided upon.

As before mentioned, the highest section of the Mount Vesuvius Electric Railway was a cable road which was constructed 23 years ago, since which it has carried many tourists to the top of the cone, or to within several hundred feet of the crater of the volcano.

It will be noted that the cable line begins at a point 793.6 meters above sea level and rises to a height of 1,181.26 meters, with grades varying from

ELECTRIC MOTOR CAR ON MOUNT VESUVIUS RAILWAY.

2,000 feet above sea level. On the last portion of this section, where the train ascended the slope of Mount Cateroni, an electric locomotive was required for pushing the electric cars up the rack railway from the generating station at the foot of the mountain.

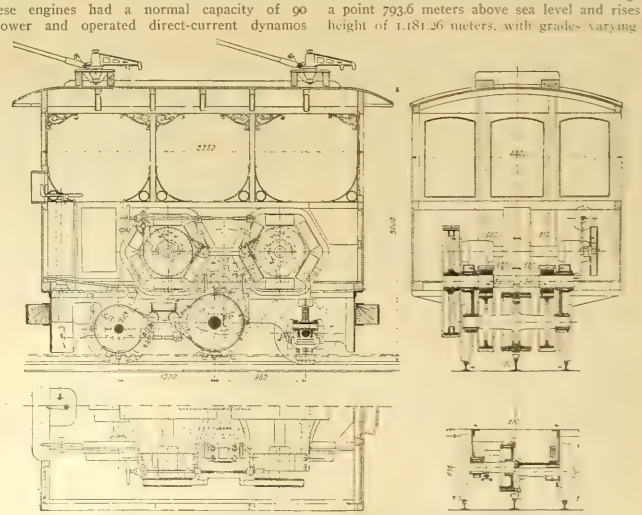
The track construction is of the Strub system, which is similar to the Jungfrau Mountain Electric Railway. At a point 793.6 meters above the sea level the cable line begins and rises to a height of 1,181.26 meters, with grades varying from 35 to 65 per cent. The cable cars each carried 21 persons.

It is stated about 15,000 persons were carried to the top of this cable line each year, the larger numbers during the months of March and April, the average being for these months more than 2,000 passengers.

On this trip as soon as the Hermitage was reached the electric locomotive was removed, as this was the end of the cog section; and the electric cars carried the passengers by their own power past the Royal Observatory to the foot of the cone where the funicular railway station is located. The scene changed as the mount was ascended from the beautiful gardens to the barren desert; and in the few minutes required for passing up the cable road to within a few hundred feet of the crater, which was finally reached by foot, dark brown lava was noted on every side, frequently colored pink and green by the rays of the sun. The great cone of ashes was seen above the mountain of lava, over which rose a black column of smoke. The field of solidified lava spread out in most curious and fantastic formations.

The Mount Vesuvius Electric Railway, operating

tion was provided with two gas engines, constructed by the Schweizerischen Lokomotiv und Maschinenfabrik of Winterthur, Switzerland. Each of these engines had a normal capacity of 90 horsepower and operated direct-current dynamos



RACK AND PINION LOCOMOTIVE ON MOUNT VESUVIUS ELECTRIC RAILWAY.

35 to 65 per cent. The cable cars each carry 21 persons and are provided with hand brakes as well as complete equipment of automatic brakes for both sets of wheels.

On the Vesuvius railway the electric cars each weighs somewhat less than nine tons and are provided with single trucks having two axles, the wheel base measuring 2.1 meters. Three compartments are provided for each car, which seats eight passengers.

It may be stated that the rack-and-pinion section of the road has much higher grades than the adhesion section, the latter not exceeding eight per cent., while the maximum for the former is about 25 per cent. The rails are fastened to wooden ties, the gauge being about 40 inches. The rack rail is located in the center between the running rails. The total length of the electrically operated sections is nearly five miles, and the trip over these portions of the road under ordinary circumstances takes about 50 minutes.

At Pugliano the station is 97.17 meters above the sea level and is 1,550 meters from Sanvito, which stands 179.6 meters above the sea level. The distance from Sanvito to the central power station, which is at Mount Cateroni, is 1,705 meters. The total cost of the Mount Vesuvius Electric Railway, including the cars, track construction and power house, was about $250,000, or somewhat over $50,000 a mile. The cost of repairs is very high, especially on the upper section of this railway, where deposits of lava have given considerable trouble.

The rack and-pinion section of the road is 1,641 meters long. The total distance from the Royal Observatory to the funicular station is 2,695.5 meters, which makes a total length of electric railway of nearly five miles, and the trip over this section of the road takes less than one hour. The central power station was constructed so that the capacity could be increased by installing an additional gas engine and generator. The engine room measures 17 meters in length and 14.5 in width, and the gas generator room measures 10.2 meters in width and 14.2 meters in length. The storage battery room has a width of seven meters and a length of 12.5 meters, while a car barn has been provided in the same building for the electric locomotive and motor cars with double tracks, having a capacity for six cars.

In conclusion, it may be remarked that the Rome correspondent of the London Chronicle says that Professor Matteucci complains that the electric railway almost annihilated the value of his scientific observations on Vesuvius during the eruption, the current affecting his delicate instruments. He intends to oppose vigorously the rebuilding of the line, according to the same authority. If this statement is correct, it will be interesting to know why the operation of the electric railway interfered with the scientific observations during the eruption more than at other times. But possibly the professor was always opposed to the electric line, and now that it is partially destroyed he means to prevent its rebuilding, if possible, in the interest of science. But no doubt the traveling public will look at the situation in an entirely different light.

Program of Southwestern Gas and Electrical Convention.

At a meeting of the executive committee of the Southwestern Gas and Electrical Association held at Houston, Tex., April 19th the programme for the state convention to be held in Galveston, May 16th, 17th and 18th, was arranged.

On May 16th, besides the regular order of business, the question box will be discussed and the following papers read: "Up-to-date Methods of Increasing the Business of Public-service Corporations," by G. C. Gum; "Extracts from a Letter from Frederick Egner on Retort-house Practices."

On May 17th three papers will be presented besides the discussion of the question box. They are: "What Is Electricity?" by S. J. H. White; "Relations of Public-service Employes to the Public," by Frank J. Duffy; "Care, Maintenance and Inspection of Street-railway Rolling Stocks," by H. S. Cooper.

Immediately after adjournment a visit to the seawall, the grade-raising dredges and grade-raising operations will be made. Later in the evening the Sons of Jove will give a public "grand rejuvenation."

May 18th there will be given a paper on "Telephone Engineering Problems," by F. W. Yenson, followed by "Organization and Operation of Purchasing and Supply Departments," by A. W. G. Birtwell, after which there will be reports of officers and election of new officers.

IOWA ELECTRICAL ASSOCIATION.

Des Moines was once more the scene of one of the conventions of the Iowa Electrical Association, which have always resulted in so much profit to its members. Conventions of this association have been marked by one thing in particular, and that is the attendance of a large number of central-station men who come to learn things, and whose interest in their association is proverbial. The convention was held in the Kirkwood Hotel on April 18th and 19th, and at this place was also held the annual convention of the Iowa Street and Interurban Railway Association on the 19th and 20th, so that the headquarters of the two conventions for the three days were highly "saturated" with ideas electrical The supply men were also there with their exhibits, and between sessions their quarters were thronged The universal opinion among these gentlemen is that at the state conventions, especially in the western states, more interest is excited in the new things to be offered by the trade than at any other gatherings of this nature where exhibits are made.

President Austin Burt of the Iowa Electrical Association called the first meeting of that body to order Wednesday morning, and introduced Mr. Milo Ward, one of Des Moines' leading citizens, who gracefully welcomed the members of the association to the city. He said among other things that the Iowa Electrical Association represents a class of men, who, in the part they have taken in the general development of the industries today, have made themselves the observed of all observers.

After Mr. Ward had concluded his remarks President Burt suggested that suitable resolutions be adopted in relation to the death of Mr. Robert H. MacMullan, general manager of the Des Moines Edison Light Company. Mr. L. D. Mathes moved that suitable resolutions be made a part of the minutes. President Burt then read his address, which was short but to the point. He said that the association can be of more help to its members than any other one thing of which he has knowledge. The regulation of rates is one of the most important considerations which can take the attention of the members, and he believed that a great deal could be done in this direction by following carefully the things which are taken up by the State Legislature relative to the central-station business.

Iowa Central-station Statistics.

Secretary G. S. Carson of Iowa City next read his report. As secretary of the association he corresponded with 130 companies representing electric-lighting plants throughout the state other than municipal plants. From these he received 82 replies, of which 77 contained data which he desired to put before the association. Of the 77 companies the total paid-up capital stock is $3,679,525; the total bonded debt, $2,495,100; total investment, $6,174,625; total interest on bonds, $130,290; total dividend on capital stock, $108,837. Eight companies with a capital of $129,000 earn 10 per cent.; 13 with a total of $250,175 earn eight per cent.; 10 with a total of $323,500 earn six per cent.; five with a total of $671,000 earn five per cent.; two with a total $26,000 earn four per cent.; two with a total of $255,000 earn three per cent.; two with a total of $165,000 earn two per cent., and 25 companies with $1,704,800 total capital earn nothing at all.

Other Business of Opening Session.

The report of Treasurer W. A. Mall, Belle Plaine, was next in order, but Mr. Mall had not had the opportunity to prepare his report, which was read later, on Thursday afternoon. The report showed the financial affairs to be in a healthy condition. At this time Mr. Carson presented to the association a fine Crosby steam indicator, which is to be for the free use of the members. It is hoped that this will be the beginning of a comprehensive collection of instruments of this sort. Many of the small companies do not feel able to invest in expensive apparatus of this nature, and if the association at a future time should be in a position to loan them such instruments as they need it would be of great help. Mr. Mall was thanked by the association in a fitting manner for his gift.

A. W. ZAHM, PRESIDENT IOWA ELECTRICAL ASSOCIATION.

Next in order on Wednesday morning after the treasurer's report came the report of the executive committee, followed by reports of special committees. Mr. Mathes in his report of the publication committee showed that the proceeds from the publication of the Iowa Electrical Association Proceedings had considerably more than paid expenses, and he was given a special vote of thanks for his efficient services.

A nominating committee was then elected, consisting of the following-named gentlemen: S. C. Green of Webster City, D. F. McGee of Red Oak, G. S. Carson of Iowa City, Austin Burt of Waterloo and L. D. Mathes of Dubuque.

The first paper on the programme was by J. R. Cravath of Chicago, and was a report on the electrical progress during the last year. Mr. Cravath said that the interest which has been taken in central-station business getting has been the most notable advance during the year. He pointed out that the organization of the new-business departments, especially among the smaller plants, is not what it should be. He also mentioned the good work being done by the Co-operative Electrical Association. Another thing noticeable is the increasing number of small single-phase systems supplying a number of small towns in a single neighborhood. Such lines, costing from $225 to $325 complete a mile, are now of quite common occurrence. This paper

DELEGATES TO THE IOWA CONVENTIONS AS GUESTS OF THE INTER URBAN RAILWAY COMPANY.

elicited some discussion in regard to the use of small current consuming devices. D. F. McGee of Red Oak wished to learn something of the cost of maintenance of electric flatirons. A. W. Zahm said from his experience this was excessive $5 apiece a year for those of his company. Many of his, however, are of the earlier types, and the new irons now on the market are practically unburnable. F. L. White had only one iron in service (120 volt direct current). It had been in operation for five years and the coil had only been renewed once, that time owing to excessive voltage. Out of 160 irons reported by Mr. Mathes only one had ever burned out.

D. F. McGee, chairman of the committee on "Facts and Factors," was to have reported at this time, but he said that the data that he required had not been freely given by the central stations and he did not have enough to make a proper presentation. He said there seemed to be a hesitancy on the part of central-station managers to reveal the true inwardness of the affairs of their companies. It is very important the facts on the operation of the various plants be obtained, however, and for this reason the committee was continued, the members promising to do all in their power to aid in the work.

In relation to this G. Lundgren remarked that the importance of records on the operation of each and every plant cannot be overestimated. The plant

the manager of [illegible] business. [illegible] manager [illegible] well [illegible] The [illegible] much [illegible] complished by an [illegible] ticular neighborhood. [illegible] who is known to be [illegible] Begin with showing him [illegible] friend him, perhaps install some new [illegible] vice in his place free of charge [illegible] will not let him know you have an axe to grind. He will talk for the central station at every opportunity and will do a world of good in [illegible] new business, because he is a disinterested party, and they are the ones that make the people believe more of the good things about electric light and power than any number of the company's own solicitors. His knowledge of chemistry will go a long way toward discrediting gasoline apparatus.

Another thing which helps out greatly is for the station to try to cut down a customer's light and power bills wherever possible by making advantageous arrangements of his apparatus, especially in the case of the poorer customers. It makes a friend of the customer instead of making him think he is being crushed by a soulless corporation.

Discussing this paper, Mr. Carson said he

[illegible] building [illegible] We [illegible] We [illegible] during [illegible] We [illegible] with [illegible] year that we [illegible] increased about 25 per cent. [illegible] advanced 15 per cent. [illegible] business and increase in price [illegible] for last year was only 10 per cent. greater than it

DELEGATES AND VISITORS AT IOWA ELECTRICAL CONVENTIONS IN DES MOINES LAST WEEK.

which he operates is a small one, but great care is taken to weigh the coal, measure the water and to measure the current produced at the switchboard, and it is a source of great satisfaction as well as a means of effecting a great saving to be able to ascertain at any time just what the cost of production is. Mr. Carson concurred in this opinion, as did also Prof. W. H. Grover of Ames, Iowa. The latter said that crude instruments are generally all that is necessary to show up the weak points of a plant that has never been under the searchlight of a thorough investigation.

Ways and Means of Increasing Business.

Ways and means of increasing business in towns under 5,000 was the subject upon which several members were expected to contribute. The names down for this subject were W. S. Mead of Parkersburg, O. E. Brownell of Lake City, Joseph Hutchinson of Manchester and Thomas Ferris of Osage. Mr. Brownell was the only one contributing a written paper to this general subject. He laid more stress upon uninterrupted service as a factor in retaining the good-will of customers than any other one thing. He encourages his customers to report local trouble wherever it occurs, which helps much to settle any little difficulties in the service, which if let go might lead to serious dissatisfaction. To insure a continuous service care should be taken to store sufficient coal to tide over any unforeseen difficulty. The railroads are, he believes, a sure barometer of the coal situation. When they commence to lay in a big supply the central-station man will be wise in doing likewise. Another thing—let the people always believe that

thought the last point brought out a particularly good one. This is one of the ways to turn aside the talk of municipal ownership. Mr. McGee did not believe the advertising and soliciting concerns offering to get business for central stations are of much use. The company's own men should be the ones to do this.

The paper by Frank B. Rae, Jr., on this general subject was read by the secretary, Mr. Rae not being present. The paper was entitled "Modern Advertising Methods" and appears elsewhere in this issue.

Steam plant Operation.

Two papers relative to the steam end of central-station practice were on the programme Wednesday afternoon. One of these was upon the subject of the "Effect of Boiler Compounds on Engine Lubrication," by L. W. Gill of Manchester. Mr. Gill was not present, however, so the subject was discussed in a general way by the members. W. J. Greene said that he had had considerable trouble with the use of soda ash, which acted injuriously when coming in contact with the cylinder oil. Mr. Brownell said that they got around that by using a heavier grade of oil. President Burt asked for information on the percentage of the cost of cylinder oil to coal bill. I. A. Innes said about one per cent. Other members having no steam-heating plant in connection said about one-half of one per cent. Mr. Burt was of the opinion that it was usually about five or six per cent. Messrs. Greene and McGee found, respectively, 1½ and one per cent.

Treasurer W. A. Mall of Belle Plaine next read a short paper on the "Economy of a Condensing

was before we used the condenser. We are well satisfied with our plant."

Relative to the condenser question, President Burt wanted to know how many among the members of the association used condensers in their plants, and it was ascertained that only four were doing this. A. W. Zahm has a condenser installed, using the steam pumps of the heating system of his plant as circulating pumps in the summer time to supply circulation for his condensers by simply cross connecting.

Effect of Day Load on Station Economy

Station economy as affected by day load was the next subject for discussion, J. P. Jones of Cedar Falls, F. H. Richardson of Boone, W. J. Greene of Cedar Rapids, and C. H. Walsh of Burlington being down for papers on this subject.

Mr. Jones had gathered some data on this subject, part of which had unfortunately been lost in a fire which occurred in his plant. Some of this, however, was available. Between the hours of seven a. m. and six p. m. in April, 1905, the load on his station was 150 kilowatts; in October, 1905, 170 kilowatts, and for one-half of November, 250 kilowatts. The questions bearing on the profitable operation of a day load were these: How long would the banked fires suffice to run the station; what would be the cost of oil waste, etc.; the cost of coal, and the item of salaries? Taking these items all into consideration, it was found by the figures given by Mr Jones that a day load could be carried with profit in a station the size of his.

Mr. Greene gave some figures on the operation

[Continued on page 350.]

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CONTENTS OF THIS NUMBER.

Art and Utility Combined in Italian Hydro-electric Plant. Illustrated 331, 332
Mount Vesuvius Eruption and Abandonment of Electric Railway. By Frank C. Perkins. Illustrated 332, 333, 334
Programme of Southwestern Gas and Electrical Convention 334
Iowa Electrical Association's Convention at Des Moines on April 18th and 19th. Illustrated 334, 335, 339, 340, 341
A. W. Zahm. Portrait 334
Iowa Street and Interurban Railway Association 340, 341
Entertainment of Visitors 341
Delegates in Attendance 341
Convention Notes 341
Editorial 336
Death of Professor Curie. Portrait 337
San Francisco Earthquake and Fire. With map 337, 338, 339
Bids for Panama Canal Electric-light Plant Rejected 339
Selling Electricity 342, 343
Proper Handling of New-business Department. By W. W. Ferris 342
Empty Houses Lighted by Electricity to Attract Purchasers. 342
Electric Plate Warmers 342
Modern Methods of Advertising. By Frank B. Rae, Jr. 342, 343
Minneapolis Merchants Believe in Light 343
Electric Signs as a Summer Load 343
Central-station Advertising. Illustrated 343
Census Figures of Electrical Manufactures for 1904 343
Deaths of R. H. MacMullan, William A. Rudd and George W. Stockley 343
Electrical Exports for February 343
Franklin Honored in Philadelphia 344
The Paris Lighting Situation 344
Free-alcohol Bill Passes Lower House 344
World-wide Telephone Rates Disclosed by Canadian Inquiry. Part II 345
Bell Telephone Output 345
General Telephone News 345

DEPARTMENTS.

Correspondence 346, 347
Great Britain 346
New York 346
New England 346
Southeastern States 346, 347
Indiana 347
Personal 347
Electric Lighting 347
Electric Railways 347
Power Transmission 348
Publications 348
Societies and Schools 348
Space Telegraphy 348
Miscellaneous 348
Trade News 348
Business 349
Illustrated Electrical Patent Record 349, 350

DATES AHEAD.

American Electrochemical Society (general meeting), Ithaca Hotel, Ithaca, N. Y., May 1st to 3d.

American Society of Mechanical Engineers (annual convention), Read House, Chattanooga, Tenn., May 1st to 4th.

Southwestern Electrical and Gas Association (annual convention), Galveston, Tex., May 16th, 17th and 18th.

Indiana Independent Telephone Association (annual meeting), Claypool Hotel, Indianapolis, May 17th and 18th.

American Institute of Electrical Engineers (annual convention), Hotel Pfister, Milwaukee, May 28th to June 1st.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

Canadian Electrical Association (annual convention), Clifton House, Niagara Falls, Ont., June 19th, 20th and 21st.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

FORTUNATELY, the loss of life at San Francisco bids fair to be less than at first apprehended. And we have not heard that any electrical men were among those killed. But in other respects the disaster has proved to be one of the most stupendous of modern times. Electrical interests have suffered severely, but are pluckily at work rehabilitating themselves. We are not advised that these interests, as such, are particularly in need of financial assistance. Many of them have strong eastern connections that will help them get on their feet. But if still later advices show that the electrical people need help beyond that necessary to tide them over the immediate emergency, it will be quickly forthcoming.

IN A PAPER read before the Dublin section of the Institution of Electrical Engineers not long ago L. Broekman gives some useful hints on the care of storage batteries. Acid should always be obtained from the makers. The use of even the best well-water and of rainwater is condemned; only pure distilled water should be used. No attempt should ever be made to treat the electrolyte with the sulphates of potassium or sodium, or with caustic soda. Habitual overcharging is wasteful and decidedly detrimental. Immediate proximity of the battery room to stables or manure heaps is harmful on account of the presence of ammonia. A semi-automatic reversible booster in place of a charging booster is recommended, as it does away with the troubles connected with the end or regulating cells of the battery. The practice of starting gas or oil engines from the battery is condemned as throwing too severe a strain on it. Parallel groupings of batteries should not be resorted to. The author thinks that with modern traction cells having an output of nine watt-hours per pound at the five-hour rate, and with a good track, efficient motors and gearing, satisfactory results could be obtained with accumulator cars. On this point, however, his hopes are not in accord with the actual results of extended tests made in the United States. In this country the expectation of a practicable system of electric traction using power from storage batteries carried on the cars has virtually disappeared.

FROM the viewpoint of downright value to central-station men the conventions of the Iowa Electrical Association have always ranked high among gatherings of like character. Indeed, many of its members believe that they derive more benefit from the state association than from the national association, and this is very likely true in many things, such as mutual support in matters of legislation and the exchange of practical experiences among managers of stations which are about in the same class. But, nevertheless, the national association is of great value, for it conducts investigations and collects and disseminates information on a scale which no state association could reasonably attempt. The interests of national and state associations do not conflict in the slightest degree. Both are needed.

The conventions just held by this association and also, at the same time, by the Iowa Street and Interurban Railway Association, in Des Moines, were no whit less productive of good results than those of previous years, and the members came away feeling pleased and benefited. The city of Des Moines is widely known for its hospitality on occasions of this sort, and this time nothing was left undone to make the stay of the delegates enjoyable in every way. The street and interurban-railway companies and the local lighting company rose to the occasion right royally and did all in their power to show everyone a good time. Many excellent papers were read at both conventions, as will be seen by the report elsewhere in this issue, and it is notable that these papers, instead of being long and tedious, were short and pithy. The discussions were enthusiastic and of real value.

TO INSURE greater safety in railroad travel a bill has been introduced in Congress to provide for the examination and licensing of all telegraph operators engaged in operating block-signal systems or in the receiving and transmitting of telegraphic train orders affecting the movements of trains on all railroads engaged in interstate commerce in the United States. This examination is to be prepared by the Interstate Commerce Commission and to be for the purpose of determining not only the technical, but the mental and physical fitness of applicants for positions in these occupations.

The measure provides that the commission shall have the right to issue licenses to applicants who pass the examinations with a percentage of 75 or more. Railroads in need of either of these classes of service would be expected to apply to the commission for the men whom they needed, and would be supplied with a list of names from an eligible list prepared from the names of successful candidates at the examinations. It is not intended that the proposed law shall interfere with the services of any employe of the roads who have been engaged in these capacities for a period of three years preceding the date of the passage of the bill.

It is provided that it shall be unlawful, after the first of January next, should the bill become a law, for railroads to employ telegraph operators other than those who have been certified by the Interstate Commerce Commission, with the exception of those already mentioned. Violation of the law in this respect would mean a penalty of not more than $500 and imprisonment for not more than one year, by any person so violating the law, while any railroad company violating the provisions of the act would be punishable by a fine of not more than $5,000 for each violation.

THERE are those who hold that the terrible earthquake and fire in San Francisco of April 18th was no greater calamity to the world than the death of one man—Prof. Pierre Curie—who was run over and killed by a wagon in the Place Dauphine, Paris, on April 19th. Curie shared with his equally distinguished wife the great honor of the discovery of radium, and the two ranked with, or perhaps above, Roentgen and Becquerel among the great chemists and physicists of the present day. But, after all, there is really no ranking or grading among the truly great men and women of science. To the Curies, who were delving in the fundamental verities, human honors or distinctions, while perhaps appreciated, must have seemed to savor of a certain pettiness. Their minds, we may suppose, were chiefly occupied with greater things. Possibly if Professor Curie had been more keenly alert to the routine of everyday existence he would have dodged the wagon and have been alive today. It is the very irony of fate that one of the very greatest authorities and students in the world on the immensely important subject of radio-activity should have been knocked down and killed in a Paris street, perhaps for lack of the ordinary alertness and dexterity that are taught to a child.

But why is the discovery of radium considered of such great importance? Dr. William Hallock answers this question in a recent article in the New York Times. Two extracts may be quoted:

> Radium has made it possible to show that we can knock electrons out of any atom and that electrons are always the same, no matter whether they are derived from oxygen, hydrogen, chlorine, or any other element. The inevitable conclusion from this observation is that all atoms contain identical electrons, or, in other words, the prophecy of Prout a century ago is realized—we find all the elements to be only different aggregations of the one and only primordial matter, the electron. Rutherford has shown, by a beautiful line of circumstantial evidence, almost as elaborate as it is convincing, that the atom of radium is undergoing a continual disintegration. The various steps are evidenced by characteristic degrees of radio-activity, until finally the inert gas helium remains as one of the end products. * * * One of the beauties of the science of the present day is the ease and quickness with which it adjusts itself to new facts of observation. All of the more recent theories of the nature and structure of matter start with the electron. It is the most-talked-of member of the scientific family at the present time. * * * * It is quite safe to say that radium has helped more toward the reading of the riddles of nature than any other element. There is scarcely a branch of physics which has not been literally illuminated by radium. It may solve the problem of the source of energy of the orb of day, which warms and sustains us, no less than of the microscopic flash which is seen when an alpha particle strikes a fluorescent screen.

Thus the discovery of the Curies is believed to be a long step toward the understanding of the composition of matter—a final determination of the ultimate foundation of all material things. Therefore the death of such a man as Professor Curie is a great loss indeed.

Death of Professor Curie.

Science has lost one of its most distinguished representatives by the death of Professor Pierre Curie of Paris, who was the joint discoverer of radium with his wife, Mrs. Curie. On April 19th Professor Curie was run over and killed by a wagon in a street in Paris. It was a strange, mournful and untimely end for the great physicist, who was but 47 years old.

The death of Professor Curie not only removes

PROFESSOR AND MRS. CURIE AND THEIR DAUGHTER.

a great scientist but ends one of the most remarkable marital partnerships in the annals of science. As a recent writer has remarked, "The two physicists to whom we are indebted for the discovery of radium are attracting the notice of everyone, and the more so in that they afford an example of a most interesting and touching collaboration, since it concerns a husband and wife, both of high scientific attainments, who aided one another with their efforts and knowledge in the arduous path that finally led to the production of pure radium and the discovery of the phenomena that are now engrossing the minds of most of the physicists of the world."

Professor Curie was a Parisian and the son of a physician. He had always been a retiring, almost timid, student. He began researches on his own account in 1879, immediately after finishing his preparatory studies. In 1895 he was made professor of physics in the university at Paris. His wife was formerly Miss Sklodowska, and was of Polish birth. When she went to Paris to study, her independent means were so small she could not matriculate at one of the big schools, and she went to a municipal working-class institute, where Mr. Curie directed the laboratory. Observing that she took extraordinary interest in his experiments and had unusual ability, he made her his assistant. Soon after they were married.

Several years ago Henry Becquerel noted that some substances, especially the metal uranium, even when not shining visibly, gave off rays resembling X-rays. Mrs. Curie interested her husband in Becquerel's study of uranic radiation, and for six years they conducted an astonishingly brilliant series of experiments to ascertain what substance emitted the so-called "Becquerel rays." They meantime lived in a Paris suburb, almost in poverty, being so poor they could not afford to pay car fare, and had to ride between their home and laboratory daily on bicycles.

Their work was crowned in 1898 with the most splendid success. The announcement of their discovery of the new substance, radium, created a profound sensation throughout the world of science. Possessing the extraordinary property of continuously emitting heat without combustion, without chemical change of any kind in its molecular structure, which remains spectroscopically identical after months of continuous emission, radium shook the foundations of several of the most widely accepted scientific theories, including the atomic theory and that of the "conservation of energy."

Mr. and Mrs. Curie in a day emerged from obscurity and took rank among the world's leading scientists. In 1903 they were awarded the Nobel prize for chemistry, but before that they had received the LaCaze prize of 10,000 francs from the French Academy of Sciences.

The Curies were unspoiled by success. They continued to live modestly and to carry on assiduously their experiments with radium. Professor Curie was a small, mild, meek man, and always dressed poorly, even shabbily. After he became famous he received many invitations to deliver public addresses, but his excessive modesty made him a poor speaker. He leaves, besides his wife and collaborator, a daughter, now eight years old.

SAN FRANCISCO EARTHQUAKE AND FIRE.

Later report [illegible] the extent of the earthquake [illegible] San Francisco to [illegible] was made in the Western [illegible] The fire following the earthquake raged [illegible] day, and the greater part of the business [illegible] and much of the residence part of the city [illegible] destroyed. The loss of life [illegible] but the number is not known, and [illegible] will be exactly. Probably not less than 200 persons were killed outright or died from [illegible] the number may be a high [illegible] to the value of property destroyed, early [illegible] eral estimates can be made. One that seems reasonable in view of the extent of the [illegible] $200,000,000. To offset this there will be the [illegible] quake.

MAP OF SAN FRANCISCO AND ENVIRONS, SHOWING ELECTRIC TRANSMISSION LINES.

It is to be remembered that although the largest loss was in San Francisco, some of the surrounding cities and towns suffered in greater proportion, considering their size. Santa Rosa was one of these. Here about 100 persons were killed, and the business section is in ruins. The accompanying map shows the location of San Francisco and its surroundings. It is a reproduction, in part, of a map showing long-distance electric transmission lines conveying power to San Francisco which was issued and copyrighted by the Stanley Electric Manufacturing Company in 1904. The heavy lines on the map show the transmission lines of the California (although all of it may not be paid, owing to the magnitude of the disaster and the fact that both earthquake and fire losses are involved) and the money contributed for relief in all parts of the United States. The latter fund will be very large. At the time of writing, including $2,500,000 from the United States government, the amount in sight is about $15,000,000.

electric-light, street-railway or telephone service, and it will be a long time before these utilities are restored to a state corresponding to the condition before the disaster. The telegraph companies, on which so much depended, were also badly crippled, while the electrical manufacturing and supply interests suffered heavy loss. But it is not believed that many persons engaged in electrical pursuits lost their lives, which is a consolation.

One effect of the earthquake was to make a bad tangle of electric overhead wires overthrown into streets choken with debris. It is possible that some deaths were caused by contact with "live wires" during the first period of the disaster. But within an hour the electric power was entirely shut off. What effect the earthquake has had on underground electrical construction is not known at the time this is written. From the point of view of the practical electrical man, this will be one of the most interesting lessons of the catastrophe.

It is difficult to obtain information from San

Francisco, owing to its distance from the eastern and central states, the disorganized condition of the telegraphs and the great mass of official and private messages with which the wires are burdened. The Western Electrician has a resident correspondent in San Francisco whose "Pacific Slope" letters are familiar to its readers, but it has been unable to get in touch with him as yet, either by telegraph or mail. But from various sources some detached facts have been secured.

Electric Lighting.

The Pacific Gas and Electric Company (successor since last January of the San Francisco Gas and Electric Company) is the principal central-station company of the city. John A. Britton is president, Frank G. Drum vice-president, Cyrus Peirce treasurer, and C. W. Conlisk secretary. The general superintendent is S. L. Naphtaly. This company, still commonly referred to as the San Francisco Gas and Electric Company, has lately made extensive improvements. The daily newspapers refer to its Post Street plant as damaged. It has recently had a discouraging experience, for on February 22d last it sustained a net loss of $450,000 by a disastrous fire in its Station C, near the new Jessie Street station. This was the old Edison three-wire station. Station A, in the southern part of the city, has a larger capacity and perhaps escaped destruction. But it will probably be some time yet before the company will be in shape to distribute current throughout the downtown district. This company has the city street-lighting contract.

The California Gas and Electric Corporation, in itself a holding corporation for several light and power companies, including the one in ill-fated Santa Rosa, is likewise controlled by the new Pacific Gas and Electric Company. Its chief officers are: President, E. J. de Sabla, Jr.; vice-presidents, John Martin and John C. Coleman; secretary, C. W. Conlisk; general manager, John A. Britton; transmission engineer, F. G. Baum. John Martin, it may be remarked, is also a member of the executive committee of the National Electric Light Association. This company controls many of the long-distance electric power transmission lines of Central California. It supplies considerable current at wholesale to the San Francisco Gas and Electric Company.

The Mutual Electric-light Company is also now supposed to be controlled by the Pacific Gas and Electric Company. H. H. Taylor is president and W. R. Summerhayes vice-president and general manager. One newspaper account referred to the power house of this company as having escaped destruction.

The Central Light and Power Company has or had a plant in the Parrott Building. Frank Pauson is president, Joseph Naphtaly vice-president, J. W. Pauson secretary and treasurer, Edward Stephenson chief electrician, and M. Mamlock superintendent.

There were several large isolated plants in the city, including those in the Rialto, Mills and Claus Spreckels buildings. The new Fairmont Hotel, several times alluded to in the dispatches, had closed contracts for a 450-kilowatt plant of its own, to be fitted up in handsome style. At least 1,200 rooms were to be lighted.

Electric Railways.

The United Railways of San Francisco (controlled by the United Railroads Investment Company of New York city) is capitalized at $40,000,000 and operated 258 miles of electric and cable railway. It buys current of the California Gas and Electric Corporation and has also two electric and three cable power plants. This company was able to give some service on the fourth day after the disaster. This report is dated April 22d: "Street-car service of a crude and limited nature was restored during the day. Electric cars were running in Fillmore Street today and appear to have plenty of power. The service was free to all. The cars on Sutter and Pacific Avenues were being hauled by horses. Several other lines will be in operation tomorrow."

Cleveland people are interested in the fate of the street-railway property in San Francisco from the fact that Patrick Calhoun, who has his residence in that city, is president of the United Railroads of San Francisco which operates there. He took the office six months ago and before that time was a director in the United Railways Investment Company, a holding company for the United Railroads. It is said that most of the capital of the company came from the East, although heavy interests are held in various cities. Mr. Calhoun is now in the East with his family, but was expected home in a short time.

Under date of April 23d the following was reported from San Francisco: "A force of men is at work straightening the street-car lines. Comparatively few street cars were lost. Only one of the main car houses was in the burned district, and the earthquake came at a time when only the owl cars were running. So when the tracks are in shape and the connection made with the lines of the big power companies, the electric lines, which run to the mission, will be started up. It will take longer to repair the plants of the cable lines, upon which the western addition and all the hill country depend for rapid transit. The cable power houses are down and the machinery must be ruined. The repairing gang found that at the corner of Mission and Seventh streets the earth had sunk away for four feet. Here they tore up the tracks and began to grade in new earth. This is probably the first active work for the reconstruction of San Francisco. The sight of men at work on something except ruins does the eyes good."

Telephone Service.

The Bell operating company in San Francisco is the Pacific States Telephone and Telegraph Company, of which Henry T. Scott was lately elected president, succeeding the late John I. Sabin (see Western Electrician of April 7, 1906, page 283). The latest information is that all telephone exchanges in San Francisco were destroyed. These include several large new switchboards installed within the last year or two. A new office building on New Montgomery Street and the stock of supplies were also destroyed. The company has established temporary headquarters in Oakland. Later it may use the Folsom Street warehouse of the California Electrical Works, which was only slightly damaged, as an exchange.

The Home Telephone Company (Independent) has a franchise. It is reported that it will spend $4,000,000 on a new plant.

Telegraphs.

From the telegraph companies, naturally, more detailed information can be obtained. Both suffered the complete destruction of their buildings and plants. Both the Western Union and the Postal Telegraph-cable companies occupied large buildings in the business portion of the city, known respectively as the Western Union Building and the Postal Building. These were damaged by the earthquake and later destroyed by fire. The Postal Building was one of the first of the large business blocks to fall. The operators remained at their posts until three o'clock in the afternoon of the day of the disaster. Both companies bought their current, which operated the power plants in the basements of the buildings.

When the buildings were wrecked in San Francisco the companies moved their operators and employes across the bay to Oakland. Here in small quarters and with limited facilities communication was maintained to some extent with the outside world. Only three separate wires could be operated by each company, and of the six the government monopolized two. The remaining wires were soon overcrowded by the newspapers and anxious people who wished to send word to friends. As the news spread over the country many thousands of messages were left at the telegraph offices addressed to people in San Francisco. Some of these might have been delivered, but as the fire progressed this became practically impossible.

Anxious people who had friends in San Francisco were compelled to wait. An illustration of the great difficulty of reaching people in the burning city is given by the fact that Mr. C. M. Baker, construction superintendent of the Postal company in Chicago, spent 12 hours of extreme anxiety trying to get word from Mrs. Baker, who had planned to reach the Palace Hotel in San Francisco on April 16th, two days before the earthquake. Mr. Baker finally, after 12 hours' continuous effort, got word that his wife was safe in Oakland.

Outside of San Francisco the Postal company suffered little damage. The Western Union lines, however, were badly damaged in several places. Several miles of the line from Oakland to Los Angeles are said to have completely disappeared in fissures caused by the earthquake. The Western Union Company last Saturday morning sent a force of men from Chicago with a large supply of construction material and telegraphic supplies, including gas engines and power equipment, to Oakland. The lines in the vicinity will be repaired and a temporary telegraph office and plant established in San Francisco. The Postal company also has taken steps toward a temporary plant in San Francisco.

At the time of writing the telegraph companies are trying to devise some scheme by which to deliver what messages they can transmit. Both companies have sent special messengers to Oakland to handle the messages which come in for San Francisco persons. But as the city is in ruins, without means of communication or transportation, it is impossible to reach the persons addressed. Messages for the stricken city are only accepted subject to indefinite delay. Thousands of messages could have been handled by the companies, but the facilities were lacking.

T. P. Cook, general superintendent of the Western Union Telegraph Company in Chicago, in speaking of the earthquake and fire, said that he had no doubt that the city would be rebuilt. San Francisco seems to be more subject to earthquakes than other parts of the country, but this, he thinks, should be no hindrance to rebuilding the city, inasmuch as it seems clear that the damage from the earthquake in the present case would not have been very great had it not been for the fire which followed.

The American Pacific submarine cable has its eastern terminus in San Francisco. Despite reports to the contrary, the service was not seriously interrupted, although the cable house was destroyed.

Clarence H. Mackay, president of the Postal Telegraph Company, sent a message to L. W. Storer, general superintendent of the Postal Telegraph Company in San Francisco, in which he said: "I cannot adequately express to you my feelings regarding the calamity which has befallen San Francisco. I hope that you will move heaven and earth to open communication to San Francisco city and thus relieve thousands from anxiety. Do this at any cost within reasonable bounds."

On several occasions when attempts were made to send out messages from a temporary telegraph office in San Francisco, the crowd waiting outside would fall on the men carrying them, and in some cases the messengers were so terrified by the sudden onslaught that they dropped the envelopes and ran back into the office for their lives.

The correspondent at Wellington, New Zealand, of the London Times telegraphs that both of the Eastern company's cables between New Zealand and Australia suddenly broke on Monday, April 23d, the supposed result of submarine disturbances.

An attempt to communicate with the stricken city by wireless is reported to have been made, but for some reason not explained it failed.

From Oakland on April 20th it was announced that until further notice letters from San Francisco will be sent through the mails free of postage. This has been made necessary on account of the unprecedented demand for stamps which the local postoffice cannot supply.

Miscellaneous.

The California Electrical Works, Pacific Coast agents of the Western Electric Company, had recently built a warehouse on Folsom Street, about three blocks from the Palace Hotel, and this, most fortunately, escaped the earthquake and subsequent fires. It was slightly damaged, probably to the extent of a few hundred dollars. The building contains about 75,000 square feet of floor space, was completed last December and is of mill construction. It is provided with wire-glass windows and a complete sprinkler equipment. The advices are that these features with the efforts of the night watchman saved the property. The Western Electric Company is establishing temporary headquarters in Oakland, from which point it will be able immediately to assist the Pacific States Telephone Company in its construction work. Its business in general supplies will be for the present conducted by its Los Angeles branch, the California Electric Company, assisted by the Denver, St Paul and Chicago houses.

The San Francisco house of the Electric Appliance Company of Chicago was wiped out. None of its men was hurt, and the records are in the vault still in the ruins. The fire rather than the earthquake caused the destruction. A good-sized stock was carried and there was considerable insurance.

R. B. Daggett and G. R. Murphy of the San Francisco office of the Electric Storage Battery Company are safe. Mr. Daggett and Joseph Appleton of the home office in Philadelphia, manager of construction, were in Los Angeles at the last account.

Due to the earthquake and fire in San Francisco, the West Coast office of the Northern Electrical Manufacturing Company, Madison, Wis., has been temporarily established at 102 Woodman Block, Oakland, Cal. Mr. H. C. Parker, the Northern company's sales manager, is prepared to give power-transmission propositions prompt and careful attention, says the company.

Up to April 24th no word had been received in

Chicago from the San Francisco office of the Westinghouse Electric and Manufacturing Company, which was at 425 Market Street.

The San Francisco office and warehouse stock of the General Electric Company were completely destroyed. The office was in the Crocker Building. Dr. Addison, the manager of the Pacific Coast department, and his associates are safe. A temporary office has been opened in the Union Savings Bank Building, Oakland.

The electrical press was represented in San Francisco by the Journal of Electricity, Power and Gas, a high class monthly, particularly well printed and illustrated. Electrical journalists will hope that this excellent publication will suffer the minimum of loss and inconvenience.

Among the members and associates of the American Institute of Electrical Engineers living in San Francisco and vicinity are Prof. H. J. Ryan, professor of electrical engineering in Stanford University; Prof. C. L. Cory, professor of electrical engineering in the University of California; Joseph N. Le Conte and G. C. Noble of the same university; W. H. Allen, consulting engineer; E. G. Baum, transmission engineer; D. H. Fry, consulting engineer; A. M. Hunt, consulting engineer; Wynn Meredith, electrical engineer; A. E. B. Ridley, engineer and contractor; Fred F. Barbour, S. L. Foster, F. V. T. Lee, J. A. Lighthipe, E. J. Molera, F. E. Smith, R. B. Daggett, Robinson Crowell, Louis Glass, L. M. Hancock, William R. Hewitt, A. S. Kalenborn, W. F. Lamme, John Martin, F. P. Medina, Elam Miller, G. R. Murphy, S. L. Naphtaly, L. E. Reynolds, F. F. Springer and F. H. Varney.

Prominent San Francisco electrical concerns not elsewhere mentioned are the Standard Electrical Works, Kilbourne & Clark Company, Drendell Switchboard Company, John R. Cole Company, C. S. Knowles, John M. Klein Electrical Company, Hunt, Mirk & Co., Century Electric Corporation, Electric Supply Company, Brooks-Follis Electric Corporation, California Incandescent Lamp Company, Van Emon Engineering Company and Charles F. Sloane Company.

John A. Roebling's Sons Company, wire maker, announces the total destruction of its store and warehouse in San Francisco. Customers will be supplied for the present from Oakland by the courtesy of the Pacific Steel and Wire Company.

The loss sustained by the Allis-Chalmers Company was considerable, owing to the fact that it kept a large stock of standard machinery in San Francisco for immediate shipment upon orders from Pacific Coast territory. The warehouse containing this machinery was situated in the center of the burned district, as were also the offices, in the Rialto Building, Mission Street. Manager H. D. Scribner's first telegram to the home office in Milwaukee, which was not received until 24 hours after the first shock, gave assurance of the personal safety of the entire office force of five salesmen and the office attendants, although the homes of Mr. Scribner and most of the others were destroyed by fire in the general conflagration. New offices, however, were procured on April 20th, on the premises of E. B. and A. L. Stone, Oakland, Cal., from which place the Allis-Chalmers business affairs relating to that district will be conducted. Duplicate lots of machinery have already been shipped to replace what was lost, and there will be very little interruption to business. The Allis-Chalmers Company has made a contribution of $3,000 to the San Francisco relief fund and $1,000 was sent to the district-office manager for distribution among the company's employes there.

Bids Rejected for Panama Canal Power Plant.

A special dispatch from a Washington correspondent of the Western Electrician is to the effect that the Isthmian Canal Commission has rejected all bids opened on April 13th for the construction of the small electric power plant at Empire, Panama, the general specifications for which were given in the Western Electrician April 7th. New bids under revised specifications are called for, to be opened May 2d. Bids are being solicited by circular letter.

Mr. Chilton, the United States consul at Toronto, writes: "It requires over 40,000 horsepower to keep Toronto's factories in motion, and in connection with that fact the development of electrical power at Niagara Falls is of interest. Within a year power will be transmitted to Toronto by at least one of the three big development companies now engaged in harnessing Niagara; and this will probably lead to a big reduction in the cost of power with all its attending advantages to manufacturers."

Iowa Electrical Association.

[illegible]

of the [illegible] He said [illegible] established [illegible] the load [illegible] to [illegible] increased [illegible] only 27 per cent [illegible]

J. A. White [illegible] out the advantages [illegible] use of a storage battery [illegible] station to take care of the [illegible] remembered that [illegible] a battery does not [illegible] hours and the [illegible] use the battery [illegible] coal for carrying the [illegible] used.

The other two members [illegible] on the subject, Mr. [illegible] and Mr. [illegible] were not present.

[illegible]

"[illegible] and [illegible] Districts," [illegible] the title of a paper read by J. A. [illegible] of [illegible] Grove. Mr. [illegible] confined [illegible] to the [illegible] of distribution and treated it in a practical rather than a technical way. In the course of his paper he said: "When the distributing system [illegible] exclusively overhead construction it is a comparatively easy matter without consideration of the system in use to reach and serve in a satisfactory way the closely built up sections of the town, especially if the power house be located, as is usually the case, near to the business district. It is, however, an entirely different proposition to reach the scattered residence section when the cost of constructing and maintaining a suitable, economical and reliable system is considered. It is especially important that the system installed for this work should be suitable when, as in the writer's experience, over 70 per cent. of the total lighting income is from this scattered residence work, and where we have an average of one meter installed for each 10 inhabitants. Those of us who have been in the work for a decade or more will remember with what vehemence the relative merits of alternating versus direct-current practice was formerly proclaimed. But this condition has happily disappeared and we may now choose that best suited to our needs, or combine the merits of both if thought advisable.

In the experience of some, the system of distribution adopted may be the result of careful planning before the work of construction is begun, while in other cases we fall heir to a system built on lines far from good modern practice and that have to be worked over as far as possible in conformity with recent ideas. The writer's experience has been largely with one of the latter class of installations. The station in mind was originally installed as a two-wire direct-current system some 12 years ago and was operated in this way for about a year when the necessity of a change became urgent. In making the change the direct current was retained for the nearby business district and alternating current adopted for all outlying work. Making this change, use was made of the existing direct-current network for the secondary system, and as these wires, which were bare copper, were of a size much larger than would usually be installed for a purely alternating system, it permitted the use of fewer and larger sized transformers. The incandescent street-lighting system formerly in use was arranged for multiple operation by using one side of the house circuit for one side of street-lighting circuit, and the lights were controlled by running the other side to the switchboard at the station and passing through a single-pole switch to the opposite bus-bar. In making the change to alternating current the circuits were cut loose from the switchboard. Regular primary circuits were run out to transformers, and one side of this circuit became one side of the street lighting primary, and a single-leg primary circuit was run out to four suitable distributing points, where transformers fed to the original street-light system. The house and also the street-lighting system was divided up for the most part so each transformer worked independently rather than banked, on account of the facility with which any trouble could be located. In this way we were able to supply both house lights and street lights without interruption or change of any service or meter connection."

Meters and Lightning Arresters.

A. W. Zahm of Mason City next read a paper upon the "Care and Maintenance of Meters." This paper will be given in a future issue.

The paper by W. P. Caspar, upon "Up-to-date Lightning Protection," was carefully prepared and excited considerable discussion. He told of the development of the lightning arrester as made by his company, and illustrated his words by a diagram showing the design of the latest type. He also pointed out the cardinal points of a good arrester and what it is expected to do in successful operation.

Discussing this subject, Mr. Carson described his system, which contains a two-mile transmission line. At first they had a good deal of trouble, and lightning arresters seemed of no use. They finally strung barbed wire over the lines, grounded fre[illegible]

[illegible] trouble [illegible]

[illegible] contended that the [illegible] compared to the [illegible] of resistance at the [illegible] jection was [illegible] good [illegible] to connect the ground [illegible] or gas pipes.

Informal Experience Session.

An informal session was held Wednesday evening at which the subject of "Some Practical Experiences with Steam Turbines" was taken up, and also any questions which members might ask as to any phase of their operating work. In the past these informal meetings have been productive of much good, as the members feel free to discuss any subject that may not be drawn in the programme.

A paper upon the subject of steam turbines in actual practice was prepared by C. E. Stanton of Dubuque and read by President Burt, in the author's absence. The paper took up some of the exigencies which have arisen in the operation of a turbine in the plant of the author. On the subject of the step bearing, he said that the water for the bearing is first filtered, then strained and passed through a screw-shaped baffler to the bearing. The baffler acts to take away the [illegible] of the pump. Some trouble was experienced with the strainer, which must be cleaned every 24 hours. The accumulators, for insuring a sufficient pressure should the pumps fail, must be inspected often, otherwise they are inclined to stick.

To grind the step bearing, partially close the stop valve so as to obtain any degree of pressure on the bearing that is desired. This is a somewhat delicate operation, and many of the members thought they would hardly care to risk the operation without an expert on the spot.

The steadying bearings are another part that should be carefully looked to, and they should be carefully cleaned before being put in place.

The close regulation of the turbine was a matter of great surprise to the purchasers, and everything in the station was run on one set of buses, the turbine operating in parallel with the reciprocating-engine machines perfectly.

President Burt also gave the results of some tests made upon a steam turbine in the plant at Waterloo. The results of these tests will be given in a future issue.

"Technical Men as Dividend Earners."

Thursday morning's programme included a paper by Prof. George D. Shepardson of the University of Minnesota upon "Technical Men as Dividend Earners." Records of a prominent western university show that 27 per cent. of its men are connected with central stations, 22 per cent. have entered telephone engineering, 17 per cent. are engaged with the manufacturers of electric-lighting and power apparatus, 10 per cent. in teaching, 10 per cent. in engineering other than electrical, eight per cent. consulting and contracting engineers, four per cent. in work not engineering, two per cent. have died. In the last four years 34 per cent. have gone with manufacturers of light and power machinery, 24 per cent. with telephone manufacturers, while the lighting and railway companies have secured 24 per cent., of whom nearly one-half are with one company. The above seems to illustrate that central stations are not using the technical man to as great an extent as the manufacturer.

The reasons why so few technically educated men are connected with the smaller operating companies are, in general, two: First, that the companies do not seem to want them, and, second, that the men

do not seem to care for such jobs. The companies do not seem to care much for technical men, partly for the reason that overzealous and short-sighted sales agents have too commonly urged as one of the desirable features of their system that "any one can run it." Another reason is that the amount of business involved will hardly warrant the employment of the highest and most expensive talent. From the standpoint of the technical man, the small station is apt to offer a more monotonous routine, a low salary, fewer advantages and a general lack of appreciation.

These reasons are partly inherent and partly due to an incomplete or incorrect understanding of the true conditions. Almost any station could employ a young technical graduate to the mutual advantage of all concerned. Generally speaking, it is better for a young man to obtain some factory experience before settling down as an operating engineer, thereby supplementing his college training (which is necessarily more theoretical than applied) by a year or more of experience in the construction and testing of electrical apparatus. The balance of Professor Shepardson's paper was devoted to actual examples of savings and betterments made by technical graduates where they have taken hold of the central-station business.

Depreciation of Electrical Properties.

Prof. G. W. Bissell of Ames next read his paper on "The Depreciation of Electrical Properties."

As a preliminary to the preparation of this paper the writer sent to each member of the association, as listed in the Proceedings of two years ago, a letter propounding and asking replies to the following inquiries:

1. In computing the total cost of your output do you make allowances for depreciation?

2. If the answer to No. 1 is affirmative, how much depreciation do you charge off, and how do you arrive at this amount?

3. How do you invest your sinking fund?

Twenty replies were received. Three answered questions 1 and 3 in the negative, without explanation or other sign of interest in the matter, and of course gave no answer to question No. 2.

Four members answered question No. 1 in the negative, but explained that circumstances, such as pressure for dividends prevented the practice, or regretted that extensive renewals of deteriorated property had prevented, or that the plant was not yet old enough to be affected by depreciation; but all four evidently appreciated the importance of the subject.

Two members took issue against the recognition of depreciation as an account to be considered in making a true book showing of the property.

One member answered question No. 1 in the affirmative and No. 3 in the negative, and evidently confused depreciation and maintenance.

The remainder, 10 in number, gave affirmative and more or less complete answers to the three inquiries.

In the course of his paper the author gave several methods for determining the rate to be allowed for depreciation. One of these is as follows:

Suppose a power plant to consist of buildings and chimney worth $25,000, having an estimated useful life of 50 years; boilers and auxiliaries, worth $20,000, having an estimated useful life of 15 years; engines and generators, worth $30,000, having an estimated useful life of 12 years; switchboard, worth $2,500, useful life 10 years. The depreciation period may be assumed at 50 years.

Buildings	$25,000 × 1/50	$ 500.00
Boilers	20,000 × 1/15	1,333.33
Engines	30,000 × 1/12	2,500.00
Switchboards	2,500 × 1/10	250.00
	$77,500	$4,583.33

$4,583.33 ÷ 77,500 = 5.9 per cent.

Rate Regulation.

Two papers upon the general subject of rate regulation were presented Thursday morning, one by L. G. Hurd of Dubuque, on the "Legal Status of Rate Regulation," and the other by George McLean of Dubuque, on "Equitable Rates in Relation to Rate Regulation."

Mr. Hurd pointed out that in certain exigencies, as in the regulation of corporations, the state may step in and determine the methods of operation, regardless of the fact that competition is supposed to be the great leveler under the ordinary conditions of buying and selling. The fair value of the property at the time when the rates are fixed is the point upon which the court must fix its attention when attacking the rate problem.

Mr. McLean said that an electric-light customer will refuse to pay a light bill when no light has been received because he cannot see the expense involved in "readiness to serve." He does not understand the minimum bill, because he argues that, for the reason he has not used his lights for a period of time, he should not pay for something he has not received. Nevertheless, he pays without question his insurance premiums even when he has had no loss by fire. It is hard for him to see the analogy.

The speaker then went on to explain the factors entering into the minimum bill, the greatest of which is "readiness to serve." He said that a sliding scale in proportion to earnings would be a good solution of the problem. This might be developed practically into a profit-sharing plan.

In the afternoon of Thursday another paper on this general subject was read by M. J. Wade of Iowa City on the "Political Status of Rate Regulation." Mr. Wade said that there has never been a demand for municipal ownership which has not arisen from an abuse of some sort on the part of the corporation. Inflating capital stock is probably the most prolific source of discontent. A corporation should, however, be allowed a rate sufficient to cover not only a fair interest on capital invested but also enough to cover the uncertainties, the worry and the risk accompanying such an investment. During the reading of this paper the members of the Iowa Street and Interurban Railway Association were present at the session in a body.

New Officers of the Association.

At the executive session following Mr. Wade's paper the following-named officers were elected for the ensuing year:

President—A. W. Zahm, general manager of the Brice Gas and Electric Company, Mason City.

Vice-president—George S. Carson, manager of the Iowa City Electric Light Company, Iowa City.

Secretary—L. B. Spinney of Iowa State College, Ames.

Treasurer—W. A. Mall of of the Belle Plaine Electric Light Company, Belle Plaine.

Members of executive committee—L. D. Mathes, Union Electric Company, Dubuque; O. E. Brownell, lessee Lake City Electric Company, Lake City, and W. N. Kiser, Des Moines Edison Light Company.

Mr. A. W. Zahm, the new president of the association, was born in St. Paul, Minn., January 10, 1872. He entered the employment of the Northwest Thomson-Houston Company at St. Paul just previous to the consolidation in 1891, being employed in installing isolated lighting plants. In 1894 he was appointed superintendent of the East Side Electric Company of St. Paul (a central station), the first to operate the Siemens & Halske direct-current five-wire system in this country. This company was merged with the St Paul Gas Light Company three years later. In 1896 Mr. Zahm was appointed manager of the Manhattan Light, Heat and Power Company of St. Paul. This company owned the Manhattan Building and was given a franchise to do commercial lighting in the business section of the city, in which undertaking it was very successful. In 1901 Mr. Zahm was appointed manager of the Public Service Company at St. Cloud, Minn., operating a lighting and steam-heating plant which was at that time being rebuilt. Finally he was appointed general manager of the Brice Gas and Electric Company of Mason City shortly after Mr. W. E. Brice acquired the property, which has been entirely rebuilt since that time. This plant gives an electric-light and power, hot-water heating and gas service. Mr. Zahm is a member of the National Electric Light Association and has been identified with the Iowa Electrical Association since 1902, the year following its organization.

The convention will be held in Clinton next year.

Iowa Street and Interurban Railway Association.

The Iowa Street and Interurban Railway Association held its third annual meeting at the Kirkwood Hotel, Des Moines, April 19th and 20th. The president of the association, Mr. George B. Hippee, general manager of the Des Moines City Railway Company, presided. The address of welcome was made by Mr. H. H. Polk, president of the Inter Urban Company.

President Hippee in his address remarked: "Right here I want to say, the National Association is a good thing, and all should be members of the same, and it is one of the big factors in the present street and interurban-railway development and affairs, and can do much good; but it is so big that it is startling to some of us in its immensity, and to we smaller fry, as we go up against the propositions and problems that interest the large city companies, are lost in the big sea of possibilities. We are not used to such big boats as they sail. We know more about the 'prairie schooner' of the West, and our problems, while seemingly hard for us who are trying to grade the prairie mounds to good practical operating grades, and bridge the sloughs and small rivers of trouble, to make our few miles of interurban or city roads a financial success, feel that we cannot be taken care of in the discussions of the larger association. Such little ventures as ours seem lost in the maze of this large organization. But here, in your home state, you should all get together, every one of you who are interested in traction propositions. Give us the benefit of your ideas and thought. Some kink that is good for you is good for your neighbors."

He also touched upon the proposed legislation against Sunday amusement resorts, and strongly discountenanced any such move. He believed these places, if properly conducted, are a great benefit to the community, and should not be legislated against.

"There are many small towns," he said, "that have no street railways in this state. The sentiment in these places should not be forced on other and larger towns who enjoy baseball, and have Sunday summer afternoon and evening entertainments. The legislation on this should be left to the local places. Let them decide locally what they want, and each of you should aid in converting your senator or representative to this idea, because it is a living, wideawake issue, and one, from the moral standard, that is right."

After the regular order of business a paper was read on Thursday morning on "Transfers—Their Use and Abuse," by John F. Ohmer of Dayton, Ohio. The paper brought forth considerable discussion as to methods to be pursued in correcting the wrongful use of transfers. The whole trouble, when sifted down, is in the perfection of a system of transfers which will prevent persons not intending to use them from turning them over to others, making them a commodity and resulting in much loss to the company.

J. G. Huntoon read a paper on "Discipline of Car Service Employes."

Thursday afternoon was given up to a discussion of the testing of rail bonds, fields and armatures. The subject was introduced by Roger W. Conant of Cambridge, Mass., who came on from that place especially to present the subject. The subject is an important one and the discussion of it required the principal part of the afternoon, with the exception of a short period, when the members joined in the session of the Iowa Electrical Association to listen to the paper of M. J. Wade on the political status of rate regulation.

"The Adoption of Gasoline Motors for Street and Interurban Service," by F. W. Hild of Dubuque, was a thoughtful paper and brought out some lively discussion. It was read Friday morning. Mr. Hild analyzed the problem, taking into account the straight electric car, the gaso-electric car and automobile for both track and macadam operation, and gave figures on cost, maintenance and operation of the various systems. The object of his paper was to find out, if possible, just what operating conditions would make this or that system a paying proposition. In conclusion he said:

"Managers of steam railroads, entrusted with the direction of large vested interests, are naturally very conservative and therefore slow to make what would appear to be radical changes in their equipment. Therefore, while they realize the limitations of the steam locomotive in suburban and interurban service, they will, before stringing the trolley wire over their tracks, try out pretty thoroughly the independent motor car, which holds out alluringly the suggestion of interurban service without the power house, without the track bonding, and without the external transmission circuit. This tryout will definitely establish the true field of the self-contained car and, in the writer's judgment, this field will be the very short spurs of existing steam railroads, serving sparse population, making infrequent trips, principally to connect with main-line trains. Take one road—the Burlington, for example. The Galena Junction shuttle train, operating on a five-mile spur, and meeting the more important trains of the main line; and the Dubuque shuttle train which operates on the mile-and-a-quarter spur from East Dubuque over the Mississippi River Bridge. These could well use such independent motor cars; unless, indeed, electric power at satisfactory rates can be purchased of the neighboring electric companies.

"There is another field, not very wide, it is true, but a profitable field, which the independent motor car may enjoy with freedom from competition. The writer expects to see the present private cars of our millionaires displaced by the independent motor car, which can be made as comfortable and luxurious as any of the Pullmans now in service. Its owner may go anywhere that standard gauge tracks lead to, regardless of limitations to locomotives or to electric cars.

"As to prospective interurban roads which are promoted with the view to using the gasoline or other types of independent motor, it is highly desirable to go slow and investigate. Broadly speaking, if a prospective road is to depend for revenue only on its passenger and light express traffic, and the business only warrants one-half or more hours headway between cars, it becomes very much of a question whether or not the road will pay or ought to be built at all."

One member, in discussing this subject, said that the operating cost of a gaso-electric car is greater than the straight electric, on account of the necessity of three operators instead of two. A skilled mechanic is now needed, a motorman and a conductor. The discussion also drifted into the relative merits of gasoline engines.

On Friday afternoon G. H. Tontrup of St. Louis read a paper on "The Standard Car Body and Truck for Both City and Interurban Service." In city service the requirements are manifestly facility in handling passengers, comfort of passengers and maintenance of equipment. The double-truck car is the steadier and facilitates handling, and should be as low and long as possible practically. The entrance should be a single door, which makes more room for passengers on the platform. The aisle should be as wide as possible and leave a comfortable seat. As to maintenance, the jar and shock should be dissipated by a sufficient number of nests of springs. Straight sides are best from a maintenance point of view, as the swell bodies of the older types of cars necessitated the removal of an expensive panel when a break was made by accident.

For the interurban car the same general conditions hold true. Smaller cars and more frequent service should be used to be consistent with what

the interurban was designed for. Mr. Lontrup suggested a length of 43 feet over all.

The last paper on the programme was by W. R. Garton, on the "Mutuality of Interest of the Operator and the Supply Man."

At the executive session the following named officers were elected:

President—F. J. Hanlon, vice president and general manager of the Mason City and Clear Lake Railway Company, Mason City.

Vice president—P. P. Crafts, general manager Iowa and Illinois Railway Company, Clinton.

Secretary and treasurer—L. D. Mathes, general manager Union Electric Company, Dubuque.

Entertainment to Visitors.

The electric-railway and lighting interests in Des Moines demonstrated, as they have done in the past, that they are composed of whole-souled and hearty men who do everything in their power to make the stay of the delegates to the two conventions a pleasant one.

The power plants were thrown open to the delegates, who were given free transportation by the Des Moines City Railway Company and the Inter Urban Company, handsome little souvenir booklets containing transportation being distributed to each visitor at the convention.

Thursday evening a smoker and vaudeville performance was given by the railway companies at the Elks hall. The entertainment included some clever wrestling and boxing bouts by local talent belonging to the Iowa Athletic Association.

Immediately after the close of the last session of the railway association the delegates were taken on two cars of the Inter Urban Company and taken for a trip over the entire system. One of these cars was a private car of the company and the other was one of the latest type of interurban cars. An excellent luncheon prepared on the private car was served to all the guests, which numbered nearly 100 persons. The accompanying picture was taken after the party had gone some distance out from Des Moines.

The lines of the Inter Urban Company are two in number, which come together just outside the city limits. One line runs to Colfax, 23 miles, on single track. The transmission line runs beside the tracks and has a voltage of 13,000, with one substation. The other line runs to Granger, about 18 miles, and is also supplied by one sub-station. The transmission pressure in this case is 23,000 volts. Service given by these lines is excellent. A great deal of freight and package-delivery business is done in addition to the regular passenger business. The day was fine and everyone enjoyed the outing immensely after the work of the conventions. A resolution of thanks was drawn up on the train and duly presented, expressing the appreciation of all for the trip which was so thoroughly enjoyed.

Delegates in Attendance.

Following is a list of the members of the Iowa Electrical Association and the Iowa Street and Interurban Railway Association who attended the conventions in Des Moines:

IOWA ELECTRICAL ASSOCIATION.

Bissell, G. M., Iowa State College....Ames
Blunk, F. M., Hamburg Electric Light Company..Hamburg
Brownell, Otto E., lessee Lake City Electric Company....Lake City
Burt, Austin, Waterloo and Cedar Falls Gas and Electric Light Company....Waterloo
Burt, M. L., Bedford Light Heat and Power Company....Bedford
Carson, George, Iowa City Electric Light Company....Iowa City
Chase, H. E., Leon Electric Light, Heat and Power Company....Leon
Christensen, Niels, Waterloo and Cedar Falls Gas and Electric Light Company....Waterloo
Cole, O. K., Grinnell Electric and Heating Company....Grinnell
Crawford, L. R., Sioux City Service Company....Sioux City
Dodd, A. L., Charles City Light and Heat Company....Charles City
Dyke, A. H., New Valley Junction Water and Light Company....Valley Junction
Emery, C. L., Mount Vernon Electric Light Company....Mount Vernon
Ford, A. H....Iowa City
Green, S. C....Webster City
Greene, W. J., Cedar Rapids and Iowa City Railway and Light Company....Cedar Rapids
Grover, W. H., Iowa State College....Ames
Hampton, A. S., Des Moines Edison Light Company....Des Moines
Harrison, M. A., Nevada Electric Company....Nevada
Harney, C....Guthrie Center
Hewes, George T....Sioux City
Higbee, John A., People's Gas and Electric Company....Burlington
Hoag, E. W., E. W. Hoag Electric Light and Power Company....Manchester
Hodson, W., Des Moines Edison Light Company.Des Moines
Hopkins, F. M., Guthrie Center Electric Light Company....Guthrie Center
Hoyer, G. C., Nashua Electric Light Company....Nashua
Hunt, E. C., Belle Plaine Electric Light Company....Belle Plaine
Innes, J. A., Citizens' Light, Heat and Power Company....Eagle Grove
Jones, J. P., Citizens' Gas and Electric Company....Cedar Falls
Jones, A. E., Perry Electric Light, Railway and Heat Company....Perry
Ketchum, William, Leon Electric Light, Heat and Power Company....Leon
Kline, L. O....Winterset
Lawton, J. H., Humboldt Electric Light and Power Company....Humboldt
Linebaugh, F. W....Ames
Lundgren, G., Cherokee Electric Company....Cherokee
Lyon, C. A., Perry Electric Light, Railway and Heat Company....Perry
Madson, L. F., Northwood Electric Company....Northwood
[illegible]
White, L. L., [illegible]

IOWA STREET [illegible] RAILWAY ASSOCIATION.

Crafts, P. P., Iowa and Illinois Railway Company....[illegible]
Garner, H. W., [illegible]
Feist, C. M., Sioux City Traction Company....[illegible]
Goldschmidt, A. G., Davenport and Suburban Railway Company....[illegible]
Hanlon, F. J., Mason City and Clear Lake Railway Company....[illegible]
Hild, F. W....[illegible]
Hippe, George B., Des Moines City Railway Company....Des Moines
Hovey, M. W., Marshalltown Light, Power and Railway Company....Marshalltown
Howard, R. M., State Electric Company....[illegible]
Huntoon, J. G., Tri-City Railway Company....Davenport
Jones, C. D., Marshalltown Light, Power and Railway Company....Marshalltown
Leussler, R. A., Omaha and Council Bluffs Street Railway Company....Council Bluffs
Mackay, E. L....Des Moines
Mathes, L. D., Union Electric Company....Dubuque
McDonald....[illegible]
Newton, M. L....[illegible]
Noyes, H. B., Omaha and Council Bluffs Street Railway Company....Council Bluffs
Parks, A....Des Moines
Polk, H. H., Interurban Railway Company....Des Moines
Rollins, Richard R....Des Moines
Walters, J. D., Tama and Toledo Electric Railway and Light Company....Toledo
Walters, W. C., Tama and Toledo Electric Railway and Light Company....Toledo

Convention Notes.

J. B. Mendenhall, special metal salesman of the National Lead Company, made it a point to stop over and see his friends at the convention.

President W. R. Garton of the W. R. Garton Company, Chicago, and C. C. Ewing were in attendance and exhibited a line of trolley wheels, insulators, bonds, etc.

F. W. Roberts of the Clarke Electric Meter Company of Chicago was at the convention and explained the work of his company, which is an expert on meter repairing and calibrating.

D. Thomas, representing the Atlas Railway Supply Company, exhibited some of the standard types of rail joints manufactured by his company, and which are so well known as to need no description.

Frank P. Kennedy and F. D. Phillips talked for the American Electrical Supply Company and explained in particular the advantages of a new steel gain for pole cross-arms, which they had on exhibit.

Sangamo direct-current and alternating-current wattmeters and Packard transformers were exhibited by the Electric Appliance Company of Chicago, with F. J. Alderson and J. K. Alline in charge.

Harry H. Polk, the president of the Inter Urban Railway Company, is a young man of pleasing personality, and the hospitality of the interurban company, which was displayed through Mr. Polk, will long be remembered.

E. P. Magoon and Sam Furst of the Illinois Electric Company and the Bryan-Marsh Company were joint entertainers. Though they did not make an exhibit their quarters were crowded, for they have many friends among the Iowa electrical men.

The American Telephone and Telegraph Company gave free use of its long-distance lines to any part of the country to delegates after four p. m. each evening. This courtesy was greatly appreciated and many took advantage of the generous offer.

J. A. White, from the Chicago office of the Electric Storage Battery Company, was a popular man at the convention. He was not only out for business, but contributed some valuable discussion on the subject of day-load economy in central-station practice.

Frank N. Jewett and C. Warner of Chicago and C. E. Delafield of St. Louis, the well-known representatives of the Wagner Electric Manufacturing Company, were present, and although they did not show any apparatus they made their presence felt none the less.

Charles L. Wight, auditor of the Des Moines City Railway Company and the Inter Urban Railway Company, accompanied the delegates on the trip over the interurban lines. Mr. Wight is a pleasing conversationalist and he took great pains to explain the workings of the system.

One of the most popular exhibits was that of the Fort Wayne Electric Works, which was in charge of Walter S. Goll of the Chicago office, F. S. Wiemeyer, Iowa representative, and J. P. Bradner of the St. Paul office. These gentlemen were ready at all times to explain the points of advantage of their apparatus, of which quite a line was shown, such as small power motors, coin-operated prepayment meters, arc lamps, fans, etc.

[illegible] explain but the [illegible]

John G. [illegible] was at the convention [illegible]

The Pittsburg [illegible] Company of Pittsburg was represented by Charles R. Rall, secretary and treasurer. The company exhibited an example of the Pittsburg [illegible] is passed through the flange and then [illegible] over the face of the flange [illegible] faces with a copper gasket [illegible] perfectly tight joint when the flanges are bolted together.

Joseph T. Ryerson & Son of Chicago, represented by J. T. Corbett, had on exhibition [illegible] of the Morrison corrugated furnace boiler and also a sectional model showing the interior construction. The particular advantage of this boiler is that the sediment from the water is collected at the bottom of the boiler, where it may be easily removed, while at the same time the circulation over the heating parts is good.

A new electric interurban road between Des Moines and Creston, a distance of 60 miles, is to be built within the next two years and is to be known as the Des Moines, Winterset and Creston. Mr. A. E. Park is the general manager, and was a prominent figure at the conventions. According to Mr. Park, a power house will be built near Des Moines, the initial installation being 2,000 kilowatts. The road will in all probability be single-phase.

George E. Quigley of Omaha was one of the popular supply men at the convention, representing the American Steel and Wire Company. An exhibit of this company's product was made in one of the hotel parlors. There were samples showing the construction of a three-phase armored cable and also of a paper-covered cable. The street-railway men were particularly interested in twin-terminal rail bonds which were shown, and many visited the exhibit particularly to see them after the discussion of the subject of rail bonding on Thursday.

Railway supplies of a varied nature were shown by Porter & Berg in conjunction with an exhibit made by the Garton-Daniels Company. The former exhibited rail bonds, Mayer & Englund overhead material, Locke high-tension insulators, Kalamazoo trolley wheels and harps, Miller anchors and the Crouse-Hinds electric headlight. In the last named the carbons are set obliquely and the light is reflected so that there are no objectionable shadows. Porter & Berg were represented by E. R. Mason and W. D. Hamer. The Garton-Daniels Company, which showed its lightning arrester, was represented by W. P. Caspar.

Westinghouse alternating-current and direct-current fan motors, type MP wattmeters, arc lamps and type F circuit-breakers were the principal things shown by the Westinghouse Electric and Manufacturing Company. W. R. Pinckard, A. M. Miller and Harry P. Coughlan were the efficient representatives of the company. They also had on exhibit the big meter which was the object of so much comment and interest at the Fond du Lac electrical show, and which was illustrated and described in the Western Electrician last week. This meter was too large to get upstairs, so it was set up on the sidewalk just outside the hotel, and there was a curious crowd around it at all hours.

Some interesting things in the line of arc-lamp construction were shown by the Stanley-G. I. Electric Manufacturing Company, Louis Friedmann, E. L. Barr and C. A. Mann being in attendance. The new type K lamp has some mechanical features to recommend it. A new form of cross-head does away entirely with the center tube, making the parts readily accessible and aiding in trimming. Another type of lamp shown was a short lamp only 15 inches long for use on low ceilings, and consuming about the same power as six 16-candlepower incandescents. There were also shown an induction motor and a Wright discount meter for determining the load upon a transformer.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Proper Handling of New-business Department.[1]

By W. W. Ferris.

Much is said and little is done toward suggestions for the organization of a new-business department. Let me therefore suggest a plan simple enough and cheap enough for even the smallest central station.

First of all, procure and maintain a respectable office, be it ever so small; light it well; maintain at all times a modest and attractive window display, which should be changed frequently; invite people to come to your office, and when they do, receive them as they should be received. Profits to be realized from the added output, together with the methods to be devised and put into operation in the getting of new business, certainly make this part of the central-station work attractive and interesting.

The proper handling of the new-business department should be divided into three general heads—salesmen or solicitors, advertising or publicity, and rates.

Requirements in a solicitor consist primarily of a love for the business, loyalty to the company and an inborn and inbred taste for the work. With any of these qualifications missing, the company had better get a new solicitor. Given these three qualities and almost any young man can make a decided success at soliciting. The field from the standpoint of a solicitor is an exceedingly inviting one. In the case of a solicitor, it is his duty only to inform a prospective customer of the facts regarding the goods which he has to sell. A plain, straightforward statement of facts is much more effective than any kind of oratory or dramatic effect. A solicitor is always telling his prospective customer of facts regarding which the customer has very little or no knowledge. In almost no case is it necessary to talk to anyone but an interested and attractive listener. Public-utility salesmen should give much attention to local affairs, should study carefully the best trade journals, and should have on hand at the office of the company several advertising magazines and trade journals generally read by prospective customers. The company should furnish for the solicitors' use an annual subscription to at least six of the leading magazines.

A fundamental essential of a successful new-business department consists in expending judiciously a certain amount of money in advertising. In my opinion a large part of this should go to the local newspapers. Advertising in its various forms must of course be of great value, but in my opinion there is no way of bringing a subject to so many people for the money as by the means of newspapers. That the public naturally looks kindly upon large advertisers is true in a general way. I would recommend that no ad. appear more than one day. Let the copy be pointed, effective and composed only of interesting facts; use no exclamations or other expressions intended to "catch" but lacking in thought.

It is a good plan for any company in organizing a promotion department to select some expression which should be used very generally throughout all its advertising matter, and which the public shall come to know as well as it knows the company's name.

When central-station service first assumed commercial proportions, flat rates were naturally made. As business grew it was soon learned that this method of charging was unprofitable and unsatisfactory to the consumer. From this extreme the tendency went to the opposite, and a few years ago it was the general opinion that nothing should be allowed of any kind except a meter rate. More recently, however, it has been learned that the purely meter rate is almost as unsatisfactory as the old flat rate. The middle ground is now generally taken, and a combination rate made which has various forms, and the instance is now very common where central stations are making flat rates on various well-defined kinds of lighting and upon some kinds of power. This middle ground has become of great value to the central station in allowing it an income on certain kinds of lighting which was utterly impossible to get under a meter system.

Regarding the question of a solicitor as to getting a start with a new customer, I suggest that the company adopt one little plan which may be of service, and that is in trying to get house lighting, particularly houses that are now using gas. I find it rather difficult, owing to the first cost of installing. People say that they would like to use electric light and will some day, but they do not care to equip their houses at the present time. My way of getting at them is this: "We will put a porch light in for you at 50 cents a month flat." This, I believe, is something a great many would like. After they are started with a porch light pretty soon they want a light inside the hall, and then the meter goes in. When they are once started it is just a question of time until the whole house is electrically lighted.

There are at least four elements to every sale. First, the introduction either for a personal interview or by letter; second, the creating of a desire in the prospective customer for that which you have to sell; third, the selecting and adjusting of that which you have to sell to his particular needs and working him up to the point where he will be ready to sign; fourth, the sale.

I realize how hard it is to break away from your daily routine and give matters of this kind your attention, but, as already stated, much has been said—little done. Discussion is valuable only when it works hand in hand with accomplishment. A single plan put into operation is worth 100 "mind's-eye" schemes. The thing in hand is the most important now. Tomorrow will take care of tomorrow's tasks if today's tasks are done today. On the clock of time there is but one word, and that is "now." Now is the time to begin. By the sweet bye-and-bye one arrives at the house of never. Putting off means leaving off and going to do becomes undone. So begin now.

When it comes to personal solicitation, such solicitation is absolutely essential to getting business. Advertising will do nothing more than bring an inquiry, and in sending out solicitors it is absolutely essential that those solicitors shall not only be salesmen but educated along electric lines. When sending out a solicitor he should be sent to do something. The point simply is that when a customer has been lined up and interested the solicitor must know exactly what the man should have, not what he wants particularly, and what is sold to him ought not to be necessarily the thing that is going to bring the company the largest revenue but what will do the customer the most good.

The central-station man, if he is going out after new business, should economize for his customer in every possible way, and that can only be done by keeping in close touch with the progress of manufacturers in making new types of reflectors, lamps, etc., which enable the lighting of windows intelligently. In regard to the motor applications the same principle is true. If a drug store is doing a good soda-fountain business, you might say there is a milk shaker available there which might be run by a motor; but it is really not enough to tell that man to run the old milk shaker by a motor. The article of latest design from some manufacturer should be shown by picture if the article itself cannot be conveniently obtained. Then go to your customer with a "dead-open-and-shut" proposition. "By this it costs so much to install and run and will give you so much profit." That is the way to sell goods and get new business. Salesmen must go in with a regular proposition well supported by facts and unvarying figures.

1. Part of a paper read before the J. J. Hogan Engineering Club of La Crosse, Wis., March, 1906. The author is connected with the Wisconsin Light and Power Company of La Crosse.

Empty Houses Lighted by Electricity to Attract Purchasers.

E. A. Cummings & Co. and the Proviso Land Association, dealing in suburban property near Chicago, have tried the experiment of connecting all their 50 new houses, built for sale in Maywood, to the electric-lighting system out there, and showing them off at night brightly illuminated.

The idea has proved most successful, the firm reporting that business has been done under these conditions which could not otherwise have been secured.

Owners of new apartment buildings in Chicago have frequently done the same thing to advantage, and, as there is no minimum bill required on electric-lighting connections any longer, it would seem like a good chance to make use of this valuable form of advertising this spring. It is a paying investment for high-grade property. At all events, be sure that your property is wired for the use of electricity, as the discriminating renter or buyer won't look at it otherwise. Having it connected in advance is excellent assurance of completed wiring.

E. A. Cummings & Co. are going to extend this method of advertising to their 16 new residences for sale in River Forest, and 23 in Harlem, at the terminus of the Metropolitan Elevated Railroad.—The Electric City.

Electric Plate Warmers.

Mrs. M. B. Florence, in an article in a late issue of The Caterer, says: "Individual electric plate warmers have been growing in favor since their practicability has been demonstrated. A large order for them has recently been placed for the New Hotel Knickerbocker, New York. They are of steel, nickel plated, oblong shape, mounted on legs. These up-to-date service adjuncts are invaluable for keeping plates or specially cooked dishes hot, for service to rooms or any other place at a distance from the kitchen, or when two or more orders are brought in at once to expedite service."

Modern Methods of Advertising.[1]

By Frank B. Rae, Jr.

You have heard a great deal within the last few months on this subject of advertising. The technical press has been full of it. Advertising agencies have bombarded you with it. In your personal meetings and conventions you have discussed and argued it. Advertising, in short, is the talk of the hour among electrical men—the fad. "Where will it all lead?" you ask.

Gentlemen, it will lead to this: The business of manufacturing and marketing electric current will become as other business, and it will be advertised as other business. The trouble just now is that central-station policy and practice is changing to meet new conditions. Heretofore business has come to you. Hereafter you must seek business. That is the meaning of all this furor.

Advertising, when stripped of its trappings and gilt, is a very plain, commen-sense business proposition—a proposition of selling goods. While it would seem that this is simple enough and obvious as the first proposition in geometry, it is a fact that only a very small percentage of so-called advertising conforms to this definition. On the contrary, the fundamental principle has been so hidden and befogged by a maze of high-sounding words that not one man in a thousand of those who foot the bills knows what he is trying to accomplish or is paying others to accomplish for him. He staggers along blindly, believing that any sort of an announcement regarding his business is advertising, and the more startling the form and wording of this announcement the better advertising he believes it to be. Just as idol-worshipers of old clothed their religion in fearful mystery and expressed it in awe-inspiring pageantry and ritual, so the ad man of today shrouds simple truth in a garment of the inexplicable and says much about nothing, with pomp and ceremony.

Gentlemen, there is just one mystery in advertising—the mystery of the personal equation. Advertising—real advertising—is good or bad only as the man who prepares it is gifted or not gifted. Words are in every man's mouth, but every man cannot be a Patrick Henry. A pen is in every man's hand, yet every man is not a Shakespeare. The tools of advertising are within every man's grasp, yet very few men can write an effective advertisement. It is well for us to recognize at once that the gift to see and express in advertisements the possibilities of a business is no more common than the gift to see and express in poetry the inspiring beauties of nature.

Advertising has been likened to salesmanship—salesmanship-on-paper is the expression of a clever ad man. For practical purposes this is a very good definition. Furthermore, it bears out what I have already said. You have all listened to the clever salesman. He came unknown, unasked and unannounced. His dress and appearance were his credentials; a bright word his introduction. In terse, clean-cut English he told his story; with convincing logic he drove home his argument; with undeniable assurance he solicited your business. Tact, courage, good breeding stamped each word. If he did not get an order he left an indelible impression of the worth of his goods. Perhaps you did not want to buy them—for any one of a thousand reasons—but sooner or later his well-delivered arguments, his tactful insistence, will win you. You will buy.

What were this salesman's qualifications? He was tastefully, or at least decently, dressed; his introduction commanded your attention; his argument appealed to your reason; his tact and cleverness assured him a future opening if not an immediate sale. These are the qualifications of a successful salesman. They are the qualifications of the successful advertisement.

* * *

My paper was to be devoted to advertising method, yet I have spoken only of advertising matter. I have done this with purpose, for unless the matter is right, no method will avail. Results of a sorry sort will come from almost any advertising just as sales will be made from almost any salesman; but if you are to enter this field with an idea of profit, let me exhort you to pay the bulk of your attention to matter. The need of method will be self-evident.

It must be understood that the backbone of your business-getting department is the solicitor. Advertising can persuade a man of the advantages of your service; can convince him that he needs it; can crystallize his desire into an immediate demand for specific information touching his individual wants; but it cannot figure his installation, nor secure his signature to a contract. This requires a solicitor.

Granted that you have intelligent and energetic solicitors, the advertising will be designed to bring the prospects to the point where it will require the least amount of the solicitor's time to close a contract. To do this is not the work of a single advertisement, nor of a number of diversified and disjointed advertisements. It is the work of a long-continued, regular, systematic advertising campaign.

It is here that the average lighting manager interposes objections. He is perfectly willing to take

1. A paper read before the Iowa State Electrical Association at Des Moines, April 18, 1906. The author is secretary of the C. W. Lee Company.

a "flyer"—to send out three or four mailing cards perhaps, or insert a so-called "catchy" ad in the newspapers. Such advertising, if advertising it can be called, is the sheerest waste of money. Object as you will to this statement, if you but compare again your advertising campaign to the work of the accomplished salesman you will begin to see the "reason why" of the follow-up method. For your salesman does not always get an order on his first call, nor his second, nor the third. It may take a half dozen of his calls to educate you to the advantages of his goods and to win your confidence—in short, to bring you to the buying point. Had the firm employing this salesman sent a different man each time; had the various men employed radically different methods, it is probable that you would pay little if any attention to their solicitations. But the one man, the one method—the constant, aggressive, persistent, follow-up—that is what lands the order.

And that is what will land orders from advertising.

The matter of such a follow-up campaign should be planned, prepared and systematized in advance with very strict regard to local conditions. It is in the planning and systematizing that such a campaign wins or loses—in the logical sequence of the advertising used. The system of handling inquiries, of checking and revising the mailing lists, of adapting the solicitor's labor and reports to the mutual benefit of both solicitors and the advertising—these are all vitally important points to be settled before a single piece of matter is issued. Having settled them the actual follow-up work resolves itself into the very simple proposition of seeing that the matter goes out promptly on the scheduled dates, that inquiries are carefully followed and that the enthusiasm of the soliciting force is kept at fever heat. When it is understood that the chief object of the advertising is to pave the way, introduce and make definite appointments for the solicitors, the importance of having the latter always aggressive will be appreciated. The actual business-getting must, and always will, remain with the soliciting force.

"Modern Methods of Advertising," so far as the central station is concerned, means merely that you regularly and persistently keep the advantages of your service before every prospective customer within reach of your mains. That such methods can be adopted with profitable results by the smaller plants has been demonstrated.

But a warning should be sounded. Do not make your advertising too elaborate or too voluminous. Do not waste it upon ill-chosen lists. Most important of all, do not allow it to be designed by an advertising man ignorant of the ethics of the lighting business, or by a lighting man lacking in advertising genius and experience.

Minneapolis Merchants Believe in Light.

"Minneapolis is fast becoming the electrical city of the country, and as far as the business districts are concerned, the best lighted," says the Journal of Minneapolis. "Block after block of the downtown streets is being equipped with private arcs—both electric and gas—that throw a brilliant white light over the building fronts, the display windows and the sidewalks and streets. Since the introduction of the idea, merchants have taken to it with a rush and are installing lights.

"The first move was the illuminated sign that is now seen everywhere. The addition of the outside lights makes the display more effective. This scheme of electrical illumination not only advertises the merchant who installs it, but helps advertise the city. The flaming arc lamp is new in Minneapolis. It has a strangely penetrating light. The lamps are made only in England. They are burned in pairs and cost $150 a pair. The same voltage is used as in the arc light, but about seven amperes are required instead of three and one-quarter, as in the old form."

Electric Signs as a Summer Load.

In a recent folder the Chicago Edison Company makes the point that the summer season is the best time of year for outdoor advertising. This is, of course, because more people are out of doors, but, with the decrease in the ordinary lighting load, the fact is a good thing to be borne in mind. To encourage the electric-sign business the company offers to secure suitable roof locations for its customers, furnish the signs subject to their approval and attend to all details. All the sign advertiser does is to pay for the light after the sign is up. It is said that there are thousands of good roof locations along the various elevated and surface roads visible nightly by hundreds of thousands of people, which might be utilized. The title of this striking folder is "Making $$$$$ After Dark." It will be seen that it is something of a step in advance in the matter of the central-station company itself securing the locations for the advertising roof signs.

Whitewashing the tunnels of the Central London Railway will be done by an ingenious device designed by General Manager G. C. Cuningham. The apparatus will be attached to an ordinary motor car. Through finely pierced piping an electrically driven pump forces the whitewash—fed by a 600-gallon tank—which emerges in the shape of a fine spray.

Central-station Advertising.

[illegible]

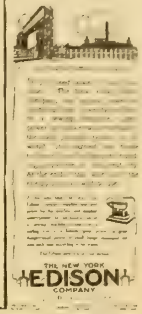
THE STUDY LAMP

Much of the comfort derived from reading evenings, depends on the light. It should throw a soft glow over the book or paper, and leave the eyes in the shadow.

This is effectually accomplished by the use of an electric portable lamp. Call at our office.

WISCONSIN LIGHT & POWER COMPANY.

Both Phones 271. 318 Main St.



CENTRAL STATION ADS IN DAILY PAPERS.

library or living room? Will not a central overhead source of illumination, with suitable shade accessories, giving the most light over the reading table and yet lighting the whole room fairly well, be best both for the company and the user? The sharp contrast between a brightly lighted area from the study lamp and the dim light of the outlying parts of the room is fatiguing to the eye, and should be avoided.

The New York ad is tastefully arranged, but it might be more forceful, more convincing. One great advantage of electric drive—"the moment the motor stops the expense ceases"—is not mentioned.

Census Figures of Electrical Manufactures for 1904.

The director of the census announced on April 23d the result of the tabulation of the statistics of electrical machinery and apparatus for the calendar year 1904, forming a part of the census of manufactures of 1905, taken in conformity with the act of Congress of March 6, 1902. Like the New Year's estimates of the Western Electrician, the figures indicate that there has been a substantial increase in this industry in the United States. Compared with the statistics of 1900, which covered the fiscal year ended May 31st, the following summary is given:

	1905.	1900.	Per Cent. of Increase.
Number of establishments	783	580	35.0
Capital	$101,469,874	$63,170,943	130.3
Salaried officials, clerks, etc.:			
Number	11,590	4,987	132.4
Salaries	$ 11,675,576	$ 4,563,112	155.7
Wage-earners:			
Average number	59,336	40,890	45.1
Wages	$ 31,226,721	$20,160,344	54.7
Miscellaneous expenses	17,974,878	6,788,314	164.2
Total cost of materials used	66,728,176	48,916,440	36.4
Total value of products	*140,614,481	91,348,889	53.9

*Exclusive of $17,335,033 reported as by-products of other industries, the aggregate value of electrical machinery and apparatus production for 1905 being $157,949,514.

The principal products are summarized as follows:

	1905.	1900.	Per Cent. of Increase.
Dynamos	$ 11,084,234	$ 10,472,576	5.8
Motors	22,370,626	19,505,504	14.7
Carbons	2,710,025	1,731,248	56.6
Incandescent lamps	8,319,154	4,036,112	106.1
Telephone and telegraph apparatus	16,074,842	12,134,678	32.7
Insulated wires and cables	34,510,684	21,292,001	62.1
All other products	59,171,047	33,490,464	76.7
Custom work and repairing	2,748,022	2,063,736	35.6
	$157,949,514	$104,746,319	50.8

T. C. Martin, special agent of the Bureau of the Census for electric industries, supplies this comment: "These figures will be developed and discussed later in the usual bulletins and reports of the Census Office. In these detailed figures the group of All Other Products, here constituting a third of the total amount, will be considerably subdivided and classified in detail. It will, of course, be understood that these figures do not include the very large amount of manufacturing and repair work done by the public-service corporations of all

[illegible]

OBITUARY.

Robert H. MacMullan.

[illegible] He was 42 years of age at the time of his death.

William A. Rudd.

William A. Rudd, manager of the Western Union Telegraph Company's Boston office, died suddenly at the Boothby Surgical Hospital in Boston on April 13th. He went to the hospital on April 4th and was operated upon for gallstones on April 6th. It was thought that he was recovering, but there was a change for the worse early in the evening of the day he died. Mr. Rudd was born in Connecticut 50 years ago and went West while young. He learned telegraphy in the West and was for some time manager of the Western Union Company's office at St. Paul, Minn., a position he resigned to become manager of the Postal Telegraph Company's office at Memphis, Tenn. He went to Boston from the latter place two years ago. He left a widow and one son. The latter, Leon E. Rudd, is manager of the Western Union Company's branch office at 16 and 18 Devonshire street, Boston. Allen Woodle, for many years in the company's employment as manager at smaller cities, is acting manager at Boston.

George W. Stockley.

George W. Stockley of Cleveland, Ohio, one of the pioneers in the electrical business in this country and the first president of the Brush Electric Light Company, died at Atlantic City, N. J., on April 19th. His death was due to pneumonia. Mr Stockley was born in Cleveland 53 years ago, and is survived by three sons and one daughter—Walter D., Galt and George J. Stockley and Mrs. Owen Johnson of New York.

Electrical Exports for February.

Electrical exports from the United States during February reached a value of $1,101,438, compared with $1,055,062 for February, 1905. Both electrical machinery and electrical appliances (the latter including telegraph and telephone instruments) show a gain over February, 1905. The figures are as follows: Electrical appliances—February, 1905, $418,483; February, 1906, $544,906. Electrical machinery—February, 1905, $637,479; February, 1906, $646,532.

Considering electrical machinery only, the principal purchasers from the United States and the value of their purchases during February were as follows: Cuba, $135,218; British North America, $128,322; United Kingdom, $117,303; Mexico, $72,528; Japan, $64,107; British Africa, $25,000; Brazil, $11,301; Philippine Islands, $10,097; British Australasia, $5,063; Germany, $9,301; Argentina, $4,801; France, $3,631.

Eastern capitalists have been looking over the ground from Corbin, Ky., to Jellico, on the line between Kentucky and Tennessee for an electric railway. Should the road be built, waterpower from the falls of the Cumberland River, 16 miles from Jellico, will be used for the generating plant. It is believed that 100,000 horsepower could be generated, as the river has a fall of about 80 feet.

Franklin Honored in Philadelphia.

An elaborate programme, including a wide range of events, characterized the celebration in Philadelphia of the bi-centennial of the birth of Benjamin Franklin. Franklin's versatility was especially beneficial to Philadelphia, where he did many things, from the inventing of an improved pump to the founding of a university and a philosophical society. The celebration in Philadelphia began with a welcoming reception on Tuesday evening, April 17th, and ended with a banquet on the evening of April 20th. There were many noted men present from all parts of the world. Flags were flying in all parts of the city and at night an equally appropriate tribute was paid in the electrical display, the City Hall being illuminated with thousands of red, white and blue incandescent bulbs, while the characteristic kite, outlined in white electric lights, with an electric key dependent from the tail, was displayed over the four entrances.

The presentation of the honorary degree of doctor of laws to Miss Agnes Irwin, great-granddaughter of Franklin, conferred by Andrew Carnegie, lord rector of St. Andrew's University, Scotland, was the first of a series of events in the celebration. This followed the reception of delegates representing learned societies from this and other countries. President Edgar F. Smith of the American Philosophical Society presided at the reception, and in his address dwelt at some length on Franklin's electrical experiments and showed that certain principles evolved by him have remained unchanged to this day. Franklin was elected president of the Philosophical Society in 1769.

In the building of the American Philosophical Society on Wednesday some of the leaders of thought in the principal nations of the world gathered. Prof. William B. Scott of Princeton and Edgar F. Smith, president of the society, shared the honors of presiding. Of the papers read many were very technical. Sir George Howard Darwin, for instance, apologized at the conclusion of a very elaborate paper on the interaction on each other of two heavenly satellites, one liquid and the other solid, connected by an imaginary pipe without weight, for discussing a theme which hardly more than one or two present would comprehend. Professors E. L. Nichols of Cornell and Ernest Rutherford of Montreal talked about electricity as developed from the beginnings of the science which Franklin had so much to do with. A popular paper was that of Professor Pickering of Harvard, in which he proposed to commemorate the Franklin bi-centennial by the establishment of an international astronomical observatory on some of the high Andean peaks.

Before beginning his paper Mr. Darwin presented to the American Philosophical Society a very fine medallion of Franklin and another of Erasmus Darwin. One of the highly technical papers was on "The Statistical Method in Chemical Geology," by Prof. Frank Wigglesworth Clark of Washington. Prof. Thomas C. Chamberlain of the Chicago University discussed a possible reversal of deep-sea circulation and its effect on geological climates. He said that the phenomena of the atmosphere and the ocean attracted the old philosopher, Franklin, and aside from atmospheric electricity, certain climatic phenomena were subjects of his special study. Prof. Hugo De Vries of Amsterdam, Holland, read a paper on "Elementary Species in Agriculture," and he was followed by Prof. Edward C. Pickering of the chair of astronomy at Harvard.

In the afternoon Prof. Albert A. Michelson of Chicago read a paper on "Form Analysis," showing by stereopticon the most delicate crystal, sheil, plant and other forms. In his paper on "The Present Position of the Problem Concerning the First Principles of Scientific Theory," Prof. Josiah Royce of Cambridge, Mass., to the evident enjoyment of the keen minds before him, undertook to analyze the thinking process, contending that the study of scientific theory must resolve itself into a sort of science of a thinker's ways. In an address on "Positive and Negative Electrons," Prof. H. A. Lorentz of Amsterdam referred to the fact that Franklin tried to explain all electricity by one electric fluid. Professor Lorentz entered into an elaborate demonstration to prove that there are two electric fluids, the positive electron being the electricity in the mass of matter, in the body of the earth, and the like, while the negative electron is the movable or fugitive electricity.

Telegrams and cablegrams of felicitation were read by Secretary I. Minis Hays from the Tokyo Zoological Society, from the oldest society in Holland, from the Imperial University at Tokyo, from the Imperial St. Petersburg University Council, the Institute of Electrical Engineers and others.

The evening was devoted to Franklin's electrical work. Several letters from prominent foreigners were read and then Professor Barke, vice-president of the society, introduced Prof. Edward F. Nichols of Cornell University, speaking of him as the foremost man of the country in the science of electricity. Professor Nichols spoke at length on "Franklin's Researches in Electricity." Among other things he said: "That Benjamin Franklin should be the author of the one theory of electricity which of all the views on this subject comes nearest to our twentieth-century concept may seem strange; for with him electricity, after all, was merely an episode, a form of intellectual diversion."

Prof. Ernest Rutherford of Montreal spoke on "The Modern Theories of Electricity and Their Relation to the Franklinian Theory." In a lengthy and somewhat technical paper he devoted himself to pointing out the significance of Franklin's contributions to the knowledge in the special domain of electrical theory. The speaker constantly linked the name of Franklin with those of J. J. Thomson, Lord Kelvin, Lorentz, Maxwell, Drude, Zeeman and other specialists in electricity. He commented on the fact that Franklin's one-fluid theory, in a modified form, had survived for a century and a half.

It is provided that 15 native and five foreign members may be elected to the Philosophical Society at each annual meeting. Just that number were elected at the conclusion of the morning programme. During the intermission for luncheon the delegates discussed the earthquake news from San Francisco. Professors Scott and Chamberlain, in answer to questions, said there was no connection between the recent eruption of Vesuvius and the seismic disturbance which wrecked San Francisco. "It is merely a coincidence, I think," said Professor Scott. "The old theory that there is a necessary connection between volcanic eruptions and earthquakes is pretty well exploded now. The two phenomena are too far separated to have any interrelation. Earthquakes are common in Northern India, where there are no volcanoes. It is true that the earth wave at Vesuvius may have been felt in some slight degree at San Francisco, just as a sound wave may register at a remote distance. The earthquake shocks in Japan, for instance, are always registered by the very delicate instruments in the Isle of Wight observatory." Professor Chamberlain said the quake at San Francisco might be due to a line of fracture in the Sierras that gives way now and then.

On Thursday Franklin's memory was honored in the Academy of Music by conferring the degree of LL. D., conferred by the University of Pennsylvania, founded by Franklin, upon Edward VII, in appreciation of the service rendered by George II in establishing the school which developed into the present institution. The honor was accepted through the British ambassador to the United States. At the same time degrees were conferred on 19 other eminent men, after which Attorney-General Carson delivered a brilliant eulogy upon Franklin.

The grave of Franklin in old Christ Church burying ground was covered with wreaths in the afternoon by representatives of the President of the United States, the commonwealth of Pennsylvania and the local institutions with which Franklin's name is immortally linked. This followed a parade of the military, Masons and postmen of the city, while the cruiser named for the state, lying off Arch street wharf, fired a presidential salute of 21 guns.

At night a brilliant reception was held in the ballroom of the Bellevue-Stratford, where the delegates to the Philosophical Society and the leading men and women of the city were introduced to each other by President Edgar F. Smith and Mayor Weaver, and by Prof. Hugo De Vries of Amsterdam, representing the foreign delegates. They stood upon a raised dais, under flags of all countries, and for more than an hour the line was passing by.

The concluding ceremonies were begun at the Academy of Music on Friday. Speakers were introduced by Governor Pennypacker, who presided jointly with President Smith of the Philosophical Society. Franklin was spoken of as a citizen and philanthropist by Horace H. Furness; as a printer and philosopher by President Eliot of Harvard, and as a statesman and diplomatist by Joseph H. Choate. Secretary of State Root presented to the Republic of France, on behalf of the Congress and by direction of the President of the United States, a gold medal in commemoration of this bi-centennial of Franklin's birth. It was accepted for the republic which had done so much, through Franklin's mediation, to aid the struggling colonies in their revolution, by Ambassador Jusserand. Mr. Choate formally presented to the United States the Earl Grey portrait of Franklin, which rested upon the stage in its gilt frame upon an easel.

The formal part of the celebration concluded with the session of the Philosophical Society in the afternoon. Before the reading of papers a telegram was sent to the California Academy of Science, expressing the grief of the Philosophical Society at the great calamity which had befallen San Francisco.

Prof. Paul Haupt of the Johns Hopkins University read a paper on "The Herodotean Prototype of Esther and Sheherazade." A paper on "The Use of Dilute Solutions of Sulphuric Acid as a Fungicide" was read by Prof. Henry Kraemer of Philadelphia, and Prof. William Keith Brooks of Baltimore read an essay on "Heredity and Variation, Logical and Biological." Franklin was represented as the one who was first to recognize that northeast storms were from the southwest, in a paper by Prof. William M. Davis of Cambridge, Mass. "The Elimination of Velocity Head in the Measurements of Pressures in a Fluid Stream" was the title of a paper by Prof. Francis E. Nipher of St. Louis, who is experimenting with apparatus to determine the wind pressure against sky-scrapers, the practical purpose of which is to assist architects in their work. Prof. Cleveland Abbe of Washington, D. C., showed that Franklin was a meteorologist of no mean ability. Dr. John A. Brashear of Allegheny read a paper on "Notes on the Production of Optical Planes of Large Dimensions," and Prof. William B. Scott of Princeton read a paper on "Notes on a Collection of Fossil Mammals from Natal."

The celebration was concluded with an elaborate banquet at the Bellevue-Stratford in the evening, at which Dr. S. Weir Mitchell was toastmaster.

In view of the disaster at San Francisco, the exercises which were to have taken place in Paris on April 20th, on the occasion of the unveiling of the statue of Benjamin Franklin, presented to the municipality of Paris by John H. Harjes, the American banker of Paris, were postponed.

The Paris Lighting Situation.

The prefect of the Seine has just presented a memoir to the Paris Municipal Council in which he gives the results of an examination of 12 propositions which have been made to him by various parties or companies, as a result of the advertised wish of the municipality to receive proposals for the carrying on of the lighting of the city of Paris on the expiration, in a year or so, of the several concessions now worked by the "secteurs." (These "secteurs," of course, are the sectors in which Paris, considered as a circle, has been divided for electric-lighting purposes, to give each company a share of the heavy "downtown" business.)

The examination of the prefect has given results which may be considered as negative. In fact, it appears from the report of the engineer in charge of the commission that the prefect of the Seine considers that two of the 12 projects submitted are complete from a technical as well as from a financial point of view; but it is stated that these projects do not provide adequately for the period of transition, which the municipality is so desirous should be adopted, on the running out of the concessions. This so-called period of transition, in fact, takes the aspect of a short concession, which the municipality desires to grant, under suitable guarantees, to allow it time to cast around and take stock of the doings of other cities in respect to municipal enterprise, before deciding to confide to a private concern a concession or concessions for any length of time. This period of transition, it is considered, should be worked by a single company, to avoid the inconvenience of dealing with the several secteurs now in existence.

The memoir goes on to state that the public appeal, decided upon on December 27th last, has not caused the submission to the city of any projects offering advantages superior to those contained in projects already in the hands of the commission. One of these projects was submitted by a syndicate formed last autumn in Paris, with the object of consolidating the Paris lighting interests and obtaining a concession from the city for future exploitation of electric lighting in the city. It is this project that the prefect of the Seine advises should be accepted. It is generally known as the Schneider-Mildé proposal, these two firms having controlling interests in the syndicate. In this scheme the problem of the "transition period" is solved by merging it in the new concession which is sought by the syndicate. The prefect considers that the proposals of the syndicate are attended with no risks and at the same time the interests of the city and those of the consumer are both well safeguarded.

It may be added that the sub-commission of the Municipal Council is not yet ready to take into consideration any proposals which may be made for the future regime of the lighting of the city of Paris, and the deliberations of this commission will form the subject of a report which may contain conclusions differing from those now presented by the prefect of the Seine in his memoirs M. V.

Free-alcohol Bill Passes Lower House.

The House of Representatives at Washington, D. C., has passed, almost unanimously, the free-alcohol bill. The bill provides that denatured domestic alcohol may be withdrawn from bond without the payment of an internal-revenue tax for use, not only in the arts and industries, but for fuel, light and power. The bill provides for its denaturing—that is, making it poisonous, so that it cannot be used as a beverage or for medicinal purposes. Mr. Young of Michigan opposed the bill on the ground that it would destroy the wood-alcohol industry. In his district alone 15,000 persons are employed in the manufacture of wood alcohol and $20,000,000 invested in manufactories. Champ Clark of Missouri pointed out, however, that most of the wood alcohol now made would be used for denaturing purposes.

World-wide Telephone Rates Disclosed by Canadian Inquiry II.

BRITISH POSTOFFICE.

The Postal Telegraph Department of the General Postoffice in England reports that the United Kingdom is divided into a number of exchange areas containing generally one large town and the surrounding smaller places. These areas vary considerably in size, the largest being the metropolitan area, which is about 640 square miles in extent. These areas are connected by long-distance or trunk lines, which are all owned and operated by the state. Circuits which may be of considerable length connecting exchanges within the same area are erected and worked by the party or parties supplying the local exchange service in the area.

There were 112,743¼ miles of long-distance lines on March 31, 1905, their cost being about $102.27 per mile of single wire, or $204.54 per mile of circuit. These lines were carried upon 10,958½ miles of poles and comprised 56,371⅞ miles of separate circuits. The charge for long-distance service is six cents for each period of three minutes' conversation for each 25 miles up to 100 miles, 12¼ cents for each additional 40 miles or fraction thereof above 100 miles.

The distances are measured "as the crow flies" between the central exchanges where the trunk lines are worked, except in the case of the lines between Great Britain and Ireland. In that case the mileage is calculated as the crow flies to the respective terminals of the cable, and an extra charge of 37 cents for each three minutes' use is made for the use of the cable. A charge of six cents for each three minutes' use is also made for the cable connecting the Isle of Wight with the mainland. Double periods are allowed for a single charge when the conversations take place at night.

Subscribers' circuits are with few exceptions of copper and metallic throughout. The size of wire varies from 150 pounds per mile to 800 pounds per mile.

The expenditure on trunk lines was $13,621,390 up to March 31, 1905. The cost of maintenance was $303,858.78 for the year ended March 31, 1905. This amount does not include depreciation. Three per cent. interest is paid on capital. The amount set aside for depreciation was $378,199.33 for the year ended March 31, 1905.

When Mr. Austen Chamberlain was postmaster-general in Great Britain he decided in view of representations made by Mr. Lough, M. P., to open experimentally some rural telephone call offices, that is to say call offices in villages by means of which the inhabitants may communicate with their nearest market town, and with callers at other village call offices on the same local system. The service was to be purely a local one.

Three districts were chosen for experiments: Cavan, in Ireland, in which Mr. Lough was interested; Fraserburgh, in Scotland, and Oakham, in England. The expense involved was small in these cases, as existing telegraph circuits could be utilized for calls also. All that was necessary was to make a few slight alterations and to provide some silence cabinets. Callers in the villages can arrange with their correspondents in the market town to attend at the call office at a certain hour, or they can first make a call to the market town in order to obtain the services of an express messenger there who will fetch the person required to the telephone. There has now been a fair opportunity of judging of the utility of arrangements of this kind, and it seems clear that, when the call offices are grouped around a town to which the exchange system has not been extended, very little use is likely to be made of the call offices and their maintenance will be unremunerative. At Oakham and Cavan, where there are no telephone exchanges, four cents is charged for each call, and if the services of an express messenger are required they have to be paid for at the ordinary express service rates, and the minimum charge for a message becomes 10 cents. This perhaps is more than the villagers can afford to pay for the privilege of speaking to their market town. In any case comparatively few calls have been made; and the receipts have not covered the expenses, although the latter have been small. At Fraserburgh the circumstances are different. There is a considerable postoffice exchange system there, and callers at the postoffice can speak to subscribers to the exchange without having to make previous arrangements with their correspondents or to employ express messengers. Moreover, as the charge for a local call on the Fraserburgh exchange is only one penny, one penny only has been charged for a local call-office call. The result has been that at Fraserburgh the call-office receipts have about met the expenses.

SOUTH AFRICA.

Johannesburg in the Transvaal has a population of 80,000. The telephone system is owned and operated by the government of the Transvaal Colony, and comprises 1,500 subscribers. There is one switchroom or central office, with 1,486 direct lines. Eighty-five outside extension telephones and 190 inside extension telephones connect with these direct lines.

The rates for business and residence telephones are:

Within a radius of two miles, $97.40 for the first connection; $85.23 for the second, and $73.05 for the third and [illegible] ... annum. There [illegible]

[illegible]

In Switzerland the [illegible] the government. [illegible] urban line [illegible] 18,500 kilometers [illegible] been for several [illegible] wire 1.5 millimeter in diameter [illegible] and for those in more exposed [illegible] wires two to three millimeters in diameter [illegible]. There are still in the Swiss telephone [illegible] great number of subscribers' circuits [illegible] bronze wire 1.25 millimeters in diameter, [illegible] are gradually being changed. Of the 47,314 subscribers' circuits there were at the end of 1904 still about 2,200 of single wire (grounded), [illegible] through to their central or switch [illegible]. On account of the extent of high-tension current plants all over the country, and the influence [illegible] thereby on the telephone lines, it has been [illegible] gradually to introduce for the telephone system exclusively the double wire, or metallic system.

For the interurban or long-distance connections, bronze wire three, four or five millimeters in diameter is used, according to the length and purpose of the lines. The interurban connections are, during the last few years, being constructed entirely of double wire. There are still 14 lines of single wire, existing from the older regime.

The expenses of the telegraph and telephone lines (the new constructions) are placed to the construction account. This amounted to $3,115,858 at the end of 1904. The interest paid is at present 3½ per cent. of the capital on December 31, 1903. The yearly amount of sinking fund for construction account is 15 per cent. of the capital on December 31, 1903. Charges for interurban calls as well as the charges for local calls are noted down by telephone girl clerks. A careful account is kept for each single subscriber, and the total amount is paid in every month through the postoffice.

During the last few years the government has begun to use simultaneous telephony and telegraphy on the interurban lines, employing the "Cailho" system. When the insulating conditions are good on these lines this arrangement has been quite satisfactory.

The population of Switzerland, according to the census of December 1, 1900, was 3,315,443. The total number of telephone subscribers in Switzerland is 47,314, or one telephone to 70 inhabitants.

GERMAN-BELGIAN COMPACT.

Agreement has been entered into between the Belgian and German governments concerning telephone service between the two countries. Lines constructed in both countries are connected so that the exchanges in Belgium and Germany may transact a toll business. The managements of the telephone departments in the two governments, however, can make extensions or improvements to the interconnecting system only by mutual agreement.

RUSSIA.

Nearly all the long-distance lines in Russia are owned and operated by the government. The total pole-route length of these is 1,521 miles. There are generally from 16 to 20 poles to each 1,167 yards. The cost of the St. Petersburg-Moscow lines, comprising two bronze metallic circuits, was $492.44 per mile.

Subscribers' circuits are overhead and underground. The former are principally of bronze, with a diameter of 1.2 millimeters, but there are also circuits of iron wire with a diameter of three millimeters for country subscribers. In the case of underground cables the circuits are copper and the diameter of the wires is 0.66 millimeter.

Revenue from the communications between St. Petersburg and Moscow in 1904 was $83,704.50, and during 1903 $63,610.23. Between Warsaw and Lodz in 1904 the revenue was $10,827.36, and during 1903 $9,500.72. The total expenditure upon the operation and maintenance of the telephone service between St. Petersburg and Moscow during each year is $18,025. For the telephone service between St. Petersburg and Moscow the surplus in 1904 was $36,050. Some of the long-distance lines are used for simultaneous telephony and telegraphy.

The switchboard in most general use has an equipment of 100 single lines and is made in the Ericsson factory at St. Petersburg. It costs $283.25. The same switchboard, with an equipment of 100 metallic circuits, costs $309. Multiple switchboards are also made at the same factory and cost from $3.61 to $5.15 for each number. A switchboard with magneto generator for operating magneto bells for two lines having double circuits costs $5.15. The same for two lines with single circuits costs $4.76. A simple switch for two lines with double circuits costs 72 cents. The same for two lines with single circuits costs 44 cents. Wall and desk telephones cost $16.48 each.

A lead-covered cable with 37 pairs of conductors costs $2.83 per toise (six feet four inches). The same with 112 pairs of conductors costs $5.15 per toise. The same with 400 pairs of conductors costs $13.39 per toise. Bronze wire of a diameter of [illegible]

[illegible]

At Hobart [illegible] with the exchange, [illegible] of which are [illegible] trunks, that is, telegraph [illegible]. [illegible] the call is received on a telephone relay [illegible] form of a "tone" on other, the calling current actuates a relay and a shutter drops. [illegible] tion coil with vibrator is used for calling. At Launceston there are four trunks, for all of which telegraph lines are used on the [illegible]. On the larger exchanges battery [illegible] are used for calling. At country exchanges the call is by magneto. The present central switchboards are now obsolete and will be immediately replaced by up-to-date equipments, the particular design being not yet decided on, probably central energy.

[*The end*]

Bell Telephone Output.

The American Telephone and Telegraph Company reports for March as follows: Output of instruments, 188,102, against 169,159 for March last year and 126,522 in 1904; instruments returned, 66,596, against 47,645 last year and 35,043 in 1904; net output, 121,506, against 121,514 last year and 91,479 in 1904; outstanding March 31, 6,046,080, against 4,781,736 last year and 3,972,095 in 1904.

GENERAL TELEPHONE NEWS.

The Davenport and Tipton Independent Telephone Company has sold its interests in Walcott, Iowa, to the German Mutual Telephone Company of Clinton, Iowa.

Among recently incorporated telephone companies are the following: Nelson Telephone Company, Nelson, Minn.; Valparaiso Telephone Company, Valparaiso, Neb.; Solon Telephone Company, Solon, Neb.; California Telephone Company, California, Mo.

A unique telephone fight is on at Webster City, Iowa. The Martin Telephone Company recently raised the rates on telephones in physicians' offices to that paid for other business telephones. As a result, 11 of the 13 doctors have removed their telephones, and the telephone company proposes to hire physicians to locate there to compete with the local doctors.

The Court of Chancery of New Jersey has appointed Charles M. Myers of New York receiver of the Telegraph and Telephone Company of America, a large holding company, with $30,000,000 capital stock. The liabilities are placed at $925,562, composed largely of unpaid assessments on stocks. The assets are $2,051,171, but of uncertain value, it is said, because they are composed of stocks and bonds of subsidiary companies, most of which are inactive.

The New England Telephone and Telegraph Company's stockholders will hold a special meeting on May 7th to act upon the directors' recommendation that the capital be increased from $30,000,000 to $50,000,000. Of the present capital stock the company has issued $28,000,000. Directly and through its sub-companies the company operates 200,000 subscribers' stations in Maine, New Hampshire, Vermont and Massachusetts. The new stock will be issued as funds are required for new construction, equipment and exchange buildings.

The annual meeting of the contract agents of the Bell telephone companies of the United States and Canada is announced to begin in Atlanta, Ga., on May 15th, continuing one week. There will be addresses by prominent officials, and other attractive features on the program. Two or more representatives from each of the Bell companies will be expected, besides officials and others interested. These meetings have usually been held in the north and east, but it was decided this year to bring the convention south, partly on account of the growth of the southern Bell system.

CORRESPONDENCE.

Great Britain.

London, April 11.—An almost perfect feeling of despair seems to be coming over promoters of private bills with the present government in power, for it is becoming abundantly clear that any public undertaking not promoted by a municipal authority in some shape or form will stand a very poor chance of being passed into law. The proceedings in connection with the London electric power bills have proved this up to the hilt. As I have already reported, the London County Council bill was read a second time and referred to a hybrid committee, while the other schemes meantime were suspended, but a right was given to appear against the London County Council bill. The promoters of the Administrative County of London bill accepted this dictum, but an effort was made to pass the new power bill, viz., the additional electric supply bill, as a measure solely to deal with the electrification of railways. This, in itself, was a laudable object and one which was strongly supported by the railway companies, for it is an open secret that none of the latter will ever take a supply from the London County Council. However, there was a strenuous opposition, and the bill was actually opposed by the cabinet, on whose behalf the House was asked to teach the promoters a lesson for attempting to secure a second reading, after the previous action of the government in sending the London County Council bill to a committee, where everyone could appear against it. The result was that the bill was rejected by a majority of nearly 200. The large proportion of business men interested in this matter view with apprehension the prospect of the supply of electricity in London being handed to the London County Council as a monopoly. Personally, however, I am of the opinion that there will not be time to pass any measure dealing with this subject this session, and that in consequence the whole controversy will be started de novo next year. Meantime large manufacturing works are leaving or threaten to leave London for the want of that cheap supply of electrical energy which is so essential to their industrial and commercial well-being.

It is interesting to note, also, that the whole action of the government in this matter has been of a party character, which, as has several times been pointed out, is much to be regretted. In addition to openly opposing all the schemes which were antagonistic to the London County Council scheme, it has appointed no fewer than seven supporters of the government out of the nine members which will form the committee dealing with the bills. It may be anticipated that at least one other member is not a radical municipalist, but, as I have suggested, save for the shortness of time, there would not be much doubt as to the result.

While on the point of municipal trading—and it is a most important one at the present time—it will be appropriate to point out that for the first time in its history the proposals of the London County Council to carry tramways over the Thames bridges, and the authority for London councils to supply electrical fittings on hire, have been passed in the lower house unopposed. The opponents are trusting in the House of Lords.

The interesting and prolonged discussion on electric winding for mines which has just been concluded at the Institution of Electrical Engineers is remarkable for the enormous quantity of statistics produced by the various speakers, all dealing with the same mines, but being based on different premises. The result was a fine confusion, without close and careful study of the figures afterward. The main object of the originator of the discussion was to show how far behind, in efficiency, electric winding is to steam winding, but the advocates of the former, in order to institute comparisons, produced figures worked out on a different basis, and thus there were two sides, each obviously making out the best case for itself; a not particularly desirable thing, from the point of view either of debate or impartial facts. One point was conceded all around, however, and that was that, whereas steam winding is much cheaper in initial capital expenditure, electric winding is much cheaper in running costs. The discussion has certainly awakened a general interest in the application of electricity to mines, which did not exist before, but the fact that a prominent member of the electrical profession should point out the shortcomings of electrical equipments, seems almost to have rankled in some minds.

The interesting statement was made in the House of Commons the other day that the rather frequent breakdowns upon the District Railway have been due to the use of German axles!

The National Telephone Company has just placed its wires underground in Birmingham, and the corporation has paid half the cost.

The development of the radial tram-car truck is being pushed here now, and the Birmingham Corporation has ordered that 150 of its new cars shall be fitted with these instead of rigid wheel trucks. The chief engineer of the Birmingham Tramway Company, which at present runs a lot of cars in the city, was an early inventor of a truck of this type.

A special meeting of the Underground Electric Railways Company of London has been held, at which it was decided to authorize the directors to raise further funds to the extent of $25,000,000 to be used in the prosecution of the objects of the company. It has been decided to abandon the use of the sliding exit doors in the middle of the electric coaches, as on several occasions passengers have been caught between them and hurt. I have witnessed one or two such accidents myself, which arise through the doors being out of the gateman's sight.

One of the London borough councils, which supplies electricity for its own street lighting at about five cents per unit, has been offered a supply for this purpose by a competing company at three cents. The company, if its offer is refused, has intimated that it will lay the facts before the London County Council and the Local Government Board. G.

New York.

New York city, April 21.—Preparation of the gas and electric-light contracts on the basis of the bids submitted by the companies on February 1st has been completed by Commissioner Ellison of the Department of Water Supply, Gas and Electricity, and he expects to lay them before the mayor on Monday. Corporation Counsel Delany already has gone over them, and it is expected that as soon as the mayor gives his assent the contracts will be signed, thus giving the lighting companies contracts for the first time in three years.

Dr. Schuyler Skaats Wheeler, chairman of the contest committee which will conduct the two-gallon efficiency automobile test in this city on May 5th under the auspices of the Automobile Club of America, has announced the conditions. The entry fee for each car is $10. The entries will close on May 2d. It is confidently believed that the results will have a wide-reaching effect in demonstrating certain practical principles in the economy and endurance of motor vehicles.

An investigation of the telephone rates in New York was begun by the Aldermanic Committee on Laws and Legislation this week. Alfred R. Conkling spoke in favor of the adoption of a 5-cent interborough telephone rate. D. A. Reynolds, who is the president of the Great Eastern Telephone Company, spoke in favor of the establishment of an Independent telephone system. While not urging the establishment of a municipally owned system, Mr. Reynolds said the city could run such a system on a 2-cent per call basis and make money. Martin Littleton, as counsel for the Atlantic Telephone Company, has sent a letter to the Board of Estimate, asking for the appointment of a subcommittee of the board, or of engineers acting in its behalf, to investigate the workings of the automatic telephone system which the Atlantic Company proposes to use if it gets its franchise.

The Commission of Gas and Electricity has received an opinion from the attorney-general holding that, upon application to the commission of a corporation for a certificate of authority to transact business, the commission need not permit the legality of the consent granted by the municipality to the corporation to be attacked. The question came up on the application of the Citizens' Lighting Company of Oswego. The People's Gas and Electric Company of the same city opposed the granting of the application and sought to attack the legality of the consent granted to the new corporation by the municipal authorities.

Paul J. Rainey has closed a contract with the De Forest wireless company for the installation of the De Forest space-telegraph system on his steam yacht Anona. This will be the first American steam yacht equipped with wireless, although the De Forest company says it has orders on hand for many other installations.

The governor has vetoed the Culleen-Keenan bill providing that street railways in Kings and Queens counties shall carry school children on their lines at a maximum rate of 3 cents. The governor says that, while the bills originate in a laudable desire to lighten the burdens of the people who have children of school age, they are disapproved because he deems them unconstitutional.

Under an opinion rendered by Corporation Counsel Delany to Commissioner Ellison of the Department of Electricity, the Great Eastern Telephone Company will have to go to the Board of Estimate for a new franchise if it intends to establish an Independent telephone system in this city. The corporation counsel declares worthless the company's claim to a franchise through the New York Electric Lines Company and goes on to deny the corporate existence of that company. The decision, however, is not going to end the fight. The concern, which wishes to compete with the New York Telephone Company, announced that it will try to force the city to permit it to lay wires. Papers are now being drawn in mandamus proceedings to force Commissioner Ellison to grant the necessary permit to open the streets. The counsel of the Great Eastern Telephone Company say that there is no doubt of the success of these proceedings.

Governor Higgins has approved the bills introduced by Senator L'Hommedieu repealing the special charters of the Lockport Water Supply Company, the Lewiston Water Works Company, the Lewiston Water Supply Company and the Buffalo and Niagara Power and Drainage Company. All are said to be inactive corporations. A memorandum filed with the approval says: "This legislation is in accordance with recommendations made by Governor Higgins in his message, that the scenery of Niagara Falls should be protected from further spoliation."

A bill introduced in the Assembly at Albany would compel the examining, licensing and registering of motormen on surface, subway and elevated railroads. By the terms of the bill the governor would appoint three persons, to hold office for three years, as the State Board of Examiners of Motormen. Severe penalties would be imposed upon those who operate cars without a license. Any corporation employing an unlicensed motorman would be liable to a fine of $500. C. I. C.

New England.

Boston, April 21.—Charles Neal Barney's petition for legislation providing for the licensing of electricians and the supervision of the electrical business in Massachusetts has been referred to the next Legislature by the present General Court. The accompanying bill provided for an examining commission of three persons and an annual licensing fee of $25 for each electrician.

The bill providing for the investigating and testing of safety and other devices on street cars, has passed both branches of the Massachusetts Legislature.

The House of Representatives has agreed to the public lighting committee's report asking leave to withdraw a petition for a referendum on propositions to build, buy or lease and maintain gas and electric plants by municipalities.

The House has passed a bill providing for the supervision of all companies engaged in the transmission of intelligence by electricty by the State Highway Commission.

In connection with the proposed establishment of an express service on the Boston Elevated Railway Company's lines in Boston, it has been ascertained that the charters of eight of the companies forming the West End Street Railway Company (whose lines are leased by the Elevated company) authorize the carrying of "persons and property." There will have to be a ruling on the West End company's authority to carry express on extensions built by it, as its charter carries no such authority. Fifty-five street-railway companies in the state, aside from the Boston Elevated company, now have the right to carry freight and express.

The Lowell (Mass.) Electric Light Corporation reports for February as follows: Operating expenses, $13,187, against $10,300 last year; net earnings, $10,912, against $10,490 last year; balance, $10,222, against $9,560 last year.

The Continental Public Utilities Company has filed its certificate of incorporation in Maine. It has a capital of $12,500,000. Milard W. Baldwin of Portland, Maine, is president. The company proposes to build and operate gas and electric-light plants and street and interurban railways.

The voters of Morrisville, Vt., have authorized the establishment of a municipal power station, which includes the building of a large dam across the Lamoille River at Cady's Falls, forming a lake of 106 acres. Electric power developed will be used by several industries in the town, as well as the company operating the electric railway between Waterbury and Stowe.

The Milford Construction Company has nearly completed the large dam across the Penobscot River between Oldtown and Milford, Maine. This dam will be 1,000 feet long, and a power house 234 by 80 feet will be built at its Milford end. The Allis-Chalmers Company will furnish 12 wheels of 800 horsepower each, and the Stanley Electric Company will furnish the generators. The electric power will be furnished manufacturing establishments along the river for 20 miles.

The Norwich, Jewett City and Voluntown Street Railway Company has begun the construction of an electric railway between Norwich and Jewett City, Conn., which will be the final link in an electric line connecting Norwich, New London and Willimantic, Conn., and Worcester and Boston, Mass. The company is controlled by the Consolidated Railway Company.

According to automobile dealers, the demand for electric automobiles is greatly increasing in Boston and vicinity.

The Edison Electric Light Company of Brockton, Mass., reports for February as follows: Operating expenses, $9,984, against $8,857 last year; net earnings, $4,301, against $2,995 last year; balance, $3,572, against $2,325 last year.

The Trolley Express Company has begun operating an express business over the Consolidated Railway Company's road between New Haven and Branford, Conn., and between New Haven and Wallingford, Conn.

Prof. H. W. Clifford of the Massachusetts Institute of Technology will deliver a lecture on "Enclosed Fuses" before the Worcester (Mass.) Polytechnic Institute branch of the American Institute of Electrical Engineers tomorrow evening. B.

Southeastern States.

Charlotte, N. C., April 21.—Although the town owns a first-class electric-lighting plant the Savannah River Power Company will supply power to Greenwood, S. C., for street lighting and other purposes on account of the cheap rate which the

power company offers. A 10-year contract with the city has been made.

A contract has been signed with the Consolidated Electric Company of Charleston, S. C., to supply lights to Sullivan's Island, which will be made a pleasure resort this summer.

The annual report of the United Railways Company of St. Louis shows that the earnings and other income have increased from $4,260,407 in 1900 to $8,460,016 in 1905, while the operating expenses have increased nearly $2,000,000 in the same time. The surplus was less than $900,000 in 1900 and the report shows it to be $3,141,647 in 1905.

Seasongood & Meyer of Cincinnati have bought the $10,000 electric-light bonds of the town of Mooresville, N. C.

R. C. Black of Atlanta has been elected superintendent of the La Grange (Ga.) municipal lighting plant and will soon have the new city lights burning.

It is reported that the Consolidated Street Railway Company of Wilmington, N. C., is endeavoring to secure control of an extensive dummy freight line in that town and operate it by electricity.

Atlanta and Macon capitalists are figuring on a new electric plant at Macon, Ga. The city is at present lighted by the Macon Railway and Light Company at $75 per light a year.

White & Middleton of Baltimore, well known contractors, will furnish dynamos for submarine boats for Russia and Germany. They will install in the boats gasoline marine engines, and while the boats run at the surface of the water the engines will be used to store electricity that will run two large dynamos. While running under the surface the boats will be driven by the electric motors entirely.

The Railway and Electric Company has regained control of the Sedalia Transit Company at Sedalia, Mo., and will make extensive improvements.

The Sumter (S. C.) Power, Light and Water Company has been chartered with $80,000 capital by Marion Moise of Sumter and others.

The Baltimore and Ocean City Railroad, chartered recently by the Legislature, promises to build a mono-rail line between the two points named. It is said the charter is the property of the American Mono Rail Company, organized some years ago to develop the invention of Mr. Howard H. Tunis of Baltimore. E. L. Tunis, Ruxton M. Ridgley and others are interested.

J. Levering Jones of Philadelphia recently visited the state of Kentucky with capitalists interested with him in the recent purchase of the electric and ice plants at Lexington, the interurban lines radiating therefrom and the electric-railway system of Frankfort. The promoters inspected their new holdings. L.

Indiana.

Indianapolis, April 21.—The Andrews Electric Railway and Power Company has filed articles of incorporation, capitalized at $35,000, to construct and operate a street-railway system in the city of Andrews. H. B. Thornton is president, T. D. Dewire vice-president and W. E. Nichols secretary.

The Indiana, Columbus and Eastern Traction companies, incorporated at Columbus, Ohio, during the past week, in addition to building from Dayton to the state line, proposes also to build to Richmond, thereby completing traction connection from Zanesville, Ohio, to Terre Haute, Ind. The capital stock is $1,000,000. The directors are headed by W. Kelsey Schoepf.

Prominent officials of the Indiana Union Traction Company who organized and incorporated a coal-mining company last winter have secured 1,700 acres of coal land in Sullivan County. The company is now planning to erect an immense power plant at these mines, which will furnish power for its hundreds of miles of Indiana roads as well as for the lighting of cities and the supplying of power and light to the people along the line.

The Goshen, South Bend and Chicago Railroad Company has filed articles of incorporation, capitalized at $150,000. The company proposes to build an electric road across Northern Indiana. The directors are F. C. Raff, D. D. Bates and John W. Tell of South Bend; Anthony Dehl of Goshen, and George S. Lay of Lafayette.

On April 28th work will begin on the construction of the Indianapolis, New Castle and Toledo traction line, according to the statement of C. N. Mikels, one of the chief promoters. Three branch lines will be built—one to connect with Greenfield, one with Richmond, and one with Muncie.

A merger of the traction lines in Vanderburgh and adjacent counties is contemplated by the Widener-Elkins syndicate, which has purchased the Evansville street-railway system, and is expected to purchase the Evansville and Princeton traction line as well as several other traction lines now being built out from Evansville. Murdock & Marshall of Lafayette are the active agents of the syndicate.

The announcement is made that the Remy Electric Company of Anderson has decided to remove its plant to Richmond, a bonus of $65,000 having been given to the company by the Richmond South Side Improvement Company. The company agrees to erect a $20,000 factory building and employ 75 men.

It is announced that a deal involving the sale of the Evansville Gas and Electric stock to the E. H. Clark syndicate of Philadelphia has been consummated. [illegible] stock [illegible] understood [illegible] of [illegible] regarded [illegible] the [illegible] of the [illegible] Evansville [illegible] Vernon, Princeton [illegible] line and other traction [illegible] in the field.

The City Council of [illegible] light plant to the [illegible] company [illegible] the city retaining the [illegible] The company agrees [illegible] at $50 a year, all night [illegible] pay $20,000 cash and [illegible] The plant is said to have been [illegible] the city, and the [illegible] have been [illegible] It is understood that the purchasers [illegible] build a new plant.

The city of Crawfordsville [illegible] considering [illegible] proposition to sell the municipal lighting plant. There is a division among the people as to the advisability of selling the plant. However, it [illegible] believed the people are tired of municipal ownership of the local lighting plant. S. S.

PERSONAL

Charles A. Brown, well known to the electrical interests, will remove his office to 1550 Monadnock Building on May 1st. Here he will continue the practice of patent law, in association with Lynn A. Williams, Charles J. Schmidt and Harvey L. Hanson.

Francis B. Crocker, professor of electrical engineering at Columbia University, and Henry G. Stott, superintendent of motive power of the Interborough Rapid Transit Company, have been invited by President Roosevelt to serve on the advisory board of fuels and structural materials.

Frank H. Gale, the advertising manager of the General Electric Company, has been elected president of the Technical Publicity Association of New York city. Mr. Gale is highly esteemed by all his friends and acquaintances, who will be pleased at this recent recognition of his ability and popularity.

Francis Lewis Sperry, well known as a mineralogist and expert chemist, died in Tallmade, Ohio, on April 17th. Mr. Sperry was 44 years old and was the discoverer of "Sperryite," named for him. He was a graduate of Sheffield Scientific School, Yale University. He was a member of the American Society of Mining Engineers.

An important change recently announced in the offices of the Southern Bell Telephone Company is the separation of the offices of vice-president and general manager, previously held by Mr. W. T. Gentry, with headquarters in Atlanta. Mr. Gentry will retain the position of vice-president, while Mr. J. Epps Brown has been appointed general manager. This action results from the increasing business of the company. Mr. Brown is a young man, but has had wide experience in his profession.

Robert L. West, who for the last six years has been district superintendent of the state of Georgia for the Southern Bell Telephone Company, has tendered his resignation to Vice-president Gentry in Atlanta. Mr. West started telephone work in Richmond and when only 19 years old was manager of the Danville (Va.) exchange, later managing the exchanges at Charlotte, Birmingham and Richmond. During Mr. West's administration in Georgia the system has increased from 13 to 50 exchanges. His resignation is generally regretted by the company.

In recognition of his long tenure in the office of president of the Institution of Electrical Engineers, and of his hard and faithful work, Mr. Robert Kaye Gray, past-president of the Institution, was induced to make the necessary sittings for two fine paintings of himself, one of which was presented to him and the other to the Institution. The portraits were also to show the appreciation of the members for his munificent entertainment of the foreign telegraphic engineers on the occasion of the International Conference, held in London. The portrait was painted by Miss Beatrice Bright, and the presentation address was made by Sir Joseph Swan.

ELECTRIC LIGHTING

P. L. Pyle has purchased the local electric-light plant in Fort Gibson, I. T., and will enlarge it.

The city of Aberdeen, S. D., has voted $36,000 in bonds for an electric-light and power system.

Edwin Sawyer of Rushton, La., has been granted a franchise for an electric-light plant in Homer, La.

Poteau, I. T., has given a 20-year franchise to R. C. Alexander of Abilene, Texas, for an electric-light system.

Specifications have been adopted by the city of Fond du Lac, Wis., for the granting of a franchise to construct and operate a plant to furnish to the city of Fond du Lac and its citizens electricity for light, heat and power. Bids will be received for the sale of the franchise at the office [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

It is announced that the [illegible] the Electric Light Company of [illegible] has been purchased by the [illegible] H. M. Byllesby & Co. of Chicago. [illegible] of this concern have [illegible] few weeks completing the [illegible] tion. The Electric Lighting [illegible] has owned the gas [illegible] electric lighting plants of the [illegible]

The Philadelphia Suburban Heat, Light and Power Company, which was organized [illegible] ago by State Treasurer William L. [illegible] J. Makiver and several Philadelphia capitalists, [illegible] purchased the plant of the Lansdowne [illegible] Light Company at Lansdowne, Pa. [illegible] purchased the plant of the Farraday Heat, Light and Power Company at Morton. This plant and the one at Lansdowne will be abandoned after the main plant at Darby has been completed. It is understood that the company will extend its system throughout Delaware County, and all lines will be supplied with light and power from the main station at Darby.

The price of the tantalum lamp has been reduced by the Siemens & Halske Company from 67.3 cents to 60.8 cents each, as a result of the introduction of improved methods of construction and a considerable increase in the production, which have lowered the cost of manufacture. As an illustration of the economy, it is stated that on the basis of the present price of 9.74 cents a kilowatt-hour in Berlin, a lamp of 25 candlepower burning 1,000 hours in a year will consume less energy to the extent of $2.80 than a carbon-filament lamp of the same candlepower. The saving in current in the case of a 10-candlepower tantalum lamp is said to be 85.6 cents in 12 months.

ELECTRIC RAILWAYS

A. B. Campbell of Spokane, Wash., is one of the trustees and chief financial backers of the Columbia and Walla Walla Traction Company, incorporated for $3,500,000, to build an electric road in the vicinity of Dayton and Waitsburg, Wash.

The Spokane and Inland Railway will have its line completed from Spokane to Palouse and Colfax by January 1, 1907, according to a statement by F. A. Blackwell, general manager of the company. The contractors have 800 men on the work.

The Washington, Baltimore and Annapolis electric railway may be completed and ready for operation in 1907. Contracts are now being let for the construction. It is thought that franchises for the terminal facilities in Baltimore will be secured within a few weeks.

Governor Stokes has signed the bill passed by the New Jersey Legislature authorizing electric railways to carry freight through such cities and towns as may pass ordinances permitting them, subject to such restrictions as may be imposed by these cities and towns. Several companies are already preparing to take advantage of the law.

The State Railroad Commission of Indiana has taken steps to compel the steam railroads and electric lines of Indiana to provide ample appliances to prevent wrecks at intersections of the roads. Rules have long been established regarding the intersection of steam railroads, but the matter of intersections of steam and electric roads is a new one in the state.

A newspaper dispatch is to the effect that Col. Fred P. Cobham of Jamestown, N. Y., is the inventor of a new and powerful electric light for use on the rear of electric cars, subway and elevated trains. One of the new lights has been successfully tested in Warren, Pa., it is said. The backers of the invention have received an invitation to demonstrate it before the officers of the Inter-

borough system in New York, and have been promised an order of 12,000 lamps if successful for use on the subway cars of the system.

The Spokane and Pend d'Oreillo Rapid Transit Company has definitely located most of its line between Spokane, Wash., and Lake Pend d'Oreillo, a distance of 44 miles. It has acquired 1,600 acres of land on the southwestern shore of the lake and proposes building a town at that point. John Russell, Jr., of Milwaukee has been added to the engineering corps of the company.

POWER TRANSMISSION.

The Mississippi Water Power Company is in process of formation, it is said, with A. S. White as head. It is also rumored that C. C. Cokefair, president of the Great Northern Development Company of Duluth, Minn., is interested. The company is reported to have $20,000,000 available and about 25,000 horsepower will be generated by means of two dams to be erected across the Mississippi River at Clearwater, Minn., and Monticello, Minn. Most of this power would be utilized at Minneapolis.

The statement was made by F. A. Dudley, vice-president of the Niagara Falls Electrical Transmission Company, before the House committee on rivers and harbors in Washington, D. C., a few days ago that Niagara River was greater in volume at the present time than it had been in years; that the use of its waters for the development of power so far had not detracted from the scenic beauty of the falls, and that at least 30 per cent. of the flow might be diverted before any difference in the volume of water could be detected.

The Thompson Power Company of Washington County, Tenn., capitalized at $30,000, has been granted a charter. T. M. Thorne, Robert Martin, R. M. May, J. H. Epps and E. J. Baxter are the incorporators. The company has been formed for the purpose of improving the waterpower in the following streams and counties of Tennessee: Nolichucky River, Washington County; Conasauga, Hiawasse and Oconee rivers in Polk County; Conasauga River, in McMinn and Monroe counties; Little Tennessee River, in Blount and Monroe counties. The company is authorized to construct and maintain dams, piers and locks for the purpose of generating power for the manufacture of electricity

The Keewatin (Ont.) Power Company will offer for sale at auction its developed waterpower on the west branch of the Winnipeg River, at the outlet of the Lake of the Woods, town of Kenora, Ont., on July 5th. The characteristics of the plant are said to be: Effective horsepower, 28,000; fall, 19 feet; water supplied directly from the Lake of the Woods; entire immunity from ice difficulties of every kind; massive granite dam, on bed-rock foundation; 386 acres of land for utilizing power; direct connection with the main line of the Canadian Pacific Railway at Keewatin Station and direct navigation connection with the Lake of the Woods and Rainy River. R. A. Mather is manager of the company.

Increasing attention appears to be directed in India to the possibilities of utilizing for power purposes the enormous volumes of water now annually running to waste during the monsoon season in the Ghats. According to the February issue of the Indian Textile Journal, the subject is now approaching a practical stage, and an English company, called the Bombay Hydro-electric Syndicate, has been formed, under the auspices of Messrs. Tata and of leading London financiers, to study the question. Dr. John Mannheim of the firm of Alfred Dickenson & Co., who are the engineers to the syndicate, is studying the electrical part of the scheme, and Mr. R. B. Joyner, M. I. C. E., has been engaged during the last winter with the final investigations respecting the hydraulic section of the undertaking. It is stated that the ease with which large quantities of water giving a magnificent fall can be stored within a comparatively short distance from the proposed power-supply station renders this one of the finest hydro-electric propositions ever contemplated.

PUBLICATIONS.

The Goldschmidt Thermit Company of New York city has issued a small pamphlet on the use of Thermit for rail welding, wheel repairing, butt-welding pipes, repairing steel castings, etc. The pamphlet is interesting and contains many suggestions for those not thoroughly alive to the possibilities of Thermit.

Little economies, as promulgated by "The Hughes Idea," are set forth in a neat booklet which will be of interest and value to all men owning or operating engine and boiler rooms. The booklet gives many hints as to economies which bring results. It is published by Milton L. Hughes & Co., consulting engineers, 324 Dearborn Street, Chicago.

The Department of Commerce and Labor, through its Bureau of Statistics, has issued two volumes, one of which, the Statistical Abstract of the United States, 1905, contains something over 600 pages, and the other, entitled "Commerce and Navigation of the United States, 1905," contains about 1,200 pages. The publications of the Bureau of Statistics which present the record of commerce from month to month aggregate about 3,000 pages during the year, but the summarization and analysis of the full year's commerce are contained in the two volumes named.

A beautiful piece of work is the new fan-motor catalogue of the Sprague Electric Company. In addition to its well-known standard direct-current fans, the company is this year listing a line of high-class alternating-current desk and bracket fans. All these types are shown in the new catalogue, the pictures being accompanied by ample descriptive matter.

The H. B. Camp Company of New York has just published a valuable little book dealing with the art of protecting cables. The divided Camp tile is given special attention. The book is full of diagrams showing the Camp products installed for the various services—in floors, for wall ducts, for high and low tension service in underground construction, etc. Plans and sections of manholes are given showing the advantages of divided Camp tile.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., is sending out Bulletin No. 19 (superseding No. 11). It is an attractive and complete book of 50 pages devoted to generator-call telephones. The various instruments and parts are fully described and nearly everything is illustrated by half-tone. The company has abandoned the idea of publishing a complete catalogue for various reasons, and instead is publishing bulletins on the loose-leaf method, which will be sent to anyone interested.

Latest practice in multiphase revolving-field belted generators is exemplified in the machines described in Bulletin No. 1073, issued by the Fort Wayne Electric Works of Fort Wayne, Ind. These machines are described in a comprehensive manner in this bulletin, as are small direct-current generators in Bulletin No. 1077. Another valuable piece of trade literature issued by this company is its instruction book on type K, multiphase integrating wattmeters. Numerous excellent diagrams are given in this little book which will be found a downright help to the central-station man.

Full details and excellent illustrations of the various types of electric hoists built by the Wellman-Seaver-Morgan Company of Cleveland are contained in an attractive 36-page booklet just published by the company. Besides a large line of steam hoists and haulages, the company builds electrically driven hoists, equipped with motors of various types, and in a variety of styles and sizes. The company has built such hoists up to 800 horsepower, and is prepared to submit proposals on either standard or special equipment to meet the requirements and work to be done. These hoists may be equipped with single or double drums, or with reels, as may be specified. The book contains much valuable information.

From the electrical department of the Allis-Chalmers Company, Milwaukee, comes a new bulletin—No. 1050—descriptive of waterwheel type alternating-current generators. Besides a number of excellent half-tones, showing installations of these alternators in service, the bulletin illustrates the various parts of the machine. The Allis-Chalmers standard waterwheel alternators are of the horizontal type, having a base, two bearings and shaft extended for the reception of a flange coupling. The company has also made vertical-type machines for direct connection to vertical turbines and is prepared to build alternators to meet special conditions. The new bulletin fully describes the details of construction and operation of these generators.

Bulletin No. 603 from the Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass., deals with the merits of carbon-break circuit-breakers—types C16, C7 and C11. There are some fine half-tone illustrations showing complete instruments and parts, also diagrams. The three types of circuit-breakers described and listed are designed to meet every requirement for switchboard service and also the requirements of users of both direct and alternating-current motors. The type of circuit-breaker which opens automatically on the occurrence of an overload or short circuit will meet the requirements of most users of circuit-breakers. The three lines of breakers are adapted to other requirements, such as automatic opening under low-voltage or under-load conditions. They may also be furnished with shunt-trip attachments, with coils for connecting in shunt across the circuit, which cause the breaker to open when a controlling switch located at a distant point is closed.

The new car-repair shops at Fort Smith, Ark., of the Fort Smith Light and Traction Company have been made the subject of a descriptive article published in pamphlet form by H. M. Byllesby & Co., engineers, of Chicago. The street-railway system of Fort Smith, Ark., has undergone a complete reconstruction since it was acquired by the Byllesby company, a little more than a year ago. The power house has been rebuilt and enlarged, the lines extended, a pleasure park containing more than 100 acres opened up, and other improvements tending to put the system on a well-paying basis have been inaugurated. Of the new features, the shops recently erected to care for the equipment contain many interesting features. In their design all the requirements of shops for a small system were considered and well worked out by Mr. O. E. Osthoff, chief engineer for H. M. Byllesby & Co.

A new booklet issued by the Buckeye Electric Company of Cleveland possesses the stamp of originality. Though the Buckeye lamp is the article which the booklet is supposed to bring to the fore, there are many other interesting things than lamp talks, among which might be mentioned a number of fine half-tone illustrations, showing views of interiors and exteriors lighted by Buckeye lamps.

SOCIETIES AND SCHOOLS.

The National Electric Light Association expects to have a full thousand names on its membership list at the time of the Atlantic City meeting, June 5th to 8th. Only 30 more are needed to make up this number, and at the rate applications are coming in there is no doubt of the full number being reached. The executive committee of the National Electric Light Association has decided to recommend to the exhibitors the adoption of a uniform style of booth construction and decoration for the convention to be held in Atlantic City, N. J., June 5th to 8th. A comprehensive plan has been submitted by Mr. M. A. Singer, who has done a great deal of work for other associations.

SPACE TELEGRAPHY.

The De Forest Wireless Telegraph Company will establish a new station on the twelfth floor of the National Bank of Commerce at Norfolk, Va., and will handle messages to a distance of about 1,000 miles, it is said.

Consul-general Ragsdale writes from Tientsin that the Chinese government has arranged to establish several space-telegraph stations throughout China for experiment with the Marconi system, and instruct Chinese operators in working it. The apparatus has been installed on four Chinese men-of-war at Shanghai and at the three North China cities of Tientsin, Peking and Paotingfu, the radius of action being about 230 kilometers and the cost about 25,000 taels. An Italian officer has been appointed, not only as instructor, but to act as engineer of the installations.

MISCELLANEOUS.

An ordinance has passed first reading in the council of Memphis, Tenn., to establish the office and define the position of electrical inspector; to provide to maintain the position by fees; to establish rules and regulations for the installation and maintenance of electrical wiring and apparatus; to provide for the licensing of electrical contractors, and to provide penalties for the violation of the ordinance.

Fearing the work of "firebugs" or other damaging mischief, threats of which have been made against its mining property, the Trenton Mining Company of Trenton, Mo., is said to have erected about its works a high wire fence, all the metal parts of which are charged with electricity. Within this inclosure the non-union miners, all of whom are small stockholders in the company, are working full hours in security from outside interference. A watch is also maintained over the works at all hours. Notices are posted along the fence warning strangers of the presence of the electric current, and forbidding trespassing upon the grounds.

The Electrical Industrial Company of Geneva, Switzerland, recently made an interesting series of experiments on three of the 20,000-volt direct-current machines of the St. Maurice-Lausanne plant to ascertain if 60,000-volt direct-current transmission were possible. These experiments having given satisfactory results, the Moutiers-Lyons electric power-transmission plant (180 kilometers in length), which is now being completed, was arranged for a pressure of 56-57,000 volts. In view of the encouraging results obtained in this connection, the Electrical Industrial Company is continuing the tests in the presence of Swiss, French and English engineers on direct currents of even higher pressures. It is thus possible for the first time to observe the effects of continuous current at pressures ranging up to 100,000 volts between the line and the ground, corresponding to a pressure of 200,000 volts between the wires, in the case of a power-transmission plant.

TRADE NEWS.

The E. M. F. Electric Company of Colorado Springs, Colo., has sold its business to the Central Electric Company of that place.

The India Rubber and Gutta-Percha Insulating Company will move its offices in New York to the Postal Building, 253 Broadway, on May 1st.

The American Steel and Wire Company of Chicago will install at Anderson, Ind., a 200-kilowatt Allis-Chalmers type I generator recently purchased.

The Hammermill Paper Company of Erie, Pa., will install a 150-kilowatt Allis-Chalmers type H generator and a 175-horsepower type H motor, recently ordered. These units will be built at the electrical works of the Allis-Chalmers Company at Cincinnati.

BUSINESS

The Brown Specialty Machinery Company, 71 West Jackson Boulevard, Chicago, has made arrangements with the Reliance Instrument Company to act as exclusive sales agent for the Reliance voltmeters and ammeters. These instruments are well known to the trade as filling a need for a low priced device that does satisfactory work.

The Westinghouse Machine Company of East Pittsburg, Pa., has recently contracted with the Olean Street Railway Company to install in its power house at Ceres, N. Y., two gas engines for supplying current to the Olean Street Railway, serving Olean, Ceres, Bolivar, etc. In the near future power will also be supplied to an interurban railway system between Olean and Salamanca, N. Y., a distance of 15 miles. The engines are to be [illegible] double-acting [illegible] tribution [illegible]

[illegible] ing agent [illegible] company [illegible] great [illegible] portant [illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 17, 1906.

817,736. Electrostatic Apparatus. Lucien I. Blake, Lawrence, Kan. Application filed January 23, 1905.

Combined are an induction coil producing alternating high-potential impulses in its secondary winding and a converter comprising a casing, a covered electrode and an exposed point electrode within the casing and having a screw adjustment, one of the electrodes being connected to a terminal of the induction coil.

817,749. Electrical Apparatus for Determining the Location of Metallic Ores. Fred H. Brown, Los Angeles, Cal. Application filed March 31, 1902.

Means are provided for establishing two electrical circuits, one of which includes a variable resistance and the other is adapted to contain the portions of the earth to be tested. There are means for causing a divided current of electricity to pass over the circuits in unequal volumes, means for indicating the difference in the volumes, a contact for movably engaging with the resistance to equalize the volumes, and a telephone receiver for determining when the volumes are equal, the receiver being in the circuit having the variable resistance and connected with and forming a part of the means for indicating the difference in the volumes.

817,761. Telephonic Repeater. Merritt Gally, Brooklyn, N. Y. Application filed April 14, 1904.

In a telephone repeater for repeating telephonic pulsations from one telephone line to another are a single receiving diaphragm and two independent receiving magnets. Both magnets are on one side of the diaphragm and operate the single diaphragm, one of the magnets for connection with one telephone line and the other magnet for connection with the other line. (See cut.)

817,767. Electric Furnace. John F. Hammond, Brewster, N. Y. Application filed April 13, 1905.

The combination with a muffle whose interior is wound with a heat-generating wire consists of a casing for the muffle and whose exterior is wound with a resistance wire, both of the wires being connected, and means for traveling from one to another of the convolutions of the resistance coil for varying the resistance.

817,781. Multiple Switchboard for Telephone Exchanges. Milo G. Kellogg, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed November 30, 1891.

A metallic-circuit and a ground-circuit line are connected together in a complete circuit for conversation from the ground of the subscriber's ground-circuit line through such line and thence through the metallic-circuit line to ground at the central office. There are two circuit connections of high retardation, one for each line, through both of which respectively the complete circuit is grounded at the central office, the line annunciators forming part of the circuit connection.

817,807. Electric Motor. Charles H. Roth, Chicago, Ill., assignor to Roth Bros. & Co., Chicago, Ill. Application filed December 27, 1904.

The combination consists of a field magnet having a main pole and two supplemental poles, all of like polarity, one of the supplemental poles being located at each side of the main pole, the combined areas of the supplemental poles being less than that of the main pole. There are means for changing the magnetic strength of the main pole without affecting the strength of the supplemental poles. (See cut on next page.)

817,827. System of Charging Storage Batteries. Asbury G. Wilson, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 14, 1905.

A railway signaling system having a primary source of alternating-current supply is provided with means for changing the alternating current into a unidirectional current. Storage batteries are charged by the unidirectional current, and feed wires extend from the storage batteries to the signaling system.

817,832. Electroplating Tank. Clarence G. Backus and George L. Wallace, New York, N. Y., assignors to Zucker & Levett & Loeb Company, New York, N. Y. Application filed July 27, 1905.

A tank, arms attached at one end to a side of the same and a rotatable drum supported by the outer ends of the arms, and means for raising the drum out of the tank and lowering it on one side of the tank substantially constitutes the device.

817,843. Electrical Measuring Instrument. John C. Gano, Chicago, Ill., assignor to the International Electric Meter Company, Chicago, Ill. Application filed July 24, 1905.

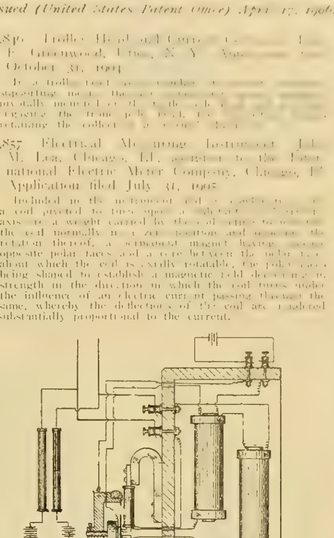
The combination with a bracket is composed of a movement supported by the bracket comprising a pair of pole-pieces fixed upon the bracket, a moving coil pivoted to rotate between the pole-pieces, a horseshoe magnet between the arms of which the pole-pieces are adapted to fit, and a clamp independent of the pole-pieces for holding the magnet and bracket together

817,850. Trolley Head and Current [illegible] F. Greenwood, Utica, N. Y. Application filed October 31, 1904.

In a trolley head [illegible] supporting [illegible] pivotally mounted [illegible] engage the trolley [illegible] retaining the collector [illegible]

817,857. Electrical Measuring Instrument. [illegible] M. Lea, Chicago, Ill., assignor to the International Electric Meter Company, Chicago, Ill. Application filed July 31, 1905.

Included in the instrument [illegible] a coil pivoted to turn upon a [illegible] axis, a weight carried by the coil [illegible] the coil normally in a zero position and [illegible] rotation thereof, a permanent magnet having [illegible] opposite polar faces and a core between the polar faces about which the coil is axially rotatable, the polar faces being shaped to establish a magnetic field decreasing in strength in the direction in which the coil moves under the influence of an electric current passing through the same, whereby the deflections of the coil are rendered substantially proportional to the current.



NO. 817,761. TELEPHONIC REPEATER.

817,858. Automatically Tripping Trolley Pole. Thomas H. Mars, Chicago, Ill. Application filed July 12, 1905.

A trolley pole having a base support with which the lower end of the pole is pivotally connected has a spring-actuated tension member detachably connected with the pole. A tripping mechanism is arranged to effect the disengagement of the tension member from the pole when the latter rises to an abnormal angle and a lost-motion mechanism is connected with the trolley pole at a point between the pivot and trolley engaging end thereof and also connected with the tension member so as to advance the latter into position to reengage the trolley pole when the latter is drawn to a horizontal position.

817,867. Supervisory Signal for Telephone Switchboards. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 24, 1902.

A local circuit having two parallel branches with a signal device in each branch, means for closing and closing each branch, a resistance in the undivided portion of the circuit and an electromagnetic switch controlling a shunt or shift circuit of the resistance, the source of current, signal devices and resistance being proportioned to prevent the actuation of either signal device when both of the parallel branches are closed, one of the signal devices being adapted to be actuated by the increased current when the resistance is shunted by the switch, are the principal features.

817,869. Electrical Measuring Instrument. Joshua Patrick, Chicago, Ill., assignor to the International Electric Meter Company, Chicago, Ill. Application filed August 3, 1905.

Combined with a coil frame and the coil disposed upon the inside of the frame are trunnions mounted upon the ends of the coil frame, bearing jewels mounted in the ends of the trunnions, supporting brackets opposite the ends of the coil frame, and pivot screws passing through the brackets and having pointed ends entering the jewels and forming bearings upon which the coil frame may freely turn.

[illegible] land, [illegible]

817,899. [illegible] October 7, 1904. [illegible]

817,920. Metering of Telephone Service. Isidor Kitsee, Philadelphia, Pa. Application filed October 29, 1904.

Means are [illegible] value of the [illegible] means embracing [illegible] make and break [illegible] to be registered, means [illegible] means in the circuit of the subscriber [illegible] source of current for the make and break [illegible] embraces at the subscriber's station [illegible]

817,921. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa. Application filed June 24, 1904. Renewed December 26, 1905.

A line of transmission consists of [illegible] of a pair of twisted wires, [illegible] being in operative relation to [illegible] station; the second wire of [illegible] relation to one wire of the third section [illegible] wire of the third section is [illegible] receiving device of the second station [illegible] the line being connected through instruments [illegible] conductor.

817,926. Transformer. Carl A. Lehr, Wilkinsburg, Pa. Application filed April 27, 1905.

A transformer comprising [illegible] circuits, the circuits being divided into [illegible] sections, has links connecting the inner and [illegible] nals of the sections of the low voltage circuit, the [illegible] being disposed alternately inside and outside [illegible] tions of the high voltage circuit.

817,945. Electric Controlling Device. Frederick L. Willard, Brooklyn, N. Y., assignor [illegible] to George Weiderman, New York, N. Y. Application filed October 2, 1905.

The device includes a number of [illegible] number of circuit-breakers [illegible] therewith, an electrical circuit through the [illegible] of the electromagnets and [illegible] a supplemental winding [illegible] through the [illegible] and movable members [illegible] corresponding [illegible] main winding [illegible] position [illegible]

817,959. Alarm [illegible] for Telephone Exchanges. Edward B. Craft, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 5, 1904.

A protective device [illegible] ing strip and [illegible] to one of the terminals [illegible] nected with the [illegible] spring to maintain [illegible] carried by the spring [illegible] holding the target [illegible] being adapted upon the [illegible] target into [illegible]

817,975. Ultra-violet Lamp. Thomas B. Kinraide, Jamaica Plain, Mass. Application filed June 12, 1905.

[illegible]

817,998. Means and Method of Transmitting Power. William Stanley, Great Barrington, Mass. Application filed March 10, 1905.

In a system of transmission are means for generating low-frequency currents of high potential, mains leading

therefrom, step-down transformers connected in multiple to the mains, and motors of the commutator type connected to the secondaries of the transformers. (See cut.)

818,027. Induction Motor. Dugald C. Jackson, Madison, Wis. Application filed March 8, 1900. Renewed April 11, 1904.

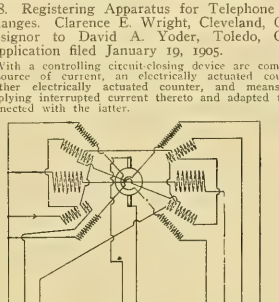
This method of operating an induction motor provided with an armature having a progressive winding, a commutator and auxiliary conductors for short-circuiting conductors of the armature winding consists in establishing a field by a single-phase alternating current, subjecting the progressive armature winding to the influence of the single-phase alternating field, inducing currents in the armature winding and passing the same in progression through the coils of the armature winding, the commutator and brushes, whereby the motor is started, changing the number of poles of the field to which the armature is subjected, and conveying current between the coils of the armature that are subject to unlike poles of the field through the auxiliary conductors for normally operating the motor.

818,035. Electric Switch. Henry E. Leppert, New Britain, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Application filed April 24, 1905.

The mechanism of a snap switch is described.

818,068. Registering Apparatus for Telephone Exchanges. Clarence E. Wright, Cleveland, Ohio, assignor to David A. Yoder, Toledo, Ohio. Application filed January 19, 1905.

With a controlling circuit-closing device are combined a source of current, an electrically actuated counter, another electrically actuated counter, and means for supplying interrupted current thereto and adapted to be connected with the latter.



NO. 817,807.—ELECTRIC MOTOR.

818,078. Electric Hoist. Philip J. Darlington, Chicago, Ill. Application filed December 19, 1904.

In the end walls of a housing for the hoisting drum is journaled the horizontal drum-shaft. A motor is mounted outside the housing upon one of the end walls thereof with its shaft passing through the housing external to the drum, and reduction gearing is supported on the other end wall of the housing and connecting the drum and motor shafts, whereby a powerful hoist is obtained occupying small head room.

818,133. Combined System of Electric Signaling and Switch Setting for Railroads. Bruno O. Wagner, El Paso, Texas. Application filed October 28, 1904.

The first of 37 claims reads: "In a system of the character stated, a source of electric energy, a semaphore mechanism and a switch-setting mechanism, the semaphore mechanism and the switch-setting mechanism each including armature and field magnets, the armature-magnets of the switch-setting mechanism and semaphore mechanism being connected in series with each other."

818,145. Telegraph System. Myron J. Carpenter, La Grange, Ill. Application filed June 2, 1905.

The system includes a telegraph key, a telephone transmitter, a support common to both adapted and arranged to communicate mechanically, vibrations due to the manipulation of the telegraph key to the telephone transmitter, a source of electric current, and a circuit including the source of current, the key, and the transmitter in series, whereby the transmitter is responsive to the sound vibrations and to the current variations produced by the manipulation of the key.

818,169. Electrical Circuit and Device. Robert J. Hewett, Westfield, N. J., assignor to the Hall Signal Company. Application filed June 2, 1905.

A circuit-changer is connected with the circuit and acts to change the connection of the magnetic means from one of low resistance to one of high resistance and the reverse. A circuit-controller is controlled by the magnetic means and is arranged to be picked up during the low-resistance connection of the magnetic means and to be held up during its high-resistance connection.

818,170. Electrical Device and Circuit. Robert J. Hewett, Westfield, N. J., assignor to the Hall Signal Company. Application filed June 2, 1905.

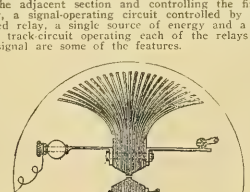
With two magnet coils, one of high resistance and one of low resistance, is combined a circuit-changer connected with the circuit and so arranged that when in one position it excludes the high-resistance coil from the circuit but includes the low-resistance coil in the circuit, and when in its other position it includes the high-resistance coil in the circuit. A circuit-controller is arranged to be picked up when the low-resistance coil is initially energized and to be held up when the high-resistance coil is energized.

818,186. Insulating Cleat. Henry D. Murdock, Wilkinsburg, Pa. Application filed July 17, 1905.

An insulating block consists of two members, one having a groove formed therein, a protuberance being carried by the upper and lower faces of the other member.

818,203. Railway Signal-controlling Circuit. Herbert B. Taylor, Newark, N. J., assignor to the Advance Signal Company, Newark, N. J. Application filed October 1, 1900.

A series of electrically separate track sections, a signal for each section, a relay located at the entrance end of each section and connected to the rails thereof, a single relay connected to the rails of the advance end of the adjacent section and controlling the first-named relay, a signal-operating circuit controlled by the first-named relay, a single source of energy and a normally open track-circuit operating each of the relays to clear the signal are some of the features.



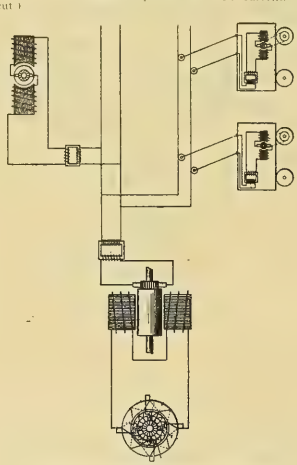
NO. 817,976.—ULTRA-VIOLET LAMP.

818,226. Electric Switch. Lewis R. Brown, South Orange, N. J., and Fred H. Wentworth, New York, N. Y.; said Wentworth assignor of thirty-one-hundredths to said Brown. Application filed May 5, 1905.

An electric switch comprises a contact-making element, means for supporting the element in inoperative position, an electric circuit, means connected with the electric circuit for releasing the element to cause it to complete another electric circuit, and means on the element for opening the first-mentioned electric circuit when it has released the element.

818,236. Space-signaling System. Cornelius D. Ehret, Ardmore, Pa. Application filed July 27, 1903.

In a wireless-telegraph receiver are means for producing fluctuating electric current, means for reinforcing the current, and a recorder controlled by the reinforced current. The receiving apparatus comprises means responsive to the received electroradiant energy for producing fluctuations or changes in locally generated current, means for amplifying the changes or fluctuations in the current, and a signal-translating instrument controlled or actuated by the amplified current. (See cut.)



NO. 817,998.—POWER-TRANSMITTING DEVICE.

818,244. Signaling System. John L. Hall, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 15, 1904.

A signal system comprising a transmitter and a receiver each having a rotatable part has means for driving the parts synchronously, an observing instrument on the transmitter movable independently of the rotatable part thereof, and means on the receiver for indicating a direction bearing a definite relation to the position of the observing instrument.

818,253. Incandescent-lamp Socket. Walter J. Jones, Hackensack, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 3, 1900.

In series incandescent lighting are a receptacle having automatic line-closing contacts and a lamp-socket adapted to receive an ordinary incandescent lamp therein and carrying co-operating contacts normally separated by insulation of low dielectric value.

818,290. High-tension Circuit-breaker. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 25, 1903.

In combination with a switch are a number of fuses and means for automatically feeding them successively into shunt relation to the switch upon successive operations of the switch. A rotatable magazine fuse is in shunt with the switch and means are provided for automatically rotating the magazine at each closure of the switch.

818,291. Electric Cut-out. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 26, 1904.

A chamber, a fuse contained therein, a movable member subjected to the pressure generated in the chamber when the fuse blows, a movable contact within the chamber operatively connected to the member, a stationary contact and means for holding the movable contact normally in engagement with the stationary contact constitutes the device.

818,349. Control System. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 10, 1904.

In combination are a number of circuits, a switch in one of the circuits and means operable to open the switch only upon the de-energization of one of the circuits while the other remains energized. Other features are a motor circuit, a control circuit, a normally closed circuit-breaker in the motor circuit, and means operable upon the de-energization of the control circuit while the motor circuit remains energized to trip the circuit-breaker.

818,361. Arc-welding Apparatus. Arthur C. Eastwood, Cleveland, Ohio. Application filed May 2, 1905.

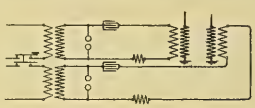
An arc-welding apparatus includes a portable terminal and an electromagnetic switch in circuit therewith, with a switch carried on the terminal and connected to control the electromagnetic switch. There is an insulated handle therefor, a hand-controlled switch on the handle, with an electromagnetic switch in circuit with the terminal and having its coil in circuit with the hand-controlled switch.

818,363. Art of Signaling Through Space. Cornelius D. Ehret, Ardmore, Pa. Original application filed July 27, 1903. Divided and this application filed August 25, 1905.

The method of rendering intelligible messages or signals transmitted through the natural media in electroradiant form consists in transforming the received electroradiant energy into the energy of electric currents or charges, controlling by such currents or charges locally generated electrical energy to produce changes or fluctuations thereof, amplifying the fluctuations or changes of the energy, and controlling or actuating a signal-translating instrument by the amplified energy.

818,372. Spark Plug. Bert W. Hallstead, Scranton, Pa. Application filed November 5, 1904.

The plug comprises a body portion, a cap carried by the body portion, a conductor-stem extending longitudinally through the cap and body portion, a body of insulating material surrounding the stem and engaging the walls of the body portion for spacing the stem from the body portion, a similar body of insulating material surrounding the stem and engaging the cap for spacing the stem from the cap, and means carried by the stem and interposed between the bodies of insulating material for spreading the bodies apart and pressing the same against the body portion and cap respectively.



NO. 818,423.—SPACE SIGNALING SYSTEM.

818,377. Reverse-current Relay. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 22, 1904.

In a relay are a stationary field-magnet member, an armature journaled between the poles thereof, a cam carried by the armature shaft, a reciprocating member adapted to be moved by the cam, and a switch-contact carried by the reciprocating member.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on April 23, 1906:

401,712. Mouthpiece Guard for Phonographs or Telephones. W. L. Candee, Brooklyn, N. Y.
401,743. Telephone Transmitter. W. Gillett, St. John, New Brunswick, Canada.
401,744. Secondary Battery. W. W. Griscom, Haverford College, Pa.
401,761. Combined Motor and Electric Generator. J. F. Shawhan, Dayton, Ohio.
401,796. Electric Railway System. S. H. Short, Columbus, Ohio.
401,797. System of Elevated Conductors for Electric Railways. S. H. Short, Columbus, Ohio.
401,801. Commutating Device. D. W. Thompson, Englewood, Ill.
401,863. Electric Meter. E. Thompson, Lynn, Mass.
401,882. Electric Belt. C. H. Grimley, New York, N. Y.
401,927. Box for the Distribution of Electric Wires. D. Brooks, Jr., Philadelphia, Pa.
401,936. Electric Conductor. T. Egleston, New York, N. Y.
401,953. Secondary Battery. W. P. Kookogey, Brooklyn, N. Y.
401,970. Electric Motor for Tramway Vehicles. W. D. Sandwell, London, England.
402,006. Secondary Battery. C. Desmazures, Paris, France.
402,007. Splice Box for Electric Cables. T. J. Dewees, Palmyra, N. J.
402,064. Switch for Electric Motor Trolleys. W. Christy, Akron, Ohio.
402,066. Dynamo-electric Machine. C. Coerper, Ehrenfeld, Prussia, Germany.
402,080. Electric Car. J. W. Henderson, Philadelphia, Pa.
402,084. Incline Electric Railway. R. M. Hunter, Philadelphia, Pa.
402,099. Printing Telegraph System. C. J. A. Munier, Paris, France.
402,104. Galvanic Battery. R. J. Pratt, Greenbush Heights, N. Y.
402,107 and 402,108. Process of Welding Together Sections of Pipe by Electricity. E. F. Ries, Baltimore, Md.
402,121. Telephone. E. A. Woelk, Belleville, Ill.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Electric Pumping Plant of the Schenectady Waterworks.

By C. T. Wilkinson

At the village of Rotterdam, N. Y., about three miles from the city of Schenectady, toward Amsterdam, stands the pumping station of the Schenectady waterworks. It is located on the bank of the Erie Canal, not far from the Mohawk River. This plant furnishes a most interesting example of a modern application of electricity.

Fig. 1 is a view showing the old and new stations (for there are two, it being the newer one which has the electrical equipment), while Fig. 2 represents the interior of the new station, showing the two electric motors that drive the pumps. The old station is steam driven, and the engines are of the vertical type and were built by the Dean Steam Pump Company of Holyoke, Mass., in 1896. The new station contains two 18-inch two-stage vertical shaft turbine-type centrifugal pumps built by the Henry R. Worthington Company.

The new pumping station has a capacity of 24,000,000 gallons daily against a head of 110 pounds, and the old one had only 12,000,000 gallons capacity, each station containing two units. The old station employed a total staff of nine attendants, while the new one has only six.

Each centrifugal pump consists of an outer casing containing a set of fixed diffusion rings and veins and an impeller. The water enters from the top at the center of the impeller and is thrown out through the diffusion veins into the discharge chamber. (See Fig. 3.) The veins are so curved that the transmission of kinetic energy of the pump into static pressure is produced with minimum loss, and a remarkably high efficiency is obtained.

The rated speed of these units is 800 revolutions per minute, and they are of the vertical type, the weight being carried by a thrust bearing. This bearing consists of two plates or disks situated at the top of the shaft, the entire weight being supported by the horizontal bearing shield of the motor.

Lubrication is effected by forcing oil under approximately 100 pounds pressure under the lower bearing surface. This oil is supplied by two vertical triplex Knowles pumps, each driven by a geared three-horsepower induction motor.

The water pumps are installed in a 21-foot pit beneath the main floor of the station (see Figs. 3 and 4), and water is supplied to them through a 42-inch suction pipe from two circular wells 42 feet and 35 feet deep. These wells, which are situated close to the station, are 50 feet in diameter and are covered by a reinforced-concrete structure. One of them is shown in the foreground of Fig. 1. The wells have concrete walls three feet thick and deep gravel bottoms, which serve to filter the incoming water.

Since the main pumps are situated above the normal water level of the wells, a priming pump is installed. This consists of a nine-inch by seven-inch vacuum pump, driven by a geared five-horsepower induction motor, which sucks the water up to the main pumps when starting, and is shown at the left of the drawing, Fig. 4, page 352.

The two main motors (Fig. 2) are rated at 800 horsepower at 800 revolutions per minute and are wound for 550 volts three-phase 40 cycles. Their smooth operation and the simplicity of control, when compared with a steam pump, are remarkable.

A drainage pump [illegible] the Worthington [illegible] vertical volute type [illegible] installed [illegible] mounted like the [illegible] pumps [illegible]

FIG. 1. ROTTERDAM PUMPING STATION OF SCHENECTADY CITY WATERWORKS.

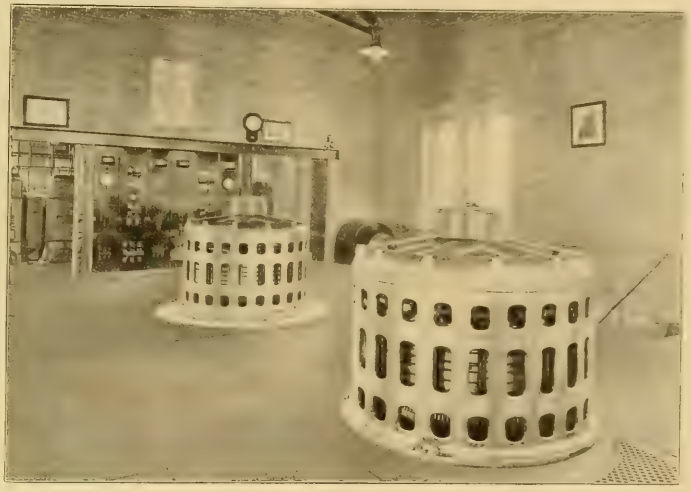

FIG. 2. INTERIOR VIEW IN ROTTERDAM PUMPING STATION, SHOWING INDUCTION MOTORS DRIVING PUMPS ON FLOOR BELOW.

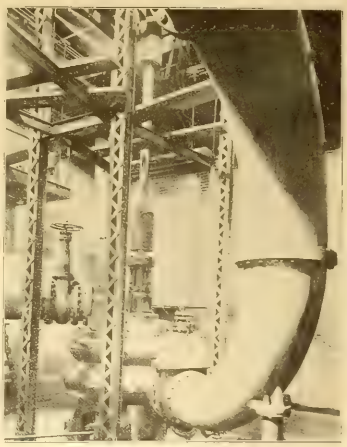

FIG. 3. TWO STAGE VERTICAL 800-HORSEPOWER TURBINE PUMP IN ROTTERDAM PUMPING STATION DRIVEN BY INDUCTION MOTOR ON FLOOR ABOVE.

[illegible] pump, [illegible]

[illegible]

The equipment of [illegible] and lightning [illegible] or prolonged [illegible] up. At the pumping station [illegible] single-phase air-blast transform[illegible] voltage for starting the 800 [illegible] current. The lighting of Rotterdam Valley and the immediate neighborhood is provided for by the installation of a 150-kilowatt lighting transformer.

The air-blast chamber, as shown in Fig. 4, is situated immediately below the transformer room, and is supplied by two independent motor blower outfits.

Fireproof doors separate the high-tension switches, main transformers, current and potential transformers and all the high-tension gear from the main station, and the switchboard forms part of this partition.

The panel equipment consists of two incoming-line panels, two high-tension transformer panels and two low potential motor panels, provided with the necessary ammeters, voltmeters, etc. Low-tension lever switches have pump motors, and remote control switches for operating motors of the oil switches and controlling switches for the drain pump, priming pump and oil pumps are also mounted on this switchboard. A spare oil pump is provided for emergencies. The whole layout is remarkable for its open spacing and roomy arrangement, and much forethought and care have been expended to prevent the possibility of shutdown, which would be a very serious matter for the city of Schenectady. Duplicate high-tension and low-tension buses are provided, with simple arrangements for switching from one to the other in case of need. The main and auxiliary switches are also double-throw, to enable them to be fed from either bus.

These turbine centrifugal pumps are especially adapted to meet extraordinary demands for a large supply of water, and they have proved remarkably efficient when called upon for exceptional outputs. In a recent large fire in Schenectady as many as 19 hose streams were taken from consecutive hydrants, thus completely satisfying the insurance interests that these pumps were capable of meeting any emergency within the delivering capacity of the mains.

The employment of electric motors for the operation of waterworks is comparatively new, but seems to have a promising future.

Steinmetz's Arrangement for Compounding Alternating-current Generators.

Among the United States patents issued on March 27th was one to Dr. C. P. Steinmetz of Schenectady relating to the compounding of alternating-current generators for varying loads and power factors. The method described in the specification of the patent (application for which was filed July 25, 1904) is of considerable interest. The inventor notes that it has been proposed heretofore to excite the field of an alternating-current generator with a constant direct-current excitation supplemented by a second excitation, corresponding

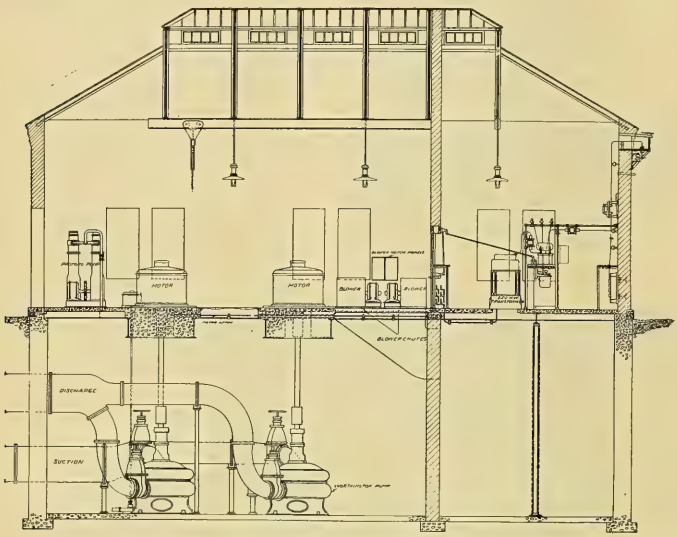

FIG. 4. SECTIONAL ELEVATION OF ROTTERDAM PUMPING STATION. (SEE PRECEDING PAGE.)

to the series excitation of a compound-wound direct-current generator, obtained by rectifying the whole or a part of the armature current and delivering it to a separate winding on the field. This method of compounding corresponds strictly to that employed in direct-current generators. As the load increases, the field flux increases, and the potential at the generator terminals may be maintained constant or increased. It does not compensate, however, for the variation in armature reaction due to varying power factor. The magnetizing effect of the armature current on the field varies greatly with the power factor, even if the amount of current remains practically constant. Furthermore, with the above arrangement, the compounding of a polyphase machine can at best be adjusted only for the average load of the several phases. Consequently, if the phases are loaded unequally, the voltage of the phase having the heaviest load or the lowest power factor will be too low and the voltage of another phase too high.

A second arrangement for compounding alternating-current generators that has been suggested heretofore consists in supplying the field with a distributed winding and a commutator like the armature of the ordinary direct-current machine. Through brushes bearing on this commutator polyphase currents are supplied to the distributed winding, these currents being so derived from the armature currents that proper compounding is obtained. The method of deriving these exciting currents consists in the use of shunt transformers to produce the constant excitation like the shunt winding of a direct-current machine, and series transformers to produce the compounding excitation, like the series winding of an ordinary direct-current machine. This arrangement, while it accurately compensates for varying load and power factor, and while it compounds the phases separately, since each portion of the armature field may have adjacent to it a distributed winding carrying a current proportional in amount and varying in power factor therewith, is subject to the disadvantage that, since it is self-exciting, it may lose its excitation in case of a short-circuit, and, moreover, the excitation furnished by the shunt transformers is not necessarily constant, but depends upon the voltage at the armature terminals.

The object of Dr. Steinmetz's invention is to provide a novel arrangement for compounding, which combines the advantages of both the arrangements briefly described above. In common with the second arrangement, varying loads and power factors are properly compensated for, and the different phases of the armature are separately compounded, while the method possesses the advantages of the first arrangement, in that no danger exists of its losing its excitation under any circumstances.

The invention consists in employing a distributed field winding with a commutator, and supplying to fixed points on the commutator a direct-current excitation and accomplishing the compounding by means of a series transformer connected to brushes bearing on the commutator.

Fig. 1 shows a single-phase alternating-current generator arranged in accordance with the invention, and Fig. 2 shows a polyphase generator similarly arranged.

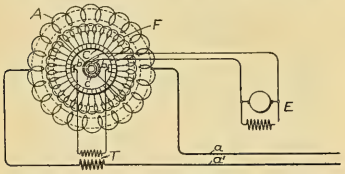

Fig. 1. Method of Excitation Applied to Single-phase Generator.

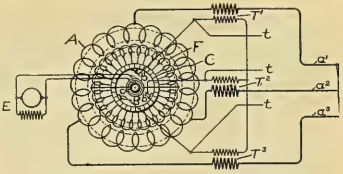

Fig. 2. Method of Excitation Applied to Polyphase Generator.

STEINMETZ'S ARRANGEMENT FOR COMPOUNDING ALTERNATING-CURRENT GENERATORS.

Referring to Fig. 1, (A) represents the armature of an alternating-current generator connected to the mains (a a'). (F) represents the field winding, which is shown as a distributed winding connected to a many-part commutator.

In addition to its connections to the commutator (C) the field winding (F) is connected at two fixed points to the collector rings (c). (E) represents a direct-current exciter, which supplies the field winding (F) through the collector rings. The direct current in the field winding (F) produces a constant field, rotating with the field structure in the same manner as when a polar winding is employed. In addition to the direct-current excitation an alternating current is supplied from the series transformer (T) through the commutator brushes (b b) to the field winding (F). This current being obtained from a series transformer, varies both in magnitude and in phase with the armature current, and since the brushes (b b) are fixed in space and are positioned opposite to the armature terminals, each turn of the field winding (F) carries at all times a current which varies in magnitude and phase with the current in an adjacent turn of the armature winding. The armature reaction may thus be neutralized for all loads and power factors and proper compounding thereby secured.

In Fig. 2 is shown the invention as applied to a three-phase machine. The armature field (A) is connected to the three line wires (a') (a^2) and (a^3). The field windings (F) are provided with a commutator (C) and collector rings (c), the latter being supplied with a direct current from the exciter (E). Instead of two commutator brushes, three brushes (b') (b^2) and (b^3) are employed, and three transformers (T') (T^2) and (T^3) are connected to the brushes, the primaries of the transformers being connected in circuit with the several phases of the armature. With the connections as shown it will be seen that if the load on one phase—as, for instance, on the mains ($a'a^2$)—is greater than that on the other two phases, the potential impressed upon brushes (b') and (b^2) will be greater than the potential impressed between brushes (b') and (b^3) or (b^2) and (b^3). A larger current consequently flows in that part of the field winding which is adjacent to the most heavily loaded part of the armature winding. Thus the different loads on the separate phases are separately and automatically compensated for. What is true as to the amount of current flow is also true as to phase. If the power factor of the load on one phase is different from the power factor of the loads on the other phases, the phase of the current in the adjacent portion of the field winding will also differ from the phase of the currents in the rest of the field winding.

A number of alternators compounded in accordance with the invention may be operated in parallel, the same as with compounded direct-current generators. In Fig. 2 are shown equalizer connections (t) from the terminals of the three compounding transformers, these connections corresponding to the equalizer connections employed with the series winding of a direct-current generator.

The New Wolfram Lamp.

Whether the new wolfram lamp which is the invention of Dr. Hans Kuzel can be covered by a basic patent is uncertain. A correspondent of the London Times Engineering Supplement is of the opinion that it cannot. He believes that no patent can confer the sole right to the use of wolfram in the manufacture of incandescent-lamp filaments. Other patents have been granted for the manufacture of these lamps, notably that of Hanamam of Budapest, the Osmium Lamp Company of Vienna, and the German Incandescence Gas Light Company (Auerlight Company) of Berlin. These patents appear to apply to processes only, and do not claim an exclusive right to use the metal. "It is not known exactly how the manufacture of these lamps has been progressing up to now," says the writer in the London paper. "Nobody has as yet introduced this lamp on the market, but I have seen in Berlin, at the works of the German Incandescence Gas Light Company (Auerlight Company) wolfram lamps of 110 volts and 32 candlepower. The Osmium Lamp Company of Vienna recently organized a public exhibition of these lamps, when the room was lit up with wolfram lamps manufactured by the company. Until, however, the lamps of the different makers appear on the market it will not be possible to judge what are their respective qualities and advantages."

One of the principal seats, it may be mentioned, of the wolfram or tungsten mining industry is situated in Queensland, Australia. The price, which has fluctuated between $87.50 and $272.26 a ton, is stated to have a rising tendency beyond the latter figure in view of the increased demand for this metal.

Philadelphia Lighting Situation.

After many weeks' deliberation over the subject of making possible competition in the city's electric lighting, Mayor Weaver on April 20th sent to the councils of Philadelphia an ordinance granting a franchise to the Commonwealth Electric Company. He urged upon the councils the necessity of prompt action on the measure so as to allow the new company to prepare to compete with the monopoly which "has for years exacted extravagant prices from the city." The ordinance provides that the Commonwealth Electric Company shall be granted certain privileges, in consideration of which it is to bid to furnish public street lighting at not more than $85 per light per annum and to give the city five per cent. of the gross receipts from all sources.

Space Telegraphy on Seagoing Steamships.

By Dr. Alfred Gradenwitz

The use of space telegraphy for the mutual communication of seagoing steamers and correspondence between the latter and the land has been making rapid advances of late. The first practical utilization of wave telegraphy on German coasts was made by the North German Lloyd, which, in

FIG. 1. SPACE-TELEGRAPH STATION ON THE STEAMSHIP BREMEN.

May, 1900, established the first German wireless-telegraph station on the Borkum Island and another at Bremerhaven, while equipping its rapid steamers with wireless apparatus. The German Navy followed this example, and the Hamburg-American line, as well as all the leading steamship companies of other countries, adopted this system of telegraphy for their large steamers, about 50 steamships of the mercantile navy of different nations being at present provided with wireless outfits. At the same time numerous stations for space telegraphy were erected at the most important coasts throughout the world, especially on the Northern Atlantic, either by the respective governments or by private companies.

With the increasing number of these installations, their advantages became more numerous, owing to the growing possibilities afforded for such ships as were provided with space-telegraph apparatus to communicate with either a land station or a passing steamer. It may be said that the rapid steamers sailing for New York from Bremen or Hamburg are at present, generally speaking, every day in telegraphic communication with some land station or another steamer. While being seldom without communication in the North Sea and the Channel, steamers are frequently in a position to exchange telegrams on the Atlantic Ocean.

This adoption of wireless telegraphy in steamship service will be, in constantly increasing degree, a benefit to passengers, especially business men, while having an extraordinary bearing on the safety of steamship service as well as on the correspondence between the steamers and the company or their agencies. In fact, a steamer supplied with space-telegraph apparatus will be able several hours before coming to anchor in the harbor to indicate the actual time of its arrival, the number of passengers, etc., so that any arrangements can be made before its arrival for dealing with the passengers and baggage, and providing for special traveling facilities. Information on the atmospheric conditions, fog, [illegible] etc., [illegible] transmitted from land stations or passing ships. [illegible] it will be remembered, [illegible] printing a [illegible] paper, [illegible] high seas [illegible] information transmitted by [illegible] telegraph.

The arrangement of a modern type of space-telegraph station for steamships will be illustrated by a description of the plant recently installed by the Gesellschaft für Drahtlose Telegraphie on the steamship Bremen of the North German Lloyd. The station illustrated in Fig. 1 and schematically represented in Fig. 2, has a warranted range of 200 kilometers on the open sea, the range actually achieved, however, being [illegible] kilometers.

The station is equipped with three different waves, 210, 350 and 450 meters in length, respectively, to effect which two antennæ have been provided.

The antenna intended for the 210-meter wave consists of a single bronze wire about 50 meters in length and leads in an oblique direction down from a yard raised on the top of the rear mast to the apparatus compartment installed on the boat deck behind the funnels. For the 350 and 450-meter waves has been provided an antenna system, comprising three parallel wires, that are suspended horizontally between the two masts, these wires being about 100 meters in length. The masts are about 32 meters in height. A short cable, being metallically connected to the hull on the outer wall of the station room, is used as earth connection.

The existing direct-current plant of about 100 volts tension is used as a source of power, the intensity of current required being about 10 amperes. The direct current is converted into alternating current by means of two turbine interrupters (one of which serves as a reserve) having a cardanic suspension, and a resonance induction. A Morse key of the Braun system, free from any sparking, serves as a telegraph key.

The capacity of the transmitter comprises seven Leyden jars. The self-induction is constituted by a bronze wire being wound up on a hard-rubber coil and being fitted with a sliding contact. The exciting-spark distance consists of three sections, [illegible]

[illegible]

[illegible]

The receiving [illegible] incoming telegrams [illegible] in the hearing apparatus [illegible] and the recording apparatus [illegible]. To exclude as far as possible [illegible] and to increase the [illegible] transformers (so-called [illegible]) are used both in the hearing and recording apparatus. [illegible] loose coupling enables [illegible] high as about three to five per cent to be attained, i. e., a difference of this magnitude in the wave length of a sending station will not interfere with the receiving. Moreover, the intensity in the receiving apparatus is reduced [illegible] on the approaching of two stations by altering the relative position of the primary and secondary coils (rotating the latter), thus reducing the effect on the secondary coil. A coil with high self-induction and a spark gap are inserted in parallel to the receiving apparatus to avoid any disturbing atmospheric influences. This so-called lightning arrester has the property of leading off to the ground any slowly vibrating discharges of the air, while the high-frequency oscillations from the sending station meet with so great a resistance in the highly self-inductive coil so as to exclude any direct discharge to the earth. The rate of telegraphing is about 18 words a minute.

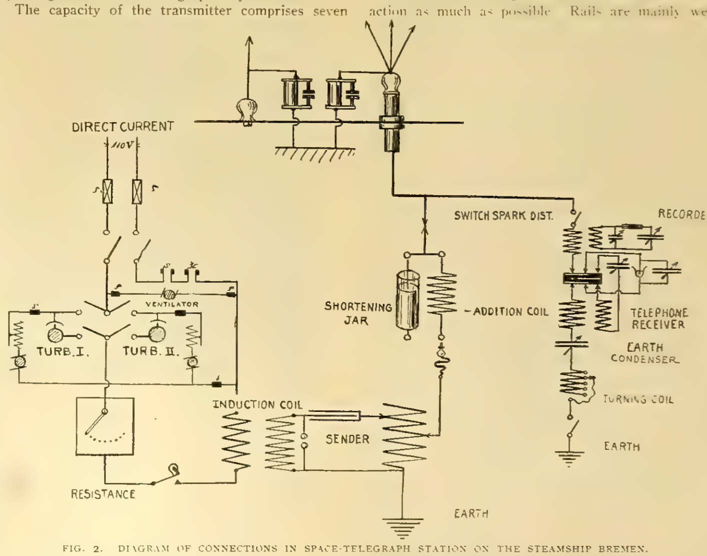

FIG. 2. DIAGRAM OF CONNECTIONS IN SPACE-TELEGRAPH STATION ON THE STEAMSHIP BREMEN.

Precautions Against Electrolysis in Detroit, Mich.

A special electrolytic survey of Detroit, Mich., was recently made by A. A. Knudson of New York, acting for the Detroit Water Company and the Detroit Gas Company. The report on this survey has not yet been made to the water commissioners, but it is stated that conditions were found much better than was anticipated. There have never been any large breaks due to electrolytic corrosion, although a number of lead services have been destroyed and some leaks caused. In general, while there are some doubtful points, the situation is well in hand, the water department, gas and street-railway companies each making frequent tests, and efforts are being made to reduce electrolytic action as much as possible. Rails are mainly well bonded, generally with heavy copper wire. Also at several of the most dangerous points, return feeders, connected with the water and gas mains, have been installed.

The Telephone Line.[1]

By S. P. Grace.

In considering the development of systems for distributing telephone lines, it will not be amiss to look back and run over hastily the various methods which have been proposed and used for this purpose. Before the introduction of the telephone there already existed the lines of the various telegraph companies, and it was but natural that when the telephone came into the field the construction of its lines should follow the same general practice as developed by the telegraph companies. It was soon found, however, that the number of telephone lines multiplied much more rapidly than did the telegraph wires, the result being poles of great height, equipped sometimes with as many as 20 cross-arms, each arm carrying from 10 to 20 wires. When these lines became overcrowded, it was customary to relieve them for short distances with aerial cables, made up of rubber-covered wires. A little later the dry-core lead-sheathed paper cable was invented, and it was largely used to supplement the open-wire leads. These heavy open-wire leads were subjected to many disturbances, because

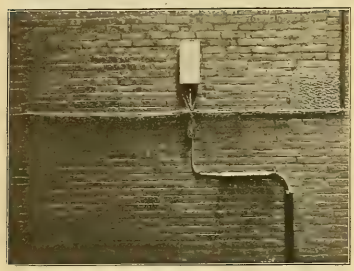

FIG. 1. EXAMPLE OF WALL WIRING SYSTEM IN TELEPHONE LINE WORK.

of sleet and windstorms, and, furthermore, they became such an "eyesore" that in many cities the wires were ordered underground in the business districts.

It is interesting to note that the first underground distributing conduit system for telephone wires was installed by Mr. Metzger and Mr. Paynter of the Central District and Printing Telegraph Company in Pittsburg in 1881, on Fifth Avenue, between Wood and Liberty streets. The roof fixtures had become too heavy for the buildings supporting them, and as permits for poles on the streets could not be secured, it became imperative to place the wires underground. The cables were laid in the bottom of a wooden box, and immediately over them was placed, at intervals, porcelain plates containing 40 holes, through which were pulled distributing wires to be run into each basement along the route. After the cables and wires were in place the entire box was filled with pitch, and this construction gave fair service for a short time. It was only a short time, however, until all forms of "solid systems" in Pittsburg and in other cities were abandoned in favor of the "drawing-in system," the standard practice calling for vitrified-clay ducts, into which the cables could be readily drawn and withdrawn. The direct underground connection of subscribers' lines was abandoned practically everywhere, on account of its cost, in favor of the distributing pole connected to the underground cables, from the top of which radiated wires to the various subscribers' premises. In the districts outside of the congested business district it continued to be the practice of most companies for many years to adhere to the tall, open-wire leads, supplemented with aerial cables. However, the Central District and Printing Telegraph Company early developed a system of distribution by means of aerial cable placed on low poles and provided with terminals every two or three hundred feet, which has given excellent satisfaction for a number of years and is now being extensively used. A more complete description of this system will be given later on in this paper.

The development of telephone-line distribution having thus been briefly sketched, let us consider what, in the present knowledge of the art, can be considered the best practice of today for the distribution of the subscribers' telephone lines. It has been many times recommended and demanded by those not experienced in the art, that all telephone wires should be placed completely underground, and these persons point to the water and gas systems as an example. There is, however, a fundamental difference between these systems, usually lost sight of. In the case of gas and water, one pipe is common for an entire street and may be tapped anywhere along its length. In the case of telephone distribution we must provide a separate pair of wires all the way from the exchange to each subscriber's premises, and no common line can be tapped, as is done in the gas and water systems. This makes the difficulties and the expense of direct underground connection very great, and, if enforced, would necessarily result in a large increase in the cost of service to the subscriber.

In modern engineering practice, before building the distributing routes in any city or district, it is customary to prepare a development study which shows the number of subscribers to be expected at the end of definite periods for the next 20 years, and also to predict the probable routes and the number of ducts required for this distribution. From studies recently made it seems best to limit the number of wires carried in cables on pole lines to about 400 pairs, and that above this limit the distribution should be made underground. On this basis it will be seen that it is economical to extend the underground-conduit system along what might be called "feeder routes" throughout the residence sections of the city. In districts where there are underground conduits it is to be recommended that direct underground connections be made to the various buildings, wherever the number of telephones in each building will justify the expense of such a connection. This is particularly true of office buildings, apartment houses, large stores, hotels, etc.

Where direct connection is not economical, the vault system or the wall-wiring system may be used. In the vault system a cable is run into one of the basements in the block, and from its terminal are carried distributing wires through the other vaults to the various telephones. This system is limited in its application, because of the irregularities and sometimes the absence of vaults, and because of the objections of property owners to having the telephone company's employes frequently passing through their basements. In the wall-wiring system a small terminal is placed on the rear wall of one of the buildings, and from it are run, through rings, twisted pair No. 18 B. & S. soft copper, rubber-covered and braided wire, to the different telephones. This type of distribution is very neat, economical in first cost, and the maintenance, because of the protected condition of the wires, is very small. It will be found that this style of distribution is particularly suited to second-class business districts and first-class residence districts in the vicinity of underground-conduit routes, where the buildings are built close enough together to prevent long spans of ring wiring. In Fig. 1 is shown a typical example of this kind of wiring.

Where the buildings are very much scattered and the lot and building lines irregular, it seems that some form of a distributing pole will furnish the best and most economical service pending the time that the block is so closely built up as to warrant direct connection or wall wiring. It is possible to design this type of pole with a small circle top, and if the wires are strung from it in a neat manner, without attempting to encompass too much territory, the effect, although not beautiful, is not displeasing. In Fig. 2 is shown the wiring of one of these poles at close range.

After agreeing that the main feeder routes should be underground, and after providing for distribu-

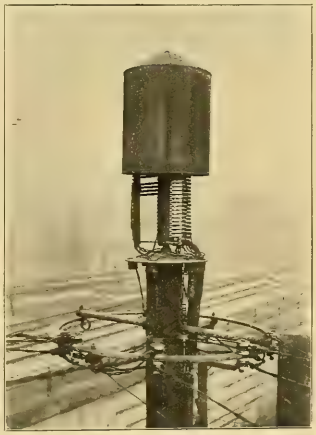

FIG. 2. TOP OF DISTRIBUTING POLE, SHOWING WIRING.

tion in the immediate vicinity of these routes by means of direct connection, vault or wall-wiring systems, as described above, there still remains the problem of distributing aerially the subscribers' lines on the many side streets. In the majority of our cities to attempt to make such distribution completely underground would either financially involve the telephone companies or else make the cost of service prohibitive to the subscribers. As explained earlier in this paper, the aerial distribution of telephone lines has in the past largely been done by means of tall open-wire leads, supplemented with aerial cables. On account of the rugged character of the territory of the Central District and Printing Telegraph Company, the streets in the various towns are, as a rule, very narrow and crooked, which made extremely difficult the building of tall, open-wire leads for distributing telephone lines.

Early in the year of 1898 it became apparent to the engineers of the Central District and Printing Telegraph Company that some new form of construction must be developed if it was hoped to distribute aerially the thousands of wires being required by the rapid expansion of the business of the company. An aerial-cable system of distribu-

FIG. 3. LINES DISTRIBUTED FROM 10-PAIR JUNCTION BOX ON POLE.

tion was conceived by Mr. Bliss and Mr. Snyder of the engineering department, and they, in conjunction with Mr. Donaldson of the construction department, proceeded to prepare plans for its installation. It should be stated, however, that the Bell Telephone Company of Philadelphia independently installed, at this time, an aerial-cable system in Germantown, Pa., although for several years it did not extend this type of construction.

Since 1898 the aerial-cable method of distribution has been followed exclusively in the territory of the Central District and Printing Telegraph Company wherever it was desired to distribute subscribers' lines aerially. Low poles of 30 to 35 feet in length have been used and aerial cable placed at the tops of the poles. On alternate poles and sometimes on every pole, was placed a 10-pair junction box. Each pair usually appeared somewhere along the lead in from two to three separate terminals, so it was possible to make use of any particular pair at different points, and, furthermore, the multiplying was so arranged as to permit the economical grouping of party lines. From the lock nuts of the terminals No. 14 B. & S. gauge copper rubber-covered and braided twisted-pair wire was strung direct to the protector at the subscriber's premises, no cross-arms being used along the lead. On account of the short length of rubber-insulated wire used in running the subscriber's loop, no protection is necessary at the cable terminal, but each line should be fused at the place where the aerial cable is connected to the underground cable.

A cable system of this kind is highly useful for distribution at right angles to underground-conduit base lines and along streets that will in the future be provided with underground subways. Construction of this kind is not an "eyesore," does not invite criticism, and the result is that underground legislation lies dormant for many years. An example of this style of construction is shown in Fig. 3, and a detail of the construction in Fig. 4.

Because of the large number required, an important part of an aerial-cable system is an efficient and economical terminal. About two years ago this matter was carefully investigated and a terminal designed which was low in first cost, low in maintenance, and possessing a long life. This terminal is built up of essentially two elements, a cast-iron box and a porcelain block for mounting the lock-nut terminals. In developing this terminal the first point insisted upon was the use of a dry-core cable for the tapping cable, which form of cable is cheap, and besides is easily handled and spliced by the cable splicers. A diagram of this terminal is shown in Fig. 5 and a reproduction of a photo-

1. Abstract of a paper read before the Pittsburg branch of the American Institute of Electrical Engineers, March 13, 1906. Mr. Grace is chief engineer of the Central District and Printing Telegraph Company.

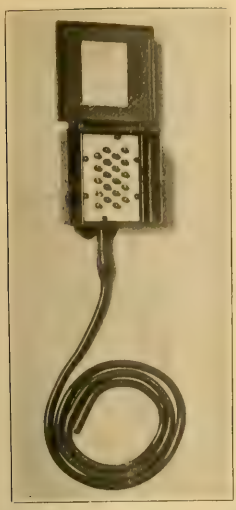

FIG. 6. TERMINAL FOR 10-PAIR JUNCTION BOX.

graph in Fig. 6. It can be used for vault wiring, wall wiring, and on poles for aerial-cable lines. The cost of a 10-pair size is $2.45, and it is believed that the life will be at least 15 years. The labor of placing and splicing is $1.70 when connected to a 50-pair cable, and the material used for splicing amounts to $1.15, which makes the cost of a complete 10-pair terminal $5.30. This type of terminal has been in service nearly two years, and tests in all kinds of weather have shown them to have a high insulation resistance.

About two years ago a number of studies were made to determine the most economical system, or, in other words, the system having the lowest annual charges, for distributing telephone lines aerially. The annual charge is made up of interest, taxes, depreciation and maintenance, and it is apparent that the system having the lowest first cost may not be the most economical in the long run. Different groupings of subscribers were assumed and their distribution was effected by open-wire systems, aerial-cable systems, aerial cable with taps on every pole, aerial cable supplemented with bare wire, etc. It was found, as a result of these studies, that the aerial-cable system with taps on alternate poles and with rubber-covered wire, directly connected from the aerial-cable terminals to the protector in the subscribers' premises, was generally the most economical. This system, besides being the most economical, is by far the most sightly of any form of aerial distribution.

It is obvious that on many streets, where there are but a few telephones, it would not be economical to place an aerial cable at once, but the distribution must be initially effected either with bare wire or twisted-pair rubber-covered wire. A study of these cases showed that it was economical to distribute all telephone lines within 1,000 feet of aerial-cable routes with twisted-pair wire strung

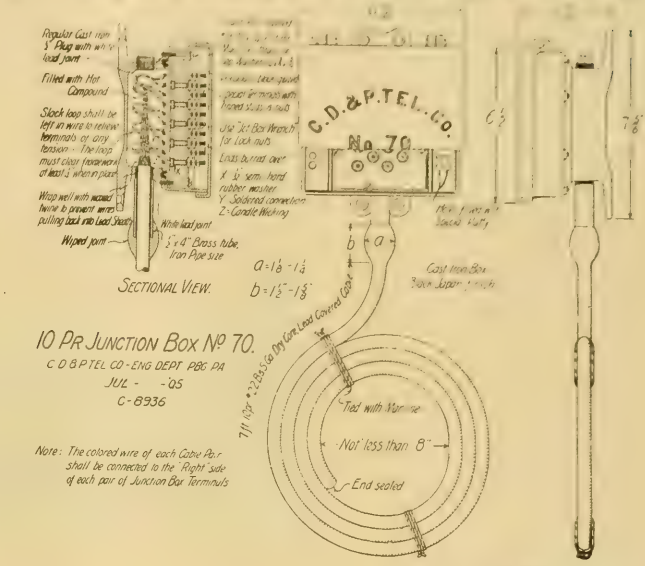

FIG. 5. DIAGRAM SHOWING TERMINAL FOR 10-PAIR JUNCTION BOX.

is not economical to parallel cable wires with outside distributing wires strung on cross-arms or brackets. The cable should be so tapped as to make the length of the subscribers' loops a minimum. This last point is very important, and every effort should be made to extend the cable system and make the subscribers' loops of a minimum length. If this is done, it is economy to construct them of high-grade material, i. e., of first-quality twisted-pair rubber-insulated and braided copper wire.

Summarizing, it would seem that the following rules for distributing telephone subscribers' lines may be followed with economical results:

First—That where the number of circuits will exceed 400, underground subways be built, and the distribution in the immediate vicinity of these feeder routes be effected by direct connection, vault sys-

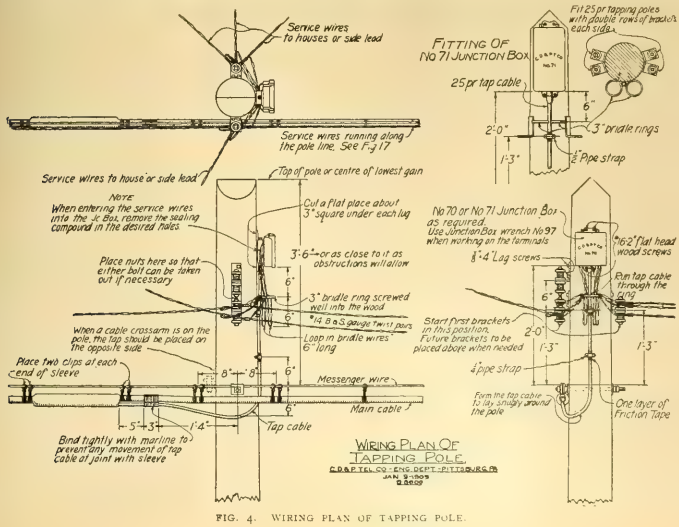

FIG. 4. WIRING PLAN OF TAPPING POLE.

should be placed wherever, by so doing, 300 feet of twisted-pair wire can be saved.

Third—That on side leads at right angles to aerial-cable lines, twisted-pair wires strung on brackets should be used for distribution to subscribers located within 1,000 feet of the cable line. If the subscribers are at a greater distance than 1,000 feet, all distribution on these side leads should be effected by means of No. 14 N. B. S. bare copper wire, strung on standard cross-arms, provided there are no obstructions in the way, such as trees, foreign wires, etc., which would necessitate the use of high poles. If obstructions are met with, a special study should be made to determine which is most economical—the setting of high poles, the use of twisted wire on low poles, or the placing of a cable.

Fourth—That when the number of circuits on a pole line reaches 10 to 15, a cable should replace them. This cable should be provided with terminals on alternate poles, so that the bare wire or covered wire formerly strung along the lead for local distribution can be removed and returned to stock, since, as before stated, it is not economical to parallel cable wires with bare or covered distributing wires.

It is certain that in the coming years the number of telephones is going to increase at a most rapid rate, and the engineer has before him a difficult problem in designing and constructing the lines necessary to connect these telephones to their exchange centers. It is true that, as the number and therefore the telephonic density increases, the line construction cost per telephone is very materially reduced, and it may be that some time in the future we can see the way clear for a complete underground distribution of all telephone lines on the most important streets of our cities. I believe, however, that this period is many years ahead, and it can well be asked, Why should the telephone companies, and therefore the public served by them, be burdened with the additional expense entailed by complete underground distribution, as long as it is possible to economically distribute in a sightly manner from properly designed aerial-cable lines?

The new French liner La Provence, built to break all speed records across the Atlantic, arrived at Sandy Hook from Havre on April 27th, having made the run in five days, 23 hours and 40 minutes. The previous record was six days, nine hours and 20 minutes. When 1,800 miles from Poldhu, on the coast of Cornwall, and 1,700 miles from Cape Cod, in America, the ship is said to have been in wireless communication with both shores of the Atlantic at the same time.

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CONTENTS OF THIS NUMBER.

Electric Pumping Plant of the Schenectady Waterworks. By C. T. Wilkinson. Illustrated 351, 352
Steinmetz's Arrangement for Compounding Alternating-current Generators. Illustrated 352
The New Wolfram Lamp 352
Philadelphia Lighting Situation 352
Space Telegraphy on Seagoing Steamships. By Dr. Alfred Gradenwitz. Illustrated 353
Precautions Against Electrolysis in Detroit, Mich 353, 354
The Telephone Line. By S. P. Grace. Illustrated 354, 355
Editorial 356
San Francisco Situation. Illustrated 357, 358
Institute Meeting in New York 358
Electrical Exports for March 358
Insulated Wiring and Underground Cables Discussed by the Institute 358, 359, 360
Standardizing Rubber-covered Wires and Cables. By John Langan 358, 359
Comments on Present Underground-cable Practice. By Wallace S. Clark 359
New Traction Facilities for Harrisburg. Illustrated 360
Arrangement of a Modern Engineering Office. Illustrated 360
Some New Small Electric Tools. Illustrated 361
Cable Clamps Used in Turning a Corner. Illustrated 361
Chicago Edison Men Entertained at Hawthorne Plant 361, 362
A New Type of Circuit-breaker. Illustrated 362
Maximum demand Systems in England and the United States. By J. S. C. (Communication) 362
Chicago Street-railway Situation 362, 363
Bristol Portable Recording Gauges. Illustrated 363
Another Wireless Conference 363
New Consolidated Company's Power Plant at Baltimore 363
Preparations for National Electric Light Convention 363
Rosewater's Recollections 364
American Pacific Cable Is Completed 364
Underwriters' Requirements for a Standard Electric Light and Power Station 365
Test of 500-kilowatt Curtis Steam Turbine 365
Space-telegraph Apparatus Apparently Foretells Earthquake 365
Buffalo Street-lighting Negotiations 365
Plans of the Wellman Polar Expedition 365
Boston Illuminating Engineers Complete Organization 366
Copper Production in the United States in 1905 366
Franklin Statue Is Unveiled in Paris 366
Railway Signal Association 366
Ohio Telephone Notes 366
Michigan Telephone Matters 366
Indiana Telephone Items 366
Telephone News from the Northwest 366, 367
Southeastern Telephone Developments 367
General Telephone News 367

DEPARTMENTS.

Correspondence 367, 368, 369
Great Britain 367
Dominion of Canada 367
New England 367, 368
New York 368
Southeastern States 368
Ohio 368, 369
Indiana 369
Michigan 369
Illinois 369
Northwestern States 369
Personal 369, 370
Electric Lighting 370
Electric Railways 370
Power Transmission 370
Publications 370
Societies and Schools 370, 371
Miscellaneous 371
Trade News 371
Business 371
Illustrated Electrical Patent Record 371, 372

DATES AHEAD.

Southwestern Electrical and Gas Association (annual convention), Galveston, Tex., May 16th, 17th and 18th.

Indiana Independent Telephone Association (annual meeting), Claypool Hotel, Indianapolis, May 17th and 18th.

American Institute of Electrical Engineers (annual convention), Hotel Pfister, Milwaukee, May 28th to June 1st.

National Electric Light Association (annual convention), Atlantic City, N. J., June 6th to 8th, inclusive.

Canadian Electrical Association (annual convention), Clifton House, Niagara Falls, Ont., June 19th, 20th and 21st.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

It is to be regretted that owing to the small number of members of the American Institute of Electrical Engineers desirous of taking part in the Italian trip, which had been planned for this summer, a definite representative party cannot be formed. Suitable explanations have been made to the Italian association, as it is not considered desirable to send a party of less than 15. This seeming lack of interest is the more remarkable when it is considered that Northern Italy, Switzerland and Germany have made more rapid strides in electrical engineering within the last three years than perhaps any other part of the world. An opportunity would also have been afforded of seeing electrical-engineering developments conceived under difficult and strenuous conditions met in ways not usually adopted in this country, where the whole art is accustomed to the apparatus of a few leading electrical companies. Three or four members of the Institute will find their way to Italy this month, but not, we believe, in any way representing the society officially. About 20 members will take part in the trip to England.

Doubtless lack of time on the part of our busy electrical engineers explains why so few expressed intention to accept the very courteous invitation of their Italian colleagues. A run of a month or six weeks over to England could be managed by a greater number than could spare the time to make the longer trip. It is unfortunate that this is the fact, but we are sure that the result is owing to no lack of appreciation of the cordial hospitality which prompted the invitation.

WIRE AND CABLE standardization an important and timely subject—was discussed at the recent meeting of the American Institute of Electrical Engineers. Especial attention was paid to the matter of insulation. It may be said without hesitation that there is no part of an electrical plant which is of more vital consequence to successful operation than the distributing medium, and engineers realize this to be true, yet it may also be said that there is no part of the system to which so little heed has been given to the matter of standardization as to the distribution end. Poor insulation in the distribution system will imperil the success of the most elaborately designed generating equipment. Some men believe, apparently, that a cable is a cable, and that if its cross section is sufficient it will do. But nothing could be farther from the truth than this too frequent assumption.

Two papers were read at the Institute meeting—one by Mr. John Langan on "Standardizing Rubber-covered Wires and Cables," and the other by Mr. Wallace S. Clark, entitled "Comments on Present Underground Cable Practice." Both showed thought and care in their preparation and they brought forth a long discussion. Abstracts of the papers and discussion appear elsewhere in this issue.

Mr. Langan hit the nail squarely on the head when he made the statement that "Under existing conditions, then, the electrical engineer has little in the way of data to guide him in obtaining reliable insulation." The widely varying character of rubber renders nearly all formulas uncertain and misleading. Some method which will enable the engineer to test off-hand the quality of an insulation without the aid of elaborate chemical processes is greatly needed. In order to establish some sort of a standard Mr. Langan suggested some specifications for rubber-insulated wires and cables and also some simple tests to determine the characteristics of the insulation.

Mr. Clark remarked that high insulation resistance, high puncture resistance, and durability, the three great attributes of good insulation, do not of necessity bear any relation to one another. The first is the easiest to obtain, the second somewhat more difficult, and the last the hardest of the three. A reasonable amount of rubber, and good rubber, is necessary to insure durability. What this percentage of rubber should be, and what kind of rubber, are the questions which are undecided. It is to be hoped that before long steps will be taken to standardize insulating compounds, so that an engineer in making his specifications may be sure of obtaining an insulation which will fulfill his requirements by simply specifying an insulation which is standard for a given work.

LINE WORK in telephone engineering has only of late years been given the consideration that is its due as one of the most important parts of the system. The result is that most telephone companies are confronted with the problem of rebuilding much of their old lines which are becoming high in their maintenance cost, and which are often an eyesore to the community which they serve. In replacing such lines and also building new ones a great many questions arise as to the policy to be adopted, and an elaborate development study is necessary in the larger towns and cities to determine the probable future demands on the system, the probable routes and the number of ducts if the underground system is to be adopted, etc. In a paper on "The Telephone Line" by S. P. Grace, presented before the Pittsburg branch of the American Institute of Electrical Engineers, which appears in abstract elsewhere in this issue, the author tells in an interesting manner of the methods to be followed in working out the problem of building an up-to-date telephone line, many of the methods described being those followed by the Central District and Printing Telegraph Company, of which Mr. Grace is chief engineer. Summarizing, he gives four general rules to be followed. First, where the number of circuits exceeds 400, underground subways should be built, the distribution to be effected by direct connection, vault systems, wall distributing systems or circle-top poles, according to local conditions. Second, where aerial distribution is used a cable should be placed on low poles not exceeding 35 feet in height, this cable to be provided with 10 or 15-pair terminals on alternate poles. Third, on side leads at right angles to aerial cables, twisted-pair wires are to be strung on brackets for subscribers located within 1,000 feet of the cable line. At distances greater than this No. 14 N. B. S. bare copper wire should be strung on standard cross-arms. Fourth, when the number of circuits on a pole exceeds 10 or 15, a cable should replace them, which should be provided with terminals on alternate poles.

ALTHOUGH a falling off in the use of the Wright demand system of charging for electric current is reported from England, where the system originated, the adherents of this method in the United States do not seem particularly disposed to change their allegiance. An interesting contribution to this important subject is made by a Boston correspondent in this issue and should be read by all station managers. But the matter of methods of charging is one which excites a wide divergence of opinion. In a paper recently read before the Hogan Engineering Club of La Crosse, Wis., and reprinted in part in the Western Electrician of April 28th, the author, Mr. W. W. Ferris, defended a departure from the meter-rate idea. "When central-station service first assumed commercial proportions, flat rates were naturally made," says Mr. Ferris. "As business grew it was soon learned that this method of charging was unprofitable and unsatisfactory to the consumer. From this extreme the tendency went to the opposite, and a few years ago it was the general opinion that nothing should be allowed of any kind except a meter rate. More recently, however, it has been learned that the purely meter rate is almost as unsatisfactory as the old flat rate. The middle ground is now generally taken and a combination rate made which has various forms, and the instance is now very common where central stations are making flat rates on various well-defined kinds of lighting and upon some kinds of power. This middle ground has become of great value to the central station in allowing it an income on certain kinds of lighting which was utterly impossible to get under a meter system." The writer of the foregoing is connected with a central station in a city of 30,000 inhabitants, where there is competition, and he probably spoke from local experience. But nevertheless it is true that it is never wise to make a fetich of any particular system of charging. The idea is simply to devise a system of rates that will attract all classes of business and yet prove profitable to the company. This is no easy task; indeed it is a very difficult one; and different stations, under varying conditions, must meet it from individual study and experience.

San Francisco Situation.

The Western Electrician has now, happily, heard from its San Francisco correspondent, who is alive and well and has secured temporary quarters in Oakland to carry on his work. Incidentally, bearing the interruption to telegraphic communication, it may be noted that he reports receiving a telegram of April 18th and a letter of April 21st on the same day, April 26th. Both were sent from the office of the Western Electrician in Chicago. The report of our correspondent, written on the spot, is as follows:

ELECTRICAL INTERESTS OF SAN FRANCISCO.

Oakland, Cal., April 26.—Before the ruins had cooled, big gangs of men were sent to tear away fallen wires of the San Francisco Gas and Electric Company and other concerns, and trace circuits wherever practicable. The wiring was also thoroughly inspected in the unburned districts, with a view to resuming electric light service as soon as it was considered safe to do so. The earthquake took place on Wednesday, April 18th, and the succeeding fire raged almost throughout the city during three days, but by Sunday the underground wires were found to be in fair condition and repairs were made.

The heavy rain of Monday morning, April 23d, flooded many conduits and caused a further delay. The 11,000-volt wires leading from the San Francisco Gas and Electric Company's main power station in the Potrero district to the main sub-station at Eighth and Mission streets were found to be in good condition. On installing step-down transformers at the sites of three other burned sub-stations, it would be possible to start up the main generating plant and distribute alternating current through a large section of the city.

The total destruction by earthquake and fire of the Jessie Street sub-station, which had been rehabilitated after the fire of February 22d that destroyed its engines, again completely crippled the Edison three-wire distributing system supplying the downtown district with direct current for light and power.

The General Electric Company, which lost its big suite of offices by the burning of the Crossley Building, has opened headquarters in the Union Savings Bank Building on Broadway Street, Oakland.

The Westinghouse Electric and Manufacturing Company's Pacific Coast district agency, which was destroyed by fire, at the corner of Market and First streets, has secured rooms on Broadway, opposite those of the General Electric Company.

The electrical supply trade situation is very unsatisfactory, especially for machinery, as large shipments, already on the way before the fire, have been held up en route in order to give trains bearing relief supplies the right of way. It is thought that it will be difficult to get the freight for the electrical supply dealers nearer to the city than Sacramento for some time. It is possible, however, that a special exception will be made by the authorities for the forwarding of electric motors, motor-generators, transformers, etc., owing to the crying necessity for lights, and the destruction of nearly all the stocks in the city. Some of the supply [illegible] in Oakland [illegible] the burned [illegible]

The [illegible] Company [illegible] in [illegible] several [illegible] and central [illegible] which [illegible] burned. Manager [illegible] in [illegible] system. It [illegible] center [illegible] pletion, a [illegible] that [illegible] the old [illegible] portion of the [illegible] would have [illegible] by the burning of the principal [illegible]

The large new [illegible] last winter on Hyde Street near [illegible] demonstrated the effectiveness of the new system, was burned on Thursday night, after the second day of conflagration. The old main exchange at 216 Bush Street, went up in flames Wednesday night. On Friday, before the flames had died out, Manager Glass had men at work on the lines along the water front, where the principal wharves had been spared by the fire, although three or four of the sheds had collapsed from the earthquake. On Saturday at noon the new office on Steiner Street, near Bush, was in operation, and long-distance connections had been established. Temporary motor-generator sets were installed and skilled electricians rapidly extended the scope of the service under emergency conditions, although the earthquake had destroyed most of the overhead wires and the fire had badly damaged some of the underground work. A.

Cross indicates the broken chimney of the San Francisco Gas and Electric Company's Jessie Street power station. Plant damaged by earthquake; ruin completed by fire.

A VIEW OF SAN FRANCISCO RUINS, SHOWING REMAINS OF JESSIE STREET ELECTRIC LIGHT PLANT, LOOKING SOUTH FROM MARKET STREET.

Under date of April 28th the Associated Press sends this from San Francisco:

"Maintenance of telegraphic communication with the outside world has been one of the most difficult questions with which the newspapers have had to contend. The experience of the Associated Press in this respect will give an idea of the obstacles confronting the other news agencies of the city. From Wednesday, April 18th, until Monday, April 23d, there was neither communication by means of telephone or telegraph between Oakland and San Francisco. On Monday one telephone circuit with Oakland was established for the Associated Press and for telegraphic purposes. The use continued throughout Tuesday, and Wednesday it failed. On Thursday the Western Union, by extraordinary efforts, succeeded in getting a bay cable in working order and by running wires in a roundabout way managed to get a wire into the municipal headquarters at Franklin Hall, on Fillmore Street. This wire was placed at the service of the Associated Press, and through communication to the East was established. News from the Associated Press headquarters has been going over this wire ever since.

"A. B. McCreary, the millionaire, who owns the site of the old Western Union Building at Montgomery and Pine streets, in which were located the offices of the Associated Press, is to begin immediately the construction of a six-story building of the most modern style. Mr. McCreary, who also owns the southwest corner of Pine and Montgomery streets, says he will not [illegible]

[illegible] still. Th[illegible] all humanitarian [illegible] telegra[illegible] throughout th[illegible] We [illegible]

Re[illegible] many [illegible] shaken down, the [illegible] vented they must either be [illegible] pletely with the steel frame, or better yet they must be made homogeneous or monolithic with the frame. Now the last named conditions are [illegible] present in the new form of concrete-steel or armored-concrete construction, which has made such rapid strides of late years in structures of the larger and more important class. As the results of most elaborate engineering tests, concrete-steel has been proved to possess in the highest degree those qualities of elasticity, toughness and homogeneous strength which, when combined in a monolithic mass, present a structure as nearly earthquake-proof as our present methods and materials can make it. Similarly, and in even greater degree, the buildings of lesser height may be rendered proof against overturning or serious rupture; for the bending and shearing moments introduced by the sudden lateral movements of the earth decrease with the decrease of height." In addition, an independent water supply for each large building is recommended, so that, in case of bursting of mains by earthquake, there will still be means of fighting the fire.

One of the first tangible penalties to investors growing out of the San Francisco disaster was the decision of the directors of the United Railways Investment Company, controlling the street railways of that city, to pay the dividend due the preferred stockholders of the company May 1st in scrip instead of in cash. The stockholders are asked to accept the scrip so that the cash in the company's treasury may be held to meet emergencies. The dividend amounts to $712,500, and the scrip will bear interest at six per cent until its redemption. The losses of the United Railroads have proved to be smaller than at first supposed. The common stock fell 43 points and the preferred 37 in the first few days succeeding the disaster, but both have recovered much of the ground lost.

Under date of April 25th, H. D. Scribner, manager of the San Francisco office of the Allis-Chalmers Company, sends this interesting account: "The earthquake occurred on Wednesday morning at 5:16 a. m. It shook down many of the weaker buildings, causing a chaotic condition of affairs, which was made worse by the cutting off of the electric and gas plants. Water mains and sewer mains were broken. Owing to the former, the fire department was unable to fight the fires immediately following the earthquake.

"The Rialto Building, where our offices were located, was entirely gutted. At this writing we have been unable to determine the exact condition of our safe, owing to the heat. We had a limited stock in the basement of the Rialto Building, but, owing to the dangerous condition of the walls, we have not approached the building, but will do so in a day or so. Our stock stored in our warehouse is probably entirely destroyed.

"Our new location is 906 Broadway, Room 21, Oakland. About every firm transacting business in San Francisco has moved to Oakland, and there was a scramble for temporary offices, which will have to be occupied for a period of from six to nine months. We were fortunate in securing a prominent location at a reasonable rent. We secured this office on the same day of the quake.

and we have our telephone now in place. Furniture is at a premium, but we have secured a job lot, consisting of dining and parlor chairs and tables, and were lucky to get three typewriters.

"At the present time we are transacting our business under difficulties, and, as our salesmen and office force have been unable to get their families to Oakland, owing to the scarcity of teams, we have not a representative office force here.

"It is useless for anyone to telegraph us, or for us to use the telegraph, owing to the congested condition of affairs. As an instance, we cite the following: The manager of the Western Union stated that they were behind 7,000 messages, 1,000 of which they put two-cent stamps on and mailed. The effect is, of course, that everyone is short of money. The bank presidents find it necessary to secure the rations which are being distributed by the United States Army Commissary. The situation is further aggravated from the fact that the weather conditions are bad. We have received a drenching rain, and as there are probably 100,000 homeless people camping in the parks of San Francisco without shelter, we shall probably have an epidemic of sickness. Hence, the manager of this office deemed it advisable to advance the salesmen sufficient money to get them out of the city with their families. Our entire office force, with their families, were saved, but a number of them lost their homes, and some of them have only the clothes with which they escaped from their residences."

The Westinghouse Electric and Manufacturing Company carried a large stock in San Francisco. This company has already made large shipments from the East to meet the immediate need for electrical material.

The Stanley-G. I. Electric Manufacturing Company has opened temporary offices at 67 Blake Block, Oakland, Cal. Several carloads of electrical apparatus have already left Pittsfield, Mass., to take the place of machinery damaged or destroyed in the California disaster.

Institute Meeting in New York.

A meeting of the American Institute of Electrical Engineers was held in the auditorium of the New York Edison Company on the evening of April 27th, President S. S. Wheeler presiding. Secretary Ralph W. Pope announced the election of 84 associate members at the meeting of the board of directors in the afternoon. The topic for discussion was the general subject of insulated wires and cables, and it was introduced by the reading of two carefully prepared papers. One of these papers, by John Langan of the Okonite Company, New York, was entitled "Standardizing Rubber-covered Wires and Cables." The other paper, entitled "Comments on Present Underground Cable Practice," was by Wallace S. Clark of the General Electric Company, Schenectady, N. Y. The field covered by these papers is an important one, and a valuable discussion ensued. Following in this issue will be found abstracts of the papers and discussion. In view of the importance of the question of insulation, it was recommended that Dr. A. E. Kennelly, who is secretary of the committee on standardization, look into the matter and, if need be, see that a committee is set at work upon the standardization of cable specifications.

Electrical Exports for March.

Electrical exports from the United States for the month of March, 1906, reached a total value of $1,295,365. In March, 1905, the amount was $1,126,201. Both classes of electrical goods—electrical appliances and electrical machinery—show an increase for March over the corresponding month of last year. The figures in detail are: Electrical appliances (including telegraph and telephone instruments)—March, 1905, $505,705; March, 1906, $590,328. Electrical machinery—March, 1905, $620,496; March, 1906, $705,037.

Considering electrical machinery only, the following countries were the principal buyers from the United States in March, the value of the exports to each country being given: British North America, $175,831; Japan, $127,921; United Kingdom, $118,934; Mexico, $111,627; Brazil, $31,914; Cuba, $22,791; British Australasia, $18,750; British East Indies, $12,772; British Africa, $11,731; Germany, $9,518; Chinese Empire, $9,501; France, $7,617; Argentina, $5,200; Central American States and British Honduras, $3,779; Hongkong, $1,300.

A newspaper dispatch from Milwaukee says that Mayor Becker is paving the way for the construction of a municipal lighting plant, which has been demanded several times by the people of the city. A commission of five has been selected to superintend the construction and operation of the plant. Irving B. Cary, an electrician, will have charge of the board, being the member appointed for five years. The members of the commission serve without pay.

Insulated Wiring and Underground Cables Discussed by the Institute.

Two papers dealing with present practice in wire and cable work were read at the meeting of the American Institute of Electrical Engineers in New York on April 27th. One of these papers was upon "Standardizing Rubber-covered Wires and Cables," by John Langan, who is identified with the selling department of the Okonite Company of New York city. The other paper was entitled "Comments on Present Underground Cable Practice," by Wallace S. Clark, engineer of the wire, cable and tube department of the General Electric Company, Schenectady, N. Y. Both papers are interesting in that they deal with one of the most vital parts of an electrical system—a part of the system which is perhaps more liable than any other to cause loss to the operating company through unseen leaks which are constantly entailing loss of current, or through breakdowns, which mean interrupted service, the bugbear of the central-station management. Abstracts of the two papers, together with some of the most important portions of the long discussion which followed their presentation, are here given.

Standardizing Rubber-covered Wires and Cables by John Langan.

On the distributing and not the generating medium depends the success of the present tendency in electrical distribution. A badly insulated wire or cable will imperil the success of any system. Not only must the insulation itself be perfect, but it must also be properly tested, properly installed and properly protected. Curiously enough engineers while examining carefully every other feature of a transmission system will often pass lightly over the question of cables.

The object of this paper is to point out and define means of standardizing rubber insulation. Under existing conditions the electrical engineer has little in the way of data to guide him in obtaining reliable insulation. This, I know, sounds very heterodox. "For if there is any one dogmatism to which electrical practice seems unchangeably attached it is that of a firm belief in the value of voltage test in determining dielectric efficiency. Yet nothing could be more misleading. Indeed it may be affirmed that a potential test is in itself no criterion whatever of permanent value." As an aid—as a collateral agent—it does, however, play an important part. But as indicating, much less proving, permanent merit, nothing could be more misleading and empirical. And the reason for this will, on a little reflection, be obvious enough.

You are all familiar with the influence of certain oils on high-tension switches and transformers. These withstand potentials that without these adventitious aids would be altogether impossible. Certain mineral and vegetable oils will, therefore, stand extremely high pressures, and in this we have a clew, and even proof, why many obviously cheap insulating compounds stand very high potential tests, and yet will, in a short time, break down in actual service. The logic of this anomalous condition is that when these communicated oils in the compound evaporate—as they will in a short time—the temporary and adventitious virtues they possess disappear also, and the insulation deprived of this artificial support quickly falls into disintegration and decay. This is the inevitable history of all such combinations. The situation is somewhat akin to a horse "doped" for a race, who shows a surprising turn of speed for a short distance and then suddenly collapses. From this it will be seen that a puncture test is, in itself, an uncertain proof of dielectric excellence.

What is it then that constitutes good insulation, and how can we ascertain and know it? This is the all-important question. With this assured, everything else logically follows. The consensus of opinion, derived alike from theoretical and practical experience, is that rubber is the best of all insulating materials. But while rubber is the principal feature of good insulation, it is not the only feature. As a matter of fact, rubber in itself is valueless as an insulating medium. The reason for this is that in its native condition it absorbs a certain amount of moisture, and when exposed to the air readily oxidizes. These factors of disintegration naturally preclude its use as a distinct and separate constituent for insulating purposes. But in conjunction with other ingredients and when allied with sulphur and properly vulcanized it becomes not only absolutely waterproof, but indeed under normal conditions one might say indestructible. From this it will be seen that there are two factors involved in good insulation. The fundamental thing is, of course, that the rubber be fine Para. But it does not matter how good the rubber is or how much of it is incorporated in the compound, if the vulcanization is not properly carried out the insulation will be defective.

Chemically considered, rubber is differentiated by the amount of acetone soluble, extractive or resinous matter which it contains, and physically by its tensile strength. Both, of course, are closely related; for where it is chemically poor it is also physically weak. In brief, a high percentage of resinous matter is indicative of the cheaper grades, such as African, Madagascar, and some South American products; and a low percentage indicates the best grades of fine Para, such as Bolivia, Madeira and Up-river.

It is well known that while vulcanization, when properly done, does not alter the constitution of rubber, yet it can be made to affect adversely or deceptively modify its behavior. For example, if it is over-vulcanized it will become hard and somewhat brittle; and if under-vulcanized it will become flabby and inert. In either case the result is indicative of imperfect insulation, and will not fulfill the requirements of a tensile test. In the one case it will break, and in the other it will stretch but not return. Good insulation, then, is clearly indicated by its prompt return after being stretched several times to, say, three to four times its length. Stretching to three and one-half times its length, as above indicated, is, roughly speaking, equal to about 800 pounds to the square inch. But bear in mind that merely stretching implies nothing; almost any kind of rubber will stretch. But in first-class rubber the insulation will jump back with a vigor somewhat similar to a magnetic pull. What, however, is aimed at in this test is a tensile strain of not less than 800 pounds to the square inch, and wherever practicable this is much more effective in weeding out the cheaper grades of rubber than the elongation test alone.

The first lesson that it conveys is, that this physical test, rigidly enforced, precludes absolutely the use of shoddy, bituminous products, and even the cheap grades of rubber. The second is, that it takes 40 to 50 per cent. of a cheaper combination to do what 30 per cent. of pure Para will do. Another way of looking at it is, that the physical test does not, in itself, prove that the insulating compound contains nothing else but pure Para. This, to be sure, is a drawback to its exclusive use where the best results are wished for. But, on the other hand, if it does not give you the best it does at any rate wipe out all cheap rubber substitutes and gives you an insulation that, if not equal in durability to 30 per cent. of Para, is immeasurably superior to anything you can now obtain by any other means short of a chemical analysis. This, in itself, is an immense advantage. It enables the distant engineer to do what he could not do heretofore—to tell off-hand what the character of the insulation is—that is, to strip the insulation from the wire and test according to the specifications herein to follow. Anyone can verify the value of it by getting some code wire and applying this test to it, or indeed, for that matter, the best wire to be found on the market, and see what the comparison will reveal.

How to obtain—how to compel—30 per cent. of fine Para in the insulating compound is, then, the problem where the best and most enduring results are desired. The following specifications will, it is hoped, in view of what has been said, be intelligible to all:

Specifications for Rubber-insulated Wires and Cables.—All conductors to have at least 98 per cent. conductivity and to be thoroughly and evenly tinned.

The insulating compound to contain not less than 30 per cent. and not more than 32 per cent. of fine Para rubber. No shoddy, reclaimed rubber, rubber substitutes, or the like, must in any form be in the compound, the extractive matter of which, when chemically analyzed, must not exceed five per cent.

All wires and cables properly insulated in accordance with the above provisions must after 48 hours' immersion in water at a temperature of 60° F., and before tape, braid or lead is applied, show the following insulation resistance and voltage tests. Insulation test to be made with a battery of 100 volts after one minute's electrification:

Low Potential, 600 Volts.

B. & S. Gauge.	Wall. Inch.	Voltage Test One Minute	Insulation Resistance. Megohms Per Mile.
Nos. 14 to 8	3-64	1,000	1,000
Nos. 6 to 2	4-64	1,000	1,000
Nos. 1 to 4-0	5-64	1,000	1,000
250,000 to 500,000 cir. mils	6-64	1,000	750
550,000 to 1,000,000 cir. mils	7-64	1,000	500

Medium Potential, 3,500 Volts.

B. & S. Gauge.	Wall. Inch.	Voltage Test for One Minute.	Insulation Resistance. Megohms Per Mile.
Nos. 14 to 8	3-32	5,000	3,000
Nos. 6 to 2	3-32	5,000	2,500
Nos. 1 to 4-0	3-32	5,000	2,000
250,000 to 500,000 cir. mils	3-32	5,000	1,000
550,000 to 1,000,000 cir. mils	4-32	5,000	600

5,000 Volts Working Pressure.

B. & S. Gauge.	Wall Inch.	Voltage Test for One Minute.	Insulation Resistance. Megohms Per Mile.
Nos. 4 to 4-0	6-32	10,000	2,500
250,000 to 500,000 cir. mils	6-32	10,000	1,500
550,000 to 1,000,000 cir. mils	6-32	10,000	1,000

11,000 Volts Working Pressure

B. & S. Gauge.	Wall. Inch.	Voltage Test for One Minute.	Insulation Resistance. Megohms Per Mile.
Nos. 4 to 4-0	9-32	15,000	4,000
250,000 to 500,000 cir. mils	9-32	15,000	3,000
550,000 to 1,000,000 cir. mils	9-32	15,000	1,500

B. & S. Gauge	Wall Inch	Voltage Test for One Minute	Insulation Resistance Megohms Per Mile
Nos. 4 to 4-0	[illegible]	20,000	[illegible]
250,000 to 500,000 cir. mils	.10-32	20,000	[illegible]
550,000 to 1,000,000 cir. mils	10-32	20,000	[illegible]

B. & S. Gauge	Wall Inch	Voltage Test for One Minute	Insulation Resistance Megohm Per Mile
Nos. 4 to 4-0	12-[illegible]	20,000	[illegible]
250,000 to 500,000 cir. mils	.12-[illegible]	20,000	[illegible]
550,000 to 1,000,000 cir. mils	12-32	20,000	[illegible]

For railway signaling, fire alarm, telephone and telegraph purposes the walls of insulation should not be less than the following:

B. & S. Gauge	Rubber Wall Inch	Voltage Test for One Minute	Insulation Resistance Per Mile Megohms
18	.1-16	1,000	3,000
16	.1-16	1,000	3,000
14	.1-16	1,000	[illegible]
12	.5-64	1,000	3,000
10	5-64	1,000	3,000
8	.5-64	1,000	[illegible]
9	.5-64	1,000	[illegible]
6	.3-32	2,000	2,500
4	3-32	2,000	2,500
2	3-32	2,000	2,500
1	3-32	2,000	2,000
0	3-32	2,000	2,000
00	3-32	2,000	2,000
000	3-32	2,000	2,000
0000	3-32	2,000	2,000

Elongation Test.—In addition to the above tests the insulating material of every wire must stand an elongation test of stretching three times its length several times; that is, a piece two inches long must stretch to six inches and promptly return to within 20 per cent. of its original length. It must then stretch four times without break or rupture and return to 25 per cent. of its original length.

This elongation test is intended principally for code wire, and would, even by omitting all conditions as to rubber, compel results that would be entirely reliable and satisfactory for all conditions of code use.

Tensile Test.—Any piece of insulation, about one-half inch wide by one-sixteenth inch thick, stripped from the completed wire or cable, should stand a tensile strain of 800 pounds to the square inch and stretch to three and one-half times its length without rupture.

The following provision will be found useful: The manufacturer must notify the electrical engineer when wire is ready for testing, and in no instance must shipment be made until notified of approval and acceptance as per above tests.

In carrying out the tests embodied in these specifications there is sought something quite different from the ordinary potential and electrical tests. Heretofore the electrical engineer, when he imposed any test at all, relied solely upon a puncture test. If it met these requirements he asked for nothing more. If a wire or cable withstood a very high puncture test it was looked upon as a prima facie evidence of dielectric excellence, forgetting that, had the pressure been maintained a moment longer, the insulation might have broken down. It is a most mischievous practice, and a wholly misleading notion of safety to push a test up to or even to approach closely the dielectric limit of the insulation; for it is no uncommon occurrence to find the very best insulation hopelessly injured by this practice. It may not be well known, but it is a fact, nevertheless, that it is the rise in temperature which accompanies a rise in potential that is so destructive of rubber insulation. The layers next the copper naturally feel these injurious effects first, and they thus successively carbonize and break down with this increasing elevation of pressure and temperature.

Much of the present tendency for high potential and breakdown tests is the result of an altogether erroneous comparison with tests imposed on paper-insulated and similar cables, which must, of course, be lead-covered before any test can be made. Such tests are of necessity "dry tests," whereas rubber-covered cables, on the contrary, are soaked in water and tested before the tape, braid or lead is applied. For this reason it is hardly an exaggeration to say that double the potential imposed on a paper cable is no more exacting than half the amount applied to a rubber cable. To expect, then, on a rubber cable anything like the same strain that is ordinarily put on a paper cable would be, in effect, expecting rubber to stand double what paper stands.

Comments on Present Underground Cable Practice.

BY WALLACE S. CLARK.

Low-tension Cables.—These are run in conduits with some portion of the circuit grounded. In railway practice one leg of a two-wire circuit, and in lighting the neutral wire, is permanently earthed. The continuous sheath on these cables is an invitation to stray currents and consequent electrolysis; while dry, well-vitrified tile is a fair insulator, but in time the joints between the sections provide leakage spots. Further, many ducts are damp at certain seasons, if not during the entire year, making the dirt which accumulates a sufficiently good conductor to offer an additional path for stray currents.

Grounding the sheath at each manhole was announced as a cure for electrolysis, but instead of a cure it has been found in some cases to be a cause of trouble. [illegible] by the sheath [illegible] drop in electromotive [illegible] sufficient to [illegible] some intermediate [illegible] ficient volume [illegible]

In case of a burn-out, the [illegible] sheath aggravates the trouble. [illegible] fault is in the duct [illegible] of the arc is to travel along the [illegible] a sufficient volume of current [illegible] device, if such are in the circuit. [illegible] another continuous [illegible] reach of the traveling arc [illegible] insures two cables out of service. [illegible] large installation can furnish [illegible] serious and expensive experience illustrating this point. Further, during the burn-out a heavy current flows in the sheath, and this may leave the sheath by arcing to earth on some perfectly good section of cable, melting a hole in the lead.

The volume of current carried by these low-tension conductors in regular practice is so large that in many cases circuit breakers or fuses will not operate with the current, due to the short circuit. The ammeters are a poor guide, especially in railway work. In many cases the outside end of the line is solidly connected to a network which is capable of furnishing all the energy needed to maintain the arc after the defective cable is disconnected at the station end, so we cannot depend on protective apparatus as used today for prevention of these troubles.

Omitting the sheath will cure all the above ills. To do this would bar paper, leaded jacketed cable absolutely, and would increase the depreciation account if some type of cable insulation needing lead only, as wood needs paint, were used. Abandoning the lead entirely is an economic possibility with only very large conductors, where it may be cheaper to renew the insulation on a non-leaded cable, say once in 10 years, than to renew a lead jacket cable once in 20 years. These figures are, of course, merely used for comparison, for there is little accurate knowledge as to the life of insulated cables. If, therefore, we are compelled to use a lead sheath the writer believes that it should be interrupted by some form of insulating joint on low-tension cables.

If this plan is carried out a serious difficulty is the inability to test the insulation of the cable. This may be met by the use of an insulated wire—proof or pressure wire—in the outer layer of strands forming the copper core. Such a wire should be insulated with some material like treated paper susceptible to the absorption of moisture.

For the purposes of initial tests when cable is installed the joints in the sheath may be bridged by fine fuse wires, which are afterward removed. Several methods of utilizing the pressure wire are suggested below:

(a) The outer end of the pressure wire is insulated, in which case periodic tests of this wire for insulation resistance will show any incipient fault in the main conductor. Between tests the wire can be connected to a drop annunciator or other signaling device which will become operative in case of a burn-out, since the pressure wire will become "alive" before any great amount of energy flows through the fault. It might also be made to operate a current-interrupting device.

(b) The wire may be used to read the pressure at the far end of the line, the potential on the wire being opposite to that on the conductor in which it is embedded. A burn-out would reverse this potential and either make the wire "dead" or of the same potential and sign as the main conductor.

This change in potential could operate devices as above outlined under heading (a). If used in this way the pressure wire would have to be disconnected at the far end for insulation tests; a much easier operation, however, than the disconnecting and insulating of the main conductor and one not interfering with working the line.

A secondary use of the pressure wire would be to calculate the temperature of the main conductor by measuring variation in the resistance, figuring from length, loss in line and known resistance cold.

High-tension Cables.—With high-tension lines some of the troubles due to the metallic sheath on low-tension cables are less marked. The load is usually more uniform and subject to less violent fluctuation, especially where sub-stations with batteries are in use, allowing protective devices to be set so as to operate more promptly.

Further, in the case of a network, such cables are usually protected against a reversal of current, so that the arc at the fault is not maintained by energy derived from the network or sub-station.

The metal sheath on high-tension cables must be earthed to prevent danger to life and also risk of puncturing the insulation by cumulative static charge. It is probably unnecessary to use insulating joints in the sheath of high-tension cables, except in some special case, where local conditions require them to prevent an excessive amount of stray current being carried.

In the matter of sheaths, for a number of years the writer has been advocating multiple conductor cables for arc circuits instead of several cables in the same duct in trunk lines. The running of a lot of small cables in one duct is not good practice. [illegible]

[illegible] short life.

[illegible] turing [illegible] High [illegible] durability the most difficult of attainment. [illegible] sonable amount of good rubber [illegible] of the art, as known to the writer, [illegible] insure durability.

An idea of the life of a rubber [illegible] operating at 11,000 volts, 25 [illegible] below through the kindness of Mr. [illegible] superintendent of the Cataract Power [illegible] Company, Buffalo.

	Cable No. [illegible] Feet	Cable No. [illegible] Feet
In service November [illegible]	[illegible]	[illegible]
Added January 22 [illegible]	[illegible]	[illegible]
Total in service from [illegible]	[illegible]	[illegible]

Burn-outs. December 28, 1897, cable No. 2, [illegible] feet from end of pole line, cause, [illegible]

May 11, 1898, cable No. 3, same as No. 2.

May 2, 1899, cable No. 3, 8,031 feet from end; cause not ascertained.

October 12, 1899, cable No. 3, 14,845 feet; end in joint.

1900, none.

1901, none.

May 17, 1902, cable No. 2, 14,224 feet from end in cable vault; mechanical injury.

1903, none.

September 19, 1904, cable No. 2, 14,204 feet from end; laborer drove gas pipe into conduit and cable.

1905, none.

March 27, 1906, none to date.

In May, 1900, cable No. 2 was tested with 22,000 volts for 24 hours.

Size of cable, 3-0, conductors, three, insulation on each conductor 9-32 inch thick; no overall jacket.

The most noticeable fact brought out is that although most of the cable is more than eight years old, there is no indication of any electro-chemical or other electrical action weakening the ability of the insulation to withstand the working pressure.

Further, these cables originally operating alone are now in multiple with some 32 miles of three-conductor cables, and therefore subjected in all probability to more severe strains, due to surges, than when first installed. These are, I believe, the oldest working rubber-insulated 11,000-volt three-phase cables in use today.

These data on rubber insulation are important, if, as the writer believes, cables for very high tension will be made with combined insulations of varying capacities rather than with a homogeneous insulation of any insulating material now in use.

Discussion (in Abstract).

Philip Torchio, New York: The papers, in a nutshell, recommend two tests: One the acetone test, to determine the percentage of extractive matter in the compound, and the other a mechanical test of elongation and tensile strength. One of the papers recommends a limit of five per cent. of extractive matter of the total compound, the other six per cent. With these percentages it is proposed to absolutely prohibit the use of less than 30 per cent. fine Para rubber in the compound. I regret that Mr. Langan in his paper has not more clearly stated the fact that it is an impossibility at the present time for any chemist to directly determine the amount of pure Para rubber in a compound. He arrives at this amount by inferences and assumptions, by means of which he tries to assume how much of the rubber found in the compound is pure Para rubber and how much is inferior rubber.

Five per cent. of the total compound is what is called for in the specifications. In a pure Para that is one per cent. of extractive matter, and one per cent. of three per cent. would be only one-third of one per cent. I should represent the extractive matter in percentage of the total amount of compound. In vulcanization it is true that about three

per cent. of extractive matter is added by the process of vulcanizing, and that would add about one per cent., not five or six per cent. of the total per cent. of the compound, for 30 per cent. pure Para.

Summing up the criticism of these proposed specifications, I should think that they could be properly made the foundation for the work of a special committee of the Institute, to whom should be given the power to investigate and collect data on the subject and make a report to the Institute at some future date.

Dr. A. E. Kennelly, Cambridge, Mass.: The purpose of a cable in the transmission of power is to withstand certain voltages, and if a system is to distribute at 10,000 volts the cable must be built to safely withstand 10,000 volts, and so much more above that as the incidents of the business may require. It is of vital consequence to the station manager to know just how much that cable will probably withstand, but in order to determine that he is not going to take that cable, after it is laid, and bring the pressure up to the breakdown point, because that would be like taking a bridge to find out how much weight it will stand, and smashing the bridge after you build it. I suppose the natural procedure would be to test samples of the cable for the breakdown test both before and after the cable was put down, but not to subject a whole cable to anything like a breakdown test. The usual practice is to take a part of the cable. The basis, both in mechanical engineering and in electrical engineering, is to test a part, and the capability of the cable to come up to the test piece is a matter of ordinary judgment for the engineer to decide. If the cable is lead-covered and is not overheated, then, after it has been in ordinary service, without being overloaded by surges, a test piece lying on a shelf ought to be in the same condition as a criterion of permanence as the actual cable that has been in daily use under electric stress. The point, I think, has not received sufficient attention that when a cable is stressed, say to 15,000 volts, it is the inside layers that are crucially tested, always the inside layer, and the outside layer gets off very easily by comparison with the dielectric stress upon the inside layer, and the thickness of wall is only a very imperfect criterion as to the strength of the cable for a given voltage. It does not really depend upon the thickness of the wall, but upon the ratio of the external thickness to the internal thickness, and it has always to be kept in mind that the maximum dielectric stress will be exerted upon the inside layer, although it is the total test that has to be preserved from the engineering standpoint, but the criterion must always be, I think, in any scientific testing of cables, the maximum stress upon the inside layer.

William McClellan, Newcastle-on-Tyne, England: The point cannot be made too strongly that, according to the use to which the insulation is to be put, the percentage and quality of rubber may vary to advantage over comparatively wide limits, and the nature of the other substances may vary to advantage also. For a large proportion of the work that is to be done 30 per cent. pure Para rubber is wholly unnecessary, and much too expensive; moreover, there is a large amount of very good rubber produced, not so fine as Para, but of the greatest use in the art of insulation. Now, a specification, to be standard, should be put in such a form as to permit the use of any percentage of any kind of rubber which the intelligent engineer may desire. Any specification which calls for 30 per cent. pure Para rubber uniformly, without regard to the particular use for which the insulation is designed, is fundamentally bad from an economic standpoint.

Charles F. Scott, Pittsburg: The real essence of a cable test should be to determine its reliability. In other kinds of apparatus we do not necessarily specify the materials and how they shall be made and treated in the course of manufacture, but we deal with the final results. There was a time when specifications for dynamos went carefully into the amperes per square inch and induction, and things of that sort. Now specifications for machinery are based upon the final results, upon tests of those elements which go to make up and determine the performance of the machine in service. In the high-tension tests for other kinds of apparatus, as is the custom in general practice and as is laid down by the standardization rules of this Institute, we depend upon a certain high-voltage test that has been raised, with high-voltage apparatus in general, to twice the working voltage. Can the cable accept the same kind of a specification, the same limits, or must it have some other kind of a specification and some other kind of limit? Must a man who wants a cable for a given service necessarily specify the ingredients of that cable and then go to the manufacturer and see it is put in and stirred up and baked properly, or is there some way to determine, in the case of the cable, whether it is going to do the service for him? If the high-tension test is to be applied, shall it be the same as for all other apparatus, or shall it be something considerably less? That matter was up for discussion at a meeting of the standardization committee recently, and it was seriously proposed that the test on cables should be considerably less than the tests of transformers. That would mean to the operating man that he has transformers which are better than the cables, and that some point in his cable would likely be the point of breakdown.

New Traction Facilities for Harrisburg, Pennsylvania.

Excavations for the new power station of the Central Pennsylvania Traction Company of Harrisburg, Pa., were begun early in December, and the construction of the building proper is now well on the way. The new plant adjoins the old No. 1 Station on South Cameron Street, Harrisburg, and when completed will replace three separate plants which are now in service. The building, 175 by 162 feet, and one story in height, is of steel construction imbedded in concrete.

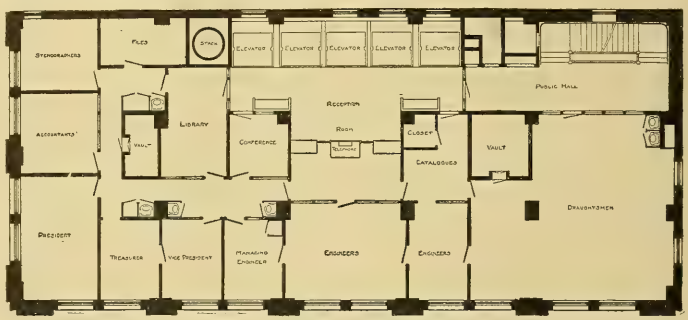
The steam and electrical equipment for the plant will consist of three Reynolds horizontal cross-compound condensing Corliss engines, heavy duty type, built at the West Allis, Milwaukee, shops of the Allis-Chalmers Company. Each engine will be direct connected to a 650-kilowatt 600-volt direct-current generator mounted on the main shaft, the generators also being furnished by the Allis-Chalmers Company and built at the company's "Bullock" works, Cincinnati. These units will have a capacity of 50 per cent. overload for short periods, giving a maximum capacity for the entire plant of approximately 4,500 horsepower. The main switchboard, which will consist of 12 panels, will be connected by a direct feeder line to each of the 12 different sections into which the traction company's lines are divided. The engine room will be 50 feet wide, extending the full length of the building, 170 feet, and directly facing Cameron Street. An electric traveling crane with a lifting capacity of 30 tons will serve the engine room for installing heavy apparatus.

The boiler room, which will occupy the rear portion of the building and contains for the present five 350-horsepower horizontal water-tube boilers furnished by the E. Keeler Company of Williamport, Pa., will be equipped with all the necessary modern appliances for handling coal and ashes, including an overhead bin for coal with 600 tons capacity. There will also be an overhead ash bin of ample capacity, the ashes being taken from the ashpits below the boilers in a basement 11 feet below the boiler-room floor and deposited in the bins by means of a vertical chain-bucket elevator. A continuous-belt conveyor extending the full length of the coal bin is used for conveying coal to a bucket elevator. The boiler plant will be equipped with the usual feed-water heaters and economizers, which will occupy one-half of the floor space of the building only, ample room being provided for the installation of additional boilers and engines as the growth of the system warrants, so that the plant will have an ultimate capacity of 9,000 or 10,000 horsepower.

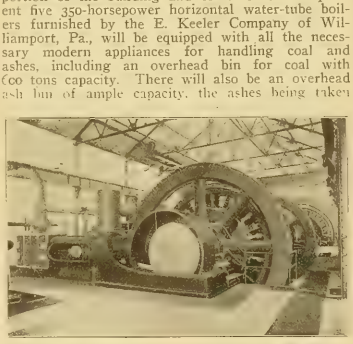
The stack, 10 feet inside diameter and 210 feet high above foundations, will be built of reinforced concrete, resting on the solid rock 20 feet below the ground level. A railroad siding connecting with both the Pennsylvania and Reading railroads will run between the boiler room and the stack.

An interesting engineering feature of the new plant will be the water-supply tunnel. Plans have been drawn and the work will shortly be started on the boring of a five-foot tunnel in the solid rock 30 feet below the surface of the ground, extending from the plant in a direct line under the yards of the Central Iron and Steel Company to the river. From the river bank a 36-foot cast-iron pipe will extend to a point in the river where the best quality of water is to be obtained. This water-supply tunnel will be built and used jointly by the traction company and the Central Iron and Steel Company.

All the work is being carried out from plans prepared by and under the direction of Mason D. Pratt, consulting engineer of Harrisburg, and W. C. Gotshall and C. O. Mailloux of New York city, acting as advisory electrical engineers. This plant will cost about $250,000 and is expected to be ready for operation early in May.



NEW QUARTERS OF THE ARNOLD COMPANY IN THE BORLAND BUILDING, CHICAGO.



DIRECT CONNECTED RAILWAY GENERATORS IN NEW HARRISBURG (PA.) PLANT.

Arrangement of a Modern Engineering Office.

As representative of a convenient arrangement of rooms to fit the requirements of a modern engineering office, the new quarters of The Arnold Company of Chicago are worthy of attention. The company moved on May 1st into the new Borland Building at the corner of La Salle and Monroe streets, a new 17-story building, where it will occupy the entire sixteenth floor and also a suite of rooms on the seventeenth floor for the drafting rooms of the architectural and structural-steel department, which has recently been added to handle the building problems which arise in connection with the construction work. The accompanying plan of the sixteenth floor of the Borland Building shows plainly how the company is quartered in its new home.

As the plan indicates, the usual corridor in front of the elevators is done away with, and the latter open directly into a large reception room. There are roomy quarters for the executive staff of the company, and the engineering department is well taken care of. There are two large rooms, one for a library and the other for conference purposes. The drafting room takes up nearly one-fourth of the space on this floor and is provided with an ample vault for storing tracings and blue prints. The accounting department, the stenographers' room and the filing department are located in one section, so that all the details of the office management may be carried out with a minimum of labor.

The Arnold Company, as is well known, is builder and contractor for electric railways, steam and waterpower plants, repair shops for railroads, etc. Among the important contracts which the company has now in hand are the building of the entire Elgin and Belvidere (Ill.) electric railway, a 35-mile interurban line, the preparation of plans and specifications for the equipment of the repair shops of the Kansas City Southern Railway Company at Pittsburg, Kan., plans for two more hydro-electric plants for the Spring River Power Company near Joplin, Mo., and the construction of a 2,000-kilowatt auxiliary steam plant for the same company, besides many others of a similar nature. The policy of the company in handling certain parts of the work, first as engineer and then as actual constructor, has a broad effect on its engineering work and enables it to keep constantly in touch with the market for materials and equipment. It is also frequently retained in connection with the operation of a property, so that its field covers almost the entire range of technical work.

Officers of The Arnold Company are: President, B. J. Arnold; vice-president, W. L. Arnold; secretary-treasurer, Ralph G. Arnold; managing engineer, George A. Damon.

Some New Small Electric Tools.

Several small motor adaptations which are quite interesting as showing how thoroughly electrical manufacturers are in touch with the need of the general public outside of the purely electrical field have been developed by the General Electric Company. The use of electric power is daily being extended by the progressive central station into almost every nook and corner of their customers' premises. Motors for small labor saving machines enable the jeweler, dentist, grocer, butcher and even their customer, the householder, to draw on the

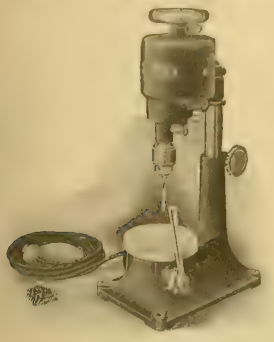


Fig. 1. Electrically Driven Bench Drill.

Fig. 2. Portable Electric Breast Drill.

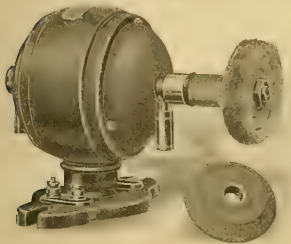


Fig. 3. Electric Grinding and Buffing Outfit.

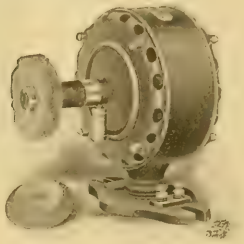


Fig. 4. Electric Grinder and Buffer.

SOME NEW SMALL ELECTRIC TOOLS.

electric-lighting circuit for economical and convenient power whenever and wherever required to meet daily needs.

The General Electric Company's latest development along these lines includes an electrically driven bench drill suitable for small work, a portable electric breast drill for the same range of requirements and an electric buffing and grinding outfit for household use. The bench drill has been particularly designed for the use of jewelers, repair men and manufacturers who have a large amount of drilling on small work or otherwise where the drilling service is not severe.

Machine and general repair-shop men as well as manufacturers are becoming better informed and more convinced of the advantages of the electric motor for driving their machinery and realize that large savings in time and money are both possible in just those operations for which the electric bench drill is designed.

The bench drill shown in Fig. 1 is furnished with a vertical motor mounted on the top of a column sliding in a socket cast integrally with the base, in which it can be adjusted for various heights. The motor body or head is also adjustable radially for drilling position.

The whole outfit rests on a broad base about six by 10 inches, which gives the desired stability. The minimum height is 16 inches when the motor arm is in the lowest position, and the maximum height is 22 inches when the motor arm is fully raised, thus giving a range of six inches through which the motor body may be raised or lowered. The work is fed to the drill by raising the circular table, which is operated by a lever with a range of 1¼ inches vertically.

The motor is series wound and can be supplied with 115 or 230-volt winding, for use on direct-current circuit only. A single gear reduction is provided between the armature shaft and drill spindle. The handwheel mounted on the armature shaft at the top is convenient for turning the spindle and adds a flywheel effect to the spindle as well, thereby insuring a smooth, steady rotation of the drill. The amount of power required in the operation of the drill naturally varies with the work performed, but in no case is it excessive. The largest drill the chuck will hold is 21-64 inch diameter, and from this all sizes down to No. 40.

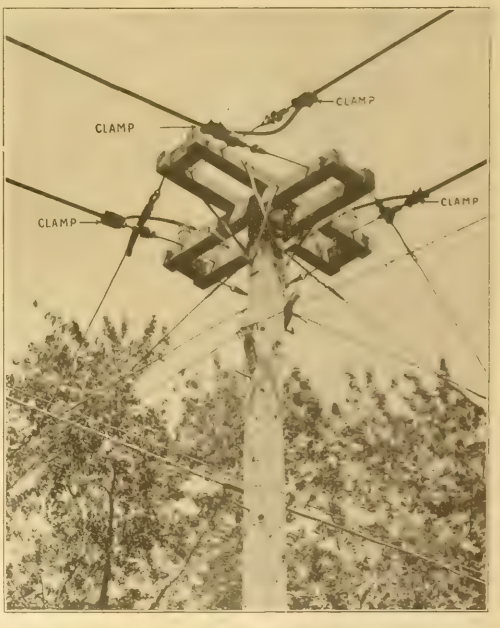
Bearings are provided with self-oiling cups, which require attention only every three or four months. The outfit includes a chuck of standard

The oiling of the bearings is effected through protected oil holes which replace the self-oiling features of the bench-drill motor. The use of a self-oiling bearing in which oil is stored is not practical with this drill, as the breast drill is used in all conceivable positions and oil could not be prevented from escaping out of the reservoirs. On this account the bearings of the breast drill must be oiled frequently.

The new domestic grinding and buffing outfit (Figs. 3 and 4) has been especially designed for grinding knives, scissors and other similar edged tools and for polishing small silverware, jewelry and other like articles. A grinding wheel of suitable character to insure a smooth cutting edge, without the use of a second sharpening, is interchangeable with the buffing wheel. These outfits are adapted for the intermittent service required in the ordinary household, but are not suitable for the heavier continuous work which is required by jewelers, dentists, etc. Other and larger outfits are furnished by the General Electric Company for this more exacting service.

The household outfit consists of motor with shaft extended two inches from the end of bearing to inside of wheel, the necessary washers and nuts for holding the wheel in place, one rag wheel of 3½-inch diameter, one three-inch emery wheel one-half inch thick, with five-eighths-inch bevel face, together with attaching plug and 10 feet of cord. These outfits are furnished for 110-volt direct current and 110-volt alternating current and can be specially wound for 220 volts

Cable Clamps Used in Turning a Corner.



CABLE CLAMPS USED IN TURNING A CORNER.

Chicago Edison Men Entertained at Hawthorne Plant.

On Saturday, April [illegible], the Western Electric Company [illegible] Hawthorne Works [illegible] Chicago Edison and Commonwealth Electric companies. [illegible] the party, numbering [illegible] attending [illegible] Mr. M. Hart, the [illegible] manager, [illegible] Mr. Bassett and Mr. Hazlett of the Western Electric Company, and the Edison Building [illegible] having at Hawthorne [illegible] often which the party [illegible] through the works under the direction of the Mills, factory engineer, and Mr. King, the engineer, power department. No effort was spared to extend to the appreciative visitors every courtesy and to show them the many points of interest in this thoroughly modern, rapidly growing establishment, whose site includes [illegible] 230 acres of ground. The scope of the entire establishment and the broad lines on which it is being developed, together with the very substantial character of the improvements already made, impressed on the visitors the belief that the Hawthorne Works of the Western Electric Company is an institution in which every Chicagoan may take pride, and deserved, perhaps, [illegible]

become one of the largest institutions of its kind in the world. The new factory is located in the western suburbs of Chicago, with exceptional transportation facilities, and built with the help of all the experience of the company in its older plants.

A New Type of Circuit-breaker.

A circuit-breaker for both direct and alternating current, which is built on extremely radical but scientific lines, making it simple and efficient in construction, is being manufactured by the Switchboard Equipment Company of Bethlehem, Pa. Fig. 1 is a front view of the circuit-breaker and Fig. 2 a side view. The fundamental principle of this breaker consists in the current passing directly

Fig. 1. Front View of Circuit-breaker.

Fig. 2. Side View of Circuit-breaker.

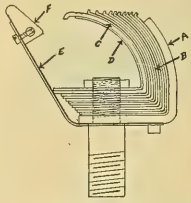


Fig. 3. Details of 125-250-volt Contacts.

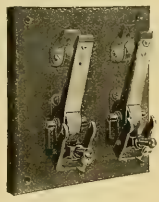


Fig. 4. Circuit-breakers Mounted as Double-pole Breakers.

A NEW TYPE OF CIRCUIT-BREAKER.

around the axis of the moving arm, making of this axis a magnet and drawing against it the tripping armature which swings freely and against gravity.

The brush is laminated and so arranged that when the arm is in contact the leaves are separated by a very decided air space, eliminating the chance of burning and reducing to a minimum the surfaces on which dust may accumulate, as shown in Fig. 3. The stud connecting the brush with the terminal nuts is screwed directly through these brush leaves, which are tapped after they have been put together, thus assuring excellent and absolute contact with the studs. There is the usual carbon for the final break, and for voltages above 250 an auxiliary heavy copper piece makes an additional break between the main brush and the final carbon.

In capacities of 1,000 amperes and above the brush leaves themselves form the stud. The 78 or more leaves are put together under heavy pressure at the base and then turned into a regular stud bolt. The brush terminal complete is stationary and thus a heavy moving mass is done away with.

Hard sheet copper is used for the arm, of more than sufficient carrying capacity. The arm is flanged to give it both rigidity and strength. It is extremely light, the advantage of which is readily seen, as it is the only moving part of the breaker. This arm has for its axis a bearing its full width, which is so constructed that a roller-bearing effect is produced. The magnet coil which magnetizes the axis or core is made of hard-drawn copper strips.

The opening impulse is given by the laminated contact brush, and the movement is further accelerated by the spiral winding of the coil which forms a powerful spring. The arm is closed by true roller action, which is both simple and efficient, the roller and roller plate being made of tempered tool steel. The armature is a heavy casting so pivoted that it cannot float. The calibration of the breaker is by means of a marked dial-head screw which varies the magnetic air gap. No springs are used and the action is due to a positive magnetic effect against gravity.

Double-pole breakers consist of two single-pole breakers mounted side by side, as shown in Fig. 4, each breaker being operated by its own individual mechanism. This is a decided advantage over operating a double-pole breaker with one coil, as peculiar grounds, accidents, etc., which may affect the service of one coil will not disable the entire protective device. Inasmuch as each half of the double-pole breaker is a separate unit it is impossible to close the circuit on overload and it is unnecessary therefore to use switches in connection with "S. E." double-pole breakers.

Dimensions of the breakers, so far as the live metal parts are concerned, are similar to those adopted by the Board of Fire Underwriters for switches. These "S. E." breakers are offered for separate or switchboard mounting and in overload, underload, reverse-current and no-voltage types.

The Switchboard Equipment Company has established branch offices in New York and Pittsburg and has for western agents Crosby, Craft & Co., Cleveland; Francis Raymond, Chicago; Railway and Power Equipment Company, St. Louis, Mo., and Pike & Beardslee, Portland, Ore.

COMMUNICATION.

Maximum Demand Systems in England and the United States.

To the Editor of the Western Electrician:

It must be frankly admitted that the movement in the direction of scientific rate schedules came from England, where the fundamental principles of the maximum-demand systems were first enunciated by Hopkinson as long ago as 1890 or even earlier. His idea was to charge the customer by meter for the consumption and in addition to charge a fixed monthly or yearly sum to cover the customer's share of the fixed expenses. It remained, however, for Mr. Arthur Wright to put these principles into practice, which he did at Brighton, England, in 1893. The fixed charge to each customer was made proportional to his maximum demand for current, and this maximum demand was determined for each customer by a demand indicator invented for the purpose, showing that Mr. Wright, even at that early date, appreciated the serious disadvantages and also the inequity of basing the charge to the customer on his connected load, as was the practice with the now nearly obsolete "flat rate" or "contract" system.

In Brighton, however, it was not possible to make the charges in the form suggested by Hopkinson, that is, to make an annual charge per kilowatt of maximum demand, and an additional charge per kilowatt-hour by meter, for the reason that this might have resulted in the average rate per kilowatt-hour to some customers being higher than 14 cents, which was the maximum rate permitted by law. If there had not been this legal restriction, the original Brighton rate might have been expressed in accordance with Hopkinson's principles as follows: $57.60 per year (or $4.80 per month), per kilowatt of maximum demand, and a meter rate of six cents per kilowatt-hour. The restriction, however, had to be considered, and it was therefore decided to charge the maximum rate of 14 cents as a primary rate, on a consumption equivalent to such a number of hours' use of the customer's maximum demand as would result in the customer paying off his fixed charges, and to charge on all consumption in excess, as a secondary rate, the simple meter rate of six cents per kilowatt-hour.

The original Brighton rates were therefore as follows: Fourteen cents per kilowatt-hour up to a consumption equivalent to 60 hours' use per month of the maximum demand and six cents per kilowatt-hour for all consumption in excess. These rates have since been reduced several times, first by reducing the number of hours' use at the high rate from 60 to 30, then by reducing the secondary rate to two cents, and finally by offering a flat meter rate of eight cents per kilowatt-hour as an alternative to the demand system.

This offer of an alternative flat rate has been spoken of in some of the technical papers as a check to the demand system in the very city in which it originated. It is really nothing of the kind. Practically the offer amounted merely to the reduction of the maximum rate per kilowatt-hour from 14 cents to eight cents, and this reduction in the maximum rate was probably due to the pressure brought to bear by the short-hour customers, who are always in a majority, and can therefore often exact lower rates than they are entitled to, the loss being made up at the expense of the long-hour customers.

This point has been well brought out recently at Chicago. The Chicago Edison Company uses a maximum-demand system of charging, with a maximum rate of 16 cents per kilowatt-hour. In the report on the rates of this company made by Messrs. Arnold and Carroll to a committee of the City Council it is stated that with this maximum rate probably 25 per cent. of the total number of customers are not producing a profit, and that any reduction in the maximum rate can only be made with the result of making still other customers unprofitable. Nevertheless such a reduction will probably be made.

In the United States there were no demand systems of charging in use prior to 1898, although the principles had obtained some recognition, notably by Mr. W. D. Marks, in his recommendations to the Edison Electric Light Company of Philadelphia in 1891. In 1897 Mr. Wright came to this country and read his paper, "Profitable Extensions of Electricity Supply Stations," at the convention of the National Electric Light Association, and since that time the rate question has been one of the most prominent subjects discussed at the conventions of central-station engineers, and demand systems of various forms have come into extended use from Maine to the Pacific Coast and from Wisconsin to Texas. They are in pretty general use by the large Edison companies, and may be found also in cities of all sizes down to a population of less than 2,000. Further, their use is apparently steadily increasing and at a more rapid rate than in England.

This is in some measure indicated by the increased sales of demand indicators reported by the English and American manufacturers, the former reporting a moderate increase, but the latter an increase over the previous fiscal year of nearly 50 per cent. This difference may be accounted for in a number of ways, one of which is probably the fact that in this country electricity is produced by enterprising private corporations, while in England there are a much larger number of municipal plants.

The form of demand system most used in the United States is the one originally adopted by Mr. Wright, viz., a high primary rate up to a consumption equivalent to a certain number of hours' use of the demand, and a low secondary rate on all consumption in excess.

Another common form is the "Doherty" or "Readiness to Serve" system, which is practically the original idea of Hopkinson, with an alternative flat meter rate to constitute the maximum. The "Readiness to Serve" system superficially appears to be very different from the "Wright," but actually the only difference is in the method of stating the rates. For instance, the rates in the city in which the "Readiness to Serve" system originated are as follows: $1.80 per year per lamp (equal to $36 per year per kilowatt) of demand and five cents per kilowatt-hour by meter, with an alternative flat meter rate of 10 cents per kilowatt-hour. This schedule might have been expressed in Wright's manner as follows: Ten cents per kilowatt-hour up to a consumption equivalent to 60 hours' use per month of the maximum demand and five cents per kilowatt-hour for all consumption in excess. Or, again, it could have been expressed as 10 cents per kilowatt-hour up to a consumption equivalent to three kilowatt-hours per standard 16-candlepower lamp of maximum demand, and five cents per kilowatt-hour for all consumption in excess.

The above-mentioned company also makes a service charge to each customer of $12 a year, but, of course, this charge could also have been made if the Wright system had been adopted instead of the "Readiness to Serve."

J. S. C.

Boston, April 27, 1906.

Chicago Street-railway Situation.

Mayor Dunne apparently has changed front in the street-railway situation by placing the improving and unifying of the street railways ahead of immediate municipal ownership. In a letter to the chairman of the local transportation committee of the council the mayor advocates the beginning of negotiations for the bettering of the service, and outlines a plan. His idea is to have the companies agree to sell their lines to the city at such future date when the city is able to take them over. The price to be paid would be fixed now, and the companies, under the mayor's plan, would begin at once to reconstruct the systems, provide for through routing and universal transfers. The reconstruction would be according to plans to be prepared by the city and concurred in by the traction companies, and the money invested in improvements would be added to the price fixed now for the tangible property. In the meantime the mayor's plan suggests that the companies operate the lines under a revocable franchise with a fair return upon their present and future investment and a share of the remaining net profits, a share of the net profits to go to the city to form a sinking fund. The local transportation committee is to work out the details of the new plan.

While it cannot be said that all factions agree with the suggestions offered in the mayor's letter, there is, however, a general feeling of encouragement respecting a settlement of the traction muddle, inasmuch as the mayor seems to have relinquished his radical "immediate" municipal ownership ideas which have several times blocked the progress toward better transportation facilities in the vain hope of the city getting immediate possession of the street railways.

While the negotiations for practical improvement of the lines are going on the mayor proposes to test in the courts the validity of the Mueller law certificates.

Reports come from the Eastern interests that plans are being made to consolidate the Union Traction Company and its underlying companies—the North and West Side companies. If successful an effort will also be made, it is said, to get the Chicago City Railway into the consolidation.

At this week's meeting of the City Council an order was unanimously passed directing that arrangements be made at once to change the Milwaukee Avenue cable line to electric operation. Petitions from citizens requesting extensions and electric equipment on certain other lines were read and referred to the transportation committee.

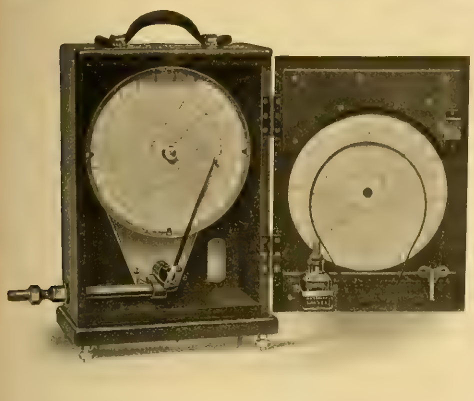
Concerning the matter of lowering the street-

railway tunnels under the Chicago River, the War Department has given its decision. It is directed that the time for removing these obstructions to navigation be extended to July 1st.

The Chicago City Railway Company has signed a new agreement with its men, to be in force 15 months. The company gives the men a general increase in wages, even though the company won the big strike a year ago. The men are now the highest paid in the United States for this class of work. Motormen and conductors who have been in the employment of the company one year or more will get 25 cents an hour. Men in other branches of work were advanced about five per cent.

Bristol Portable Recording Gauges.

The value of recording pressure gauges as a powerful factor in promoting safety and economy has long been recognized, and their adoption has been quite general in mills, factories, water and gas works, electric-light plants, power stations, public buildings, blast furnaces, mines, etc., both in this country and abroad. Many users have, however, felt the need of a light, compact, portable recording pressure gauge, and particularly an instrument which is so well made and free from delicate mechanism that an ordinary workman can manipulate it successfully with reasonable care. To cover these requirements, the Bristol Company of Waterbury, Conn., has placed upon the market a modification of its well-known recording gauge.



BRISTOL PORTABLE GAUGE FOR PRESSURE OVER FIVE POUNDS.

In these portable gauges the metal case has been omitted, the pressure tube and clock for driving the chart being mounted on a light aluminum back, which is in turn mounted in a handsome wooden carrying case designed with special reference to ease in handling and making connections to the source of pressure.

For recording pressures which may exceed five pounds per square inch, the type of gauge illustrated herewith is employed. A special flexible connection with unions is supplied to facilitate connecting to piping at various angles. When a permanent installation is unnecessary, this instrument could be used to advantage, as, for example, on boiler tests, water mains or fire-protective systems where a few accurate and continuous records would settle disputes or lead to better service.

For gas pressures in outlying districts, mine ventilating pressures, draft or light vacuum, a slightly different type of gauge is adapted, since it is capable of recording pressures as low as one-twentieth-inch head of water. Correction is readily made by means of a rubber hose to a nipple, which projects through the side of the case. A simple clamping device is employed to hold the pressure tube rigidly when the gauge is being transported. Those who are interested in the distribution of gas will be particularly pleased to note the production of an instrument which will be of such great assistance in solving their problems.

Portable gauges above described are said to weigh about one-third as much as the standard-form gauges mounted in a carrying case, which has been used heretofore as a substitute. Both forms are furnished with leveling screws to facilitate adjustment of the instrument. Provision is also made for carrying a supply of charts and ink with each gauge.

Another Wireless Conference.

Germany has issued invitations to 20 states to take part in an international space-telegraph conference at Berlin on June 28th. Besides the six powers participating with Germany in the first conference, 23 other governments have been invited to send representatives.

New Consolidated Company's Power Plant at Baltimore.

If the expectations [illegible] Light and Power Company [illegible] Md., are realized [illegible] at Westport will be generating [illegible] more in June. [illegible] interest and a [illegible] will be interesting [illegible] taken from the Baltimore Sun. [illegible] capacity of the plant will be about [illegible] power, and it is capable of almost indefinite extension, as the company owns about 2[illegible] of land at the site, admirably located for its purpose. The location is on the Patapsco River and the company's property includes all the land lying between the tidewater line of the Western Maryland Railroad on one side and the Curtis Bay branch of the Baltimore and Ohio Railroad on the other. The site is isolated from adjacent buildings, eliminating fire hazard. Transportation facilities include three coal-carrying railroad systems, viz., the Baltimore and Ohio and the Western Maryland, by tracks entering the property, and the Pennsylvania Railroad by water delivery from Canton. The water delivery can also be utilized for receiving coal from the Baltimore and Ohio at Locust Point. Storage capacity is sufficient for a coal supply for a whole year. Water supply for the boilers will be taken from Gwynns Falls and filtered. Water for condensing purposes will be taken from the Patapsco River. Tunnels for taking in and discharging water from the river are provided.

The building is 255 feet deep and 115 feet wide; it is single story, 70 feet high, with operating galleries and coal storage. It is constructed so that additions can be readily made to enlarge its capacity. There will be no wood anywhere in the construction of the building; even the framing for windows and doors is of steel. The material used is reinforced concrete, and the foundations, walls, floors, pillars, galleries, coal bunkers and discharge chutes for ashes from the furnaces are all built of this material. Borings were made of the soil to decide whether it was necessary to use piling under the foundations, and while it was shown that the soil would support such a structure, under the policy of being doubly sure there were driven 1,800 piles, and on these were laid reinforced concrete footings, from which the building rises.

In the center of the building is the largest smokestack about Baltimore, rising to a height of 209 feet from mean low tide. The inside diameter of the smokestack at the top is 14 feet. Radial brick is used in its construction and the exterior is of buff, presenting a neat appearance. In addition to the natural draft furnished by this chimney the boiler room is equipped with forced draft to provide for any sudden demands for power.

The boiler room will contain 18 650-horsepower Babcock and Wilcox boilers. These will be equipped with superheaters to raise the temperature of the steam, taking care of the initial condensation. The furnaces under the boilers discharge their ashes through reinforced concrete chutes into cars which run on railroad tracks in the basement, extending out and over land now under water to be reclaimed by filling in with ashes.

The coal is stored in bunkers above the boilers and is fed by gravity to the furnaces. These bunkers are filled by coal-handling machinery of the latest type, so that the coal in its transit from the barge or car into the boilers, and thence from the grates in the form of ashes, is automatically handled until the ashes drop into water to reclaim land. The coal is carried by a gantry crane equipped with a bucket that picks up two tons of coal. This crane is the largest of its kind ever attempted. It is 295 feet from end to end and traverses the coal-storage field. It will deliver coal to the bunkers inside of the station or to the storage field and will take coal from the storage field to the bunkers. It can handle from a barge to the field 150 tons an hour, and from barge to bunkers 60 tons an hour.

From the boilers the steam is delivered through well-designed steam piping to the engine room. The delivery system is such that if a boiler breaks down it will only cut out a small portion of the plant, which could be quickly overcome through an equalizing line connecting with the reserve boilers.

In the engine room the first plans contemplated four McIntosh & Seymour vertical compound-condensing engines. This has since been greatly increased. Two of these engines are being erected and the others will follow from the builders at short intervals. Each engine has a rated capacity of 3,000 horsepower and an an overload capacity of 50 per cent., making the maximum of each engine 4,500 horsepower, aggregating 18,000 horsepower for the four. In addition, to meet the rapidly growing business of the company there has just been ordered an engine of 7,500 rated horsepower, [illegible] mum cap[illegible]

[illegible] maximum [illegible]

[illegible] Pratt and Penn Street [illegible] McClellan Street station, and the Monument and Constitution Street station. The Pratt and Penn Street and the Monument and Constitution Street stations are now steam driven, but after the power from Westport is received the steam engines will be shut down, disposing of whatever objection there may be to the smoke from these stations. The McClellan Street station is already equipped and the other two stations are being equipped to receive the Westport power. This includes the machinery for transforming and reducing the power.

Immunity from fire hazard and guaranty of a uninterrupted coal supply have been secured. Important as this is to the users of electric current for light and power purposes, including as it does the illumination of the streets and public parks of Baltimore, the operation of many factories and the illumination of business buildings and homes, there is still another advantage to the public obtained in the plant. This is the installing of 25-cycle apparatus of the same characteristics as the equipment which furnishes power from the Pratt Street power house of the United Railways, which runs the entire street-railway system of Baltimore, thus making it practicable for an interchange of electric power between these two big power plants in the event of accident.

The power station and its equipment are from the plans of P. O. Keilholtz, consulting engineer. The foundations and bulkhead were built by Armstrong & Latta, and the superstructure, which is now rapidly approaching completion, is being erected by the Baltimore Ferro-concrete Company. Among the other contractors besides those already mentioned are the following: Generators, General Electric Company; gantry crane, Lauer-Harper Company; equipment for gantry crane, Morgan Engineering Company; switchboard, Westinghouse Electric and Manufacturing Company; chimney, the Alphons Custodis Chimney Construction Company.

The Consolidated Gas, Electric-light and Power Company is the successor of the United Electric Light and Power Company and owns a large majority of the stock of the Consolidated Gas Company. Alten S. Miller is vice-president of the company, P. O. Keilholtz is the consulting engineer, Douglass Burnett is the manager of the electric department, and W. Stuart Symington is secretary and treasurer. S. Davies Warfield is chairman of the board of directors of the company and of the executive committee of the board.

Preparations for National Electric Light Convention.

The approaching convention of the National Electric Light Association promises to be interesting and important. The papers arranged for by President Blood cover a wide range of topics, and the authors are men eminent in their respective branches of the profession. In addition to the convention proper, there will be an exhibition of the associate members, occupying the large hall at the entrance to Young's Pier. The space has nearly all been taken.

Special rates have been secured from no less than 35 hotels. However large the attendance this year, it is probable that the association will have better hotel accommodations than have been available heretofore.

There will be no lack of entertainment. On one of the days the committee expects to take the ladies attending the convention to Philadelphia, where luncheon will be served at the Bellevue-Stratford. The attractions at the "Board Walk" will be exhausted, and possibly a short sea trip after "crossing the bar" will be taken. Efforts are also being made to have an exhibition drill of either the beach guards or the United States life-saving crew at the Atlantic City stations.

The hotel circular will be issued in a few days. Any other information regarding the convention can be obtained at the secretary's office, 136 Liberty Street, New York city.

Rosewater's Recollections.

Edward Rosewater, editor of the Omaha Bee, printed in a special issue of his paper last year a gossipy article entitled "Personal Recollections of Some of the World-famed Electricians" which may be of interest to many of the readers of the Western Electrician. Somewhat condensed, Mr. Rosewater's reminiscences are as follows:

A century and a half has elapsed since Benjamin Franklin drew lightning from the clouds and transmitted electric shocks across the Delaware River, but practical harnessing of electricity dates back only threescore years. Within this comparatively brief period all races and nationalities have been brought into touch and sympathy by the electric telegraph, which has become the potential factor that gives the press its tremendous power. Within my own memory the telegraph has girdled the earth and placed its remotest parts into almost instantaneous communication. Electrical distance writing has been supplemented by electrical distance talking, distance lighting and distance propulsion.

As a pioneer telegrapher of more than 13 years' continuous service and amateur in electric science, it has been my fortune to come in contact with a number of eminent inventors and electricians to whom the world, and especially America, is indebted for many marvelous achievements in the domain of electrical discovery and progress.

Most eminent, if not the most famous, among these was Prof. Joseph Henry. My acquaintance with Professor Henry dates back to the summer of 1862, while I was stationed as a military telegrapher at Washington. Being desirous of perfecting myself in electrical science, I procured a letter of introduction to Professor Henry, secretary of the Smithsonian Institute, from Colonel Anson Stager, chief of the United States Military Telegraph Corps, and was most cordially received by him and accorded the privilege of the Smithsonian library and laboratory. Professor Henry was then a man of middle age, medium height, chestnut hair, blue eyes, florid complexion, clean-shaven face and handsome features, that were preserved by him to the advanced age of nearly fourscore years. At that time the electric telegraph was only 18 years old. The first wire across the continent had just been completed (July 4, 1862), while the first cable had been laid across the Atlantic six years previously, but remained mute, only two or three messages having been transmitted when it ceased to work.

Although Samuel F. B. Morse, then still living, had been medallioned and honored by all nations as the father of the telegraph, Professor Henry was the real father and inventor of the works inside of the watch, while Professor Morse contributed only the case. Professor Henry had discovered and perfected the first electromagnet and taught Professor Morse how to use it in connection with his crude clockwork device that registered the Morse alphabet of dots and dashes upon strips of paper. Years before Professor Morse had conceived the idea of distance communication by electric energy, Professor Henry, as instructor in physics at Princeton College, had constructed an electric magnet that could lift 3,000 pounds, and that magnet is still preserved in the Princeton College museum.

My acquaintance with Professor Henry extended over more than a dozen years, and he freely and frequently talked about the invaluable assistance he had rendered Professor Morse before he had taken out the telegraph patents. Professor Henry was a pure scientist and disdained to use his inventions and discoveries for profit. Among the precious mementoes preserved by me is an autograph letter from Professor Henry, in beautiful script, dated at the Smithsonian Institute, Washington, D. C., February 29, 1864, which closes as follows:

"I now embrace the first opportunity to inform you that we shall be pleased to receive any communication from you in regard to the weather with which you may favor us, and we should be particularly pleased to have a record of electrical phenomena you may observe, from which a general account may be made up at the end of a given time for our annual reports."

In compliance with this request, I established the first weather bureau west of the Mississippi River, and under the direction of Professor Henry, had thermometer and barometer records taken at fixed hours at Omaha, Julesburg, Fort Laramie, Fort Bridger, South Pass and Salt Lake City. Years thereafter Professor Henry, in passing through Omaha, paid me a visit and recalled the interesting material collected for the first weather-report service that had ever been attempted in the United States. It was not until 1867, if memory serves me right, that the United States Signal Corps inaugurated a system of weather reports extending across the continent.

The most noted, all-around man among the pioneer telegraphers was Anson Stager, a native of Rochester, N. Y., who at the outbreak of the war was general superintendent of the Western Union Telegraph Company, with headquarters at Cleveland, and subsequently colonel and brevet brigadier-general in command of the United States Military Telegraph Corps, with headquarters in the War Department, to the close of the civil war, when he was promoted to the position of vice-president and general superintendent of the Western Union system, which had by that time absorbed half a dozen other systems. Anson Stager was the first telegrapher who received a message by tongue, a feat that was regarded as almost miraculous. While for many years not actually engaged in the operating room, he always retained his skill as a manipulator of the key and reader by sound. He was a short stout man, with a large round head, oval face, blue eyes and reddish chin whiskers, without moustache. General Stager was the incarnation of executive force—short, sharp, decisive, quick to grasp a problem and quicker still to size up a man or a situation.

When Edward Creighton, who had constructed the Pacific telegraph between Omaha and Salt Lake City, in conjunction with Brigham Young, asked Colonel Stager to recommend to him an expert operator qualified to rough it in the wild and woolly West, Colonel Stager pointed me out as a young man who could fill the bill, and, by way of encouragement, tapped me on the shoulder and remarked: "You will be worth $30,000 in 15 or 20 years if you take a position with Creighton on the overland telegraph line." In those days $30,000 was a very large fortune.

My acquaintance with James D. Reid, the first telegraph superintendent in America, did not begin until I had passed out of the telegraph service in the '70's, but the greeting I received from him at our first meeting made me understand without explanation how and why he had obtained such a firm hold upon the affections of old-time telegraphers, and was looked up to by them as their mentor on all matters relating to the early history of the telegraph.

James D. Reid had been the intimate friend and associate of Professor Morse in his struggles for the recognition of his claims and the establishment of his system of telegraphy, and, perhaps better than any other man, was in position to write the history of the telegraph in America, which still remains the standard work among American telegraphers. He was the antithesis of Anson Stager, physically and mentally—tall, affable, genial, communicative and at all times approachable. At the age of more than fourscore he was appointed, at the instance of Andrew Carnegie, a pioneer telegrapher and countryman, to the United States consulship at Dunfermline, Scotland, where he died in the harness in 1901 at the age of 90.

During my inspection tours of the postal-telegraph systems of Europe in 1891 I spent a couple of hours in the largest telegraph office in the world, in the General Post Office Building in the city of London, where more than 3,000 operators are employed in the transmission of dispatches. While most of the wires were equipped with Wheatstone instruments, several of their long-distance lines were equipped with Delany's sextuplex—an instrument that transmits six messages over one wire at the same time, or two more than Edison's famous quadruplex.

This instrument, I was informed, is an American invention, for which the British government pays a royalty of $10,000 per annum to its inventor, Patrick Bernard Delany. When I met Mr. Delany 10 years ago he had perfected a number of inventions for facilitating the transmission of dispatches by submarine cable and also an automatic telegraph system capable of transmitting from 800 to 1,200 words per minute over a single overhead wire.

Mr. Delany endeavored to introduce this system on the lines of the Associated Press, but its managers decided to hold fast to the Morse system, operated in conjunction with typewriting machines. Since then I have met Mr. Delany occasionally and kept up a very interesting correspondence. Among American electrical engineers I know of none who can boast of as large a number of devices for expediting telegraphic communication.

Mr. Delany holds 150 patents, covering anti-induction cables, synchronous multiples of telegraphy, automatic systems for ocean cables, rapid-machine telegraphy for land lines, etc. He is a member of the Franklin Institute, which awarded him the Elliott Cresson gold medal and the John Scott legacy medal for his inventions, and at the age of 60 he is still active in his scientific researches in his laboratory at South Orange, N. J., where another and more famous telegraph operator, Thomas Edison, also makes his home and maintains his experimental laboratory.

Edison's phenomenal career is a household word all over the globe and it would be superfluous for me to indulge even in a brief recital. When I last met Edison in his laboratory at Menlo Park, which, by the way, is the greatest storehouse of books on the progress of science in all the languages and in materials for experimental alchemy, he was dressed in a blue blouse and cotton overalls and hard at work in making chemical tests.

He had grown stout and gray, although he still has a full head of hair, and his handsome, smooth-shaven face preserves all the appearance of middle-aged youth. While somewhat hard of hearing, Edison is a most interesting conversationalist, and he talked freely, not only about electricity, the subject always nearest to his heart, but about the progress of the country and especially the growth of western cities. When asked as to whether he had reached any conclusion as to the nature of electricity, he responded: "You know as much about it as I do." That was simply an admission that he was still in the dark, notwithstanding all the electric illumination evolved by his genius.

My first introduction to Alexander Graham Bell, the inventor of the Bell telephone, took place about 15 years ago at the residence of Gardiner G. Hubbard, in the city of Washington. Mr. Hubbard, the father of Mrs. Bell, had manifested deep interest in the postal telegraph and had appeared before congressional committees as an advocate of postal telegraph, and appeared to be much interested in the investigation I had made of the postal telegraphs of Europe.

At first sight I was much impressed by Professor Bell's superb physique and massive head, that recalled the portraits of Balzac and the elder Dumas. He was brilliant in conversation, gracious in his manners, and his recital of the story of the first telephone constructed by him for the benefit of his wife, from the lower to the upper floor of his residence, was a genuine treat.

I renewed my acquaintance with Professor Bell when he visited Omaha a few years later and narrated publicly, for the first time, the story of his great invention before an appreciative audience of telegraph and telephone men.

In the spring of 1897, while attending the Universal Postal Congress, then in session in Washington, I received an invitation from George Owen Squier, first-lieutenant of artillery, United States Army, to witness some experiments with his automatic-telegraph invention at Fortress Monroe. These experiments proved eminently satisfactory, although the mechanism was somewhat complex. In August of the same year I received a letter from Lieutenant Squier, dated from London, in which he wrote as follows:

"I know you will be interested in hearing of some of the great results of the synchronograph which we have recently been trying over the government postal lines in England. The British government has given us every facility possible and are entirely convinced of the superiority of our system. On August 22d, over a line from London via York and Aberdeen and return to London, a distance of over 1,100 miles, including over 80 miles of underground cable, we sent messages at the rate of 4,300 words per minute, and this speed was only limited by the particular dynamo available. We have also tried a cable of 120 knots, from here to Germany, and sent over it at the rate of 1,300 words per minute. Our apparatus is mounted in the general postoffice at London, from which point the experiments thus far have been made. I will be glad to send you a detailed account of these experiments as soon as time permits making it out.

When it is borne in mind that the most rapid speaker would not talk more than 250 words per minute, this achievement would seem almost incredible and forcibly calls attention to the possibilities of the future in the way of lightning communication. The fact that an army officer in the artillery service should be the inventor of such an apparatus is also most remarkable.

Among the eminent electrical scientists with whom I have come in touch recently is Michael Pupin, professor of electromechanics in Columbia University. Professor Pupin is an Americanized Hungarian athlete, who might have become a match for Jim Corbett. Although still on the sunny side of 50, he has made prodigious strides in the field of electricity. I visited Professor Pupin early one morning two years ago last winter while he was at breakfast in his luxuriously furnished apartment in New York and had a very agreeable running conversation concerning certain electrical phenomena in which I had become interested and incidentally concerning some of his recent inventions, which included improvements on electrical current transmission over long-distance wires and through submarine cables, from which Professor Pupin has realized a respectable fortune. Ordinarily a very busy man and not easily accessible, Professor Pupin accorded me a courteous and patient hearing and freely communicated his views and impressions on the subject about which I was anxious to secure information from first source.

American Pacific Cable Is Completed.

The Pacific cable between the United States and China, begun several years ago, has been completed, the last link being between Manila and Shanghai. In commemoration of this achievement messages were exchanged between President Roosevelt and the Emperor of China on April 17th.

The first stretch of the cable was laid between San Francisco and Honolulu. It was later extended to Manila by way of Guam and Midway and finally to Shanghai. Nearly 10,000 miles of cable have been laid at an average depth of 2,640 fathoms. The greatest depth was 3,490 fathoms—approximately four miles. The extension of the line beyond Manila was delayed by the political upheaval in China and later by the war between Japan and Russia. The United States is now in communication with its Pacific Ocean possessions and with China by means of the cables of an American company operated by American operators.

Underwriters' Requirements for a Standard Electric Light and Power Station.

Fire-insurance rates, which on many central stations are absurdly high, are lowest for what the underwriters term the standard electric light and power station. This is a station constructed in accordance with the most modern practice to reduce the fire hazard and also equipped with certain specified protective apparatus. The requirements, in general, are such as most central station companies in larger cities adopt voluntarily in the design and construction of modern stations; but in smaller towns managers, even in building new plants, are often debarred from acting up to the letter of the stipulations, in all respects, on the ground of expense. Older plants, of course, often exhibit wide points of divergence from what underwriters call the standard. However, better rates are obtained theoretically, at least, to the degree in which the station under consideration approximates to the standard. The whole subject has been and is being carefully investigated by a committee of the Illinois State Electric Association, and the reader is referred to a report of the Peoria convention of that association (Western Electrician of October 14, 1905) for further information. In addition data are herewith given of the fire underwriters' requirements for what is termed a standard electric light and power station. These facts may well be preserved for future reference:

All generators must be located in a dry place; must be insulated on floors or base frames, which must be kept filled to prevent absorption of moisture, also kept clean and dry. Where frame insulation is impossible the inspector may, in writing, permit its omission, in which case the frame must be permanently and effectively grounded.

Conductors from generators, switchboards, rheostats or other instruments and thence to outside lines must be in plain sight and readily accessible, must be wholly on non-combustible insulators, such as glass or porcelain, and must be separated from contact with floors, partitions or walls through which they pass by non-combustible insulating tubes. They must be rigid and so far apart that they cannot come in contact, and must be covered with non-inflammable insulating material sufficient to prevent accidental contact, except that bus-bars may be made of bare metal. They must have ample carrying capacity to prevent heating, and where leaving the building must be looped downward, the tubes in which they are inclosed to be inclined so as to prevent the entrance of rain water along the wires. An approved safety fuse or automatic circuit-breaker, on a non-combustible base, must be provided for each feeder and primary main. All wire connections must be soldered to secure good contact, excepting approved screw contacts. Branch wires for station lighting must be installed in accordance with the National Code of Rules for electric-light and power wiring.

Switchboards must be so placed as to reduce to a minimum the danger of communicating fire to adjacent combustible material. Special attention is called to the fact that switchboards should not be built down to the floor, nor up to the ceiling, but a space of at least 18 inches or two feet should be left between the floor and the board and between the ceiling and the board in order to prevent fire from communicating from the switchboard to the floor or ceiling, and also to prevent the forming of a partially concealed space, very liable to be used for storage of rubbish and oily waste. The boards must be accessible from all sides, when the connections are on the back, or may be placed against a brick or stone wall where the wiring is entirely on the face. They must be kept free from moisture and made of non-combustible material or of hard wood in skeleton form, filled to prevent absorption of moisture. Bus bars must be equipped in accordance with rules for placing conductors.

Resistance boxes and equalizers must be equipped with metal or other non-combustible frames; the word "frames" meaning the entire case and surroundings of the rheostat, and not alone the upholding supports. These boxes and equalizers must be placed on the switchboard, or, if not thereon, at a distance of a foot from combustible material, or separated therefrom by a non-inflammable, non-absorptive insulating material.

Lightning arresters must be attached to each side of every overhead circuit connected with the station, and must be mounted on non-combustible bases, in plain sight on the switchboard or in an equally accessible place away from combustible material. They must also be connected with at least two "earths" by separate metallic strips or wires having a conductivity not less than that of the No. 6 B & S wire. These strips or wires must be run as nearly as possible in a straight line from the arresters to the earth connection. Arresters must be so constructed as not to maintain an arc after the discharge has passed.

In general all apparatus must be maintained in good condition and, together with all wiring, must conform with rules for safe wiring.

Test of 500-kilowatt Curtis Steam Turbine.

[illegible]

Condenser [illegible] pump driven by [illegible] power centrifugal [illegible] The condensed [illegible] the compartment [illegible] can be taken from the [illegible] turned to [illegible] water.

Excitation current [illegible] horizontal Curtis turbo-[illegible] is used for heating feed [illegible] heater. Steam from the feed pump [illegible] same manner.

The following conditions of test [illegible] with: First, one-half load; second, [illegible] third, full load; fourth, 50 per cent overload [illegible] without auxiliaries. In order to make [illegible] tests were also made afterward on two reciprocating units. One of these was a 300-kilowatt cross-compound condensing Buckeye engine direct connected to a 300-kilowatt General Electric generator. The other unit was a 200-horsepower cross-compound condensing Buckeye engine direct connected to a 133-kilowatt General Electric alternator. The condenser for this equipment was of the Wheeler Admiralty type, with water, steam and air pistons on one rod. First, the 300-kilowatt engine was run alone, full load; second, both engines in parallel, full load; third, both engines in parallel, variable load. (All without auxiliaries.)

Following are the results of the tests:

	A	B	C	D	E	F	G	H
	Length of Test, Hours.	Average Load, K. W.	Per Cent of Capacity.	Steam Pressure, Mercury.	Vacuum, Inches Mercury.	Total Steam Used, Pounds.	Steam per K. W. Hour, Pounds.	Builders' Guarantee, Pounds.
No. 1. Turbine ½ load	1.00	25	50.0	150	27.87	[illegible]	21.67	[illegible]
No. 2. Turbine variable load	8.00	366	73.2	[illegible]	26.01	[illegible]	21.82	[illegible]
No. 3. Turbine full load	2.00	518	103.6	147	27.81	[illegible]	19.61	[illegible]
No. 4. Turbine 50% overload	1.00	750	150.0	144	28.02	[illegible]	[illegible]	[illegible]
No. 5. 300 kilowatt engine full load	1.00	301	[illegible]	147	21.70	[illegible]	[illegible]	24.15
No. 6. 300 kilowatt engine full load, 133 kilowatt engine in parallel	1.00	[illegible]	100.0	141	20.42	[illegible]	[illegible]	21.82
No. 7. 300 kilowatt engine variable load, 133 kilowatt engine in parallel	2.00	202	67.4	129	22.29	[illegible]	20.52	

Vacuum under column E is absolute and steam under C, per kilowatt-hour, is corrected for moisture and vacuum on the basis of 1.25 pounds for each inch of variation from 28 inches absolute.

The next table gives combined results of the generator and auxiliaries, together with total coal used per kilowatt-hour. The results are all referred to the kilowatt load of the generator, giving the relative amount of steam to operate each class of auxiliary:

	Average Kilowatt.	Step and Oil Pumps, Pounds.	Circulating and Air Pumps, Pounds.	Exciter, Pounds.	Total Auxiliaries, Pounds.	Generator, Pounds.	Total Generator and Auxiliaries, Pounds.	Total Coal Per Kilowatt Hour.
No. 8. Turbine ½ load	25	[illegible]	2.80	1.61	[illegible]	21.67	26.01	[illegible]
No. 9. Turbine variable load	366	[illegible]	2.01	[illegible]	[illegible]	21.82	[illegible]	[illegible]
No. 10. Turbine full load	518	0.24	[illegible]	[illegible]	2.45	19.61	[illegible]	[illegible]
No. 11. Turbine 50 per cent. overload	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
No. 12. 300 kilowatt engine, full load	301		[illegible]	[illegible]	4.78	[illegible]	26.12	[illegible]
No. 13. 300 kilowatt engine and 133 kilowatt engine full load in parallel	[illegible]		1.28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
No. 14. 300 kilowatt engine, variable load 133 kilowatt engine full load in parallel	202		[illegible]	[illegible]	[illegible]	20.52	[illegible]	[illegible]

The Massachusetts State Harbor and Land Commission has received a joint petition from the Lynn Gas and Electric Company and the Suburban Gas and Electric Company of Revere, Mass., for permission to lay an electric cable across the Saugus River. The latter company says the summer development of the beach has called for more light than the local plant can supply without a large addition. The business not being continuous the year round, the Revere company has decided to purchase current from the Lynn company.

Space-telegraph Apparatus Apparently Foretells Earthquake.

[illegible]

[illegible] tion. With th[illegible]

[illegible]

Buffalo Street-lighting Negotiations.

The Buffalo General Electric Company [illegible] Buffalo, N. Y. [illegible] a lamp a year, beginning [illegible] less than 2,833 lamps [illegible] desire. The present rate is $75 a lamp a year, so that the reduction, it is thought, will put an end to all talk for a municipal lighting plant. [illegible] agreement was reached [illegible] committee of the board of [illegible] of aldermen appointed to [illegible] made with the electric company [illegible] the committee [illegible] has been submitted to the board of aldermen. The report covers the situation fully. The committee examined the cost of electric lighting in various cities of the country, and found that in most of them the rates were higher than those now charged in Buffalo, which has, of course, the benefit of cheap current from Niagara Falls. In places where prices were lower than $75 a year the committee found that the difference was due to the fact that the lamps were of smaller capacity, or that they were lighted for a less number of hours, or to some local condition not connected with the real cost of the service. The committee also took up the question of the existing rates to private consumers of electricity. It found that the maximum price charged was 12 cents a kilowatt-hour. It succeeded in prevailing upon the company to reduce the maximum price to nine cents a kilowatt-hour. Charles R. Huntley is general manager of the Buffalo General Electric Company.

Plans of the Wellman Polar Expedition.

Walter Wellman left America on April 24th and will go to Paris to prepare for his proposed trip to the North Pole by an airship. Maxwell J. Smith, who will be in charge of the space telegraph system of the expedition, will sail on May 5th. Major Hersey will represent the United States Weather Bureau and the National Geographical Society, and will act as navigator and observer for the expedition. Dr. W. M. Fowler of Bluffton, Ind., will accompany the party as physician and surgeon. Felix Riesenberg of Chicago, because of his familiarity with navigation and nautical astronomy, has been selected to act as assistant navigator and observer, and will leave for Paris in two or three weeks. Francis H. Buzzacott, famous in the Far West as guide, sportsman and camp expert, will accompany the expedition as chief of the commissary department and head sportsman, and will sail three weeks hence.

Mr. Wellman will spend most of May in Paris, and a series of ascensions will be made in ordinary balloons to familiarize the explorers with the conditions and problems of air navigation. Mr. Wellman expects to reach Tromsoe with his entire party early in June. Cable messages from Paris report work on the airship progressing as planned, and Mr. Godard, the builder, expects to have it finished by the end of May. In fact, all of Mr. Wellman's plans are being worked out on schedule time, and he sees only the brightest prospects before him.

Boston Illuminating Engineers Complete Organization.

The Boston section of the Illuminating Engineering Society held its second meeting at the American House, Boston, Mass., on the evening of April 24th. Forty persons were present and the following-named officers were elected: Chairman, John Campbell of Boston; secretary and treasurer, George H. Stickney of the General Electric Company's works at Lynn, Mass.; managers for long term, C. L. Edgar, president of the Edison Electric Illuminating Company of Boston, and E. N. Wrightington of the Consolidated Gas Companies of Boston; managers for short term, Dr. Louis Bell and A. T. Sampson.

Dr. Bell gave a talk on "Illumination," and N. W. Gifford of the East Boston Gas Company read a paper entitled "Some Suggestions from the Gas Side." There was an animated discussion on the Searle paper, which was read in New York, on April 12th. (Western Electrician, April 21, 1906, page 315.) It was decided to hold regular meetings of the Boston section on the fourth Tuesday in each month.

Copper Production in the United States in 1905.

A preliminary statement covering the copper industry, both smelting and refining, of the United States in 1905, shows that there has been a substantial increase in the industry as compared with the statistics for 1900. There has been one difficulty in compiling these statistics, due to the fact that the matte product is handled by the refineries. There is included in the copper production a relatively small amount of copper exported in the form of matte. The copper production for the United States —939,327,142 pounds—includes 91,743,719 pounds of copper produced from imported ores. This leaves the copper production from mines located in the United States at 847,543,423 pounds, or 378,385 long tons, of which amount 205,189,233 pounds was what is known as Lake copper.

The number of establishments has decreased from 47 in 1900 to 40 in 1905; on the other hand the capital invested has increased from $53,063,395 to $76,265,987. The gross value of the products of the smelters and refineries in 1900 was reported as amounting to $165,131,670, and had been increased to $240,780,216 last year. The copper production increased from 602,595,113 pounds at $94,061,667 in 1900 to 939,327,142 pounds at $119,860,923 in 1905.

Franklin Statue Is Unveiled in Paris.

The unveiling of the Franklin statue in Paris, which was to have taken place on April 20th but was postponed on account of the San Francisco earthquake, as stated in the Western Electrician last week, was successfully carried out on April 27th. The statue was presented by John H. Harjes of America to the municipality of Paris.

The exercises included addresses by Ambassador McCormick and Prof. Albert Henry Smyth of Philadelphia, the delegate appointed by the United States, and a reply by Minister of Public Works Barthou for the French government. The presentation speech at the statue was made by Mr. Harjes, and President Chautard of the Municipal Council accepted the gift on behalf of the city.

The statue is a duplicate of the one in front of the Philadelphia postoffice, and is the work of Sculptor John J. Boyle of New York, who spent two years in its execution. It is nearly twice life size and represents Franklin in his favorite armchair. The statue was unveiled by Misses Mary Waddington and Hope Dorothy Harjes. At the close of the ceremonies Mr. Barthou gave Professor Smyth the insignia of the Legion of Honor.

Railway Signal Association.

The New York meeting of the Railway Signal Association will be held on May 8th in the Grand Union Hotel. Besides the consideration of the adoption of the amendments to the constitution proposed at the Chicago meeting, March 19th, four papers will be read, as follows: "The Upward Indication of the Semaphore Arm," by Mr. L. R. Clausen, signal engineer, Chicago, Milwaukee & St. Paul Railway; "Electric Locking at Electric Interlocking Plants," by Mr. W. H. Arkenburgh, chief draftsman, Union Pacific Railroad; "Substitution of Track Circuits for Detector Bars," by Mr. H. W. Lewis, supervisor of signals, Lehigh Valley Railroad; "Alternating-current Track Circuits in the New York Subway," by Mr. J. M. Waldron, signal engineer of the Interborough Rapid Transit Company.

Three large locomotives for the Spokane and Inland electric railway have been ordered, and delivery is promised in six weeks. Three others will be ordered. They were designed by J. B. Ingersoll, the assistant manager of the line. Each weighs 40 tons and will pull a 400-ton train up a two per cent. grade at eight miles an hour. The locomotives are of the single-phase alternating-current type.

Ohio Telephone Notes.

The Cleveland Telephone Company states that its subscribers now number 20,000, whereas it had 3,800 12 years ago. The growth in the local business has been closely followed by the long-distance business and the number of operators on the long-distance board has gradually increased, until now 60 are employed. The company has, besides its main building in the business district, six modern branch exchanges.

The Central Union made 1,000 installations at Toledo in March, showing a net gain of 800. The growth of the business at Columbus is said to be entirely satisfactory.

Construction work has been begun on the plant of the Sandusky Telephone Company, and the whole plant will be overhauled and rebuilt. It is said that the Valley Telephone Company, connecting with 900 cities and villages in Michigan, is seeking connections with the company.

The Canal Fulton Telephone Company of Canal Fulton, with a capital stock of $10,000, has been incorporated by R. F. Meyers, W. E. Scoville and others.

The Tiverton Bell Telephone Company of Tiverton has been incorporated with a capital stock of $5,000 by J. N. Smith, W. C. Hunter and others.

Considerable talk has been caused by the result of the investigations of the Drake legislative committee in Cincinnati, so far as it relates to the Independent telephone matter. Sol P. Kineon and John J. Downey testified that they went to August Hermann in the City Hall, according to published reports, and that he told them it would cost them $50,000 to get a franchise in Cincinnati. He suggested that they place the money with him and he would handle the matter, according to the report. They finally agreed to place the money with a responsible person, to be paid when the franchise was granted and signed. After being referred to an attorney who charged them $500 for drafting an ordinance, the matter dragged so long that Downey got disgusted and dropped out. Mr. Kineon testified that the ordinance was introduced in council, but got no further until the Queen City Telephone Company endeavored to secure a franchise. When a company was to be organized by Kineon and Downey the testimony showed that George B. Cox agreed to furnish the $50,000 that was to be used in completing the organization and furnish the first working capital needed.

The Columbus Citizens' Telephone Company has ordered 500 more main-line switches for its automatic board. The capacity is exhausted, with the exception of 300 switches, and 11,000 main-line telephones are now in operation.

A committee of the Cincinnati Council has visited Louisville, Indianapolis, Toledo, Cleveland and Columbus to investigate the working of two telephone systems, having been invited to do so at the expense of the City and Suburban Bell Telephone Company. It is said they refused to inspect the plants at any of the cities named, but confined their work to talking with business men regarding the desirability of two systems. It is said that the Bell people are now working on a plan to reduce the rates to somewhere between $85 and $90 for unlimited service, and that if this is done the council committee will probably recommend one system. The rate for unlimited service is now $100. The Bell people are making a fight against the admission of the Independent system in the city. But it is hard to see how they will be able to keep the toll lines out, even if the city does not grant a franchise for an exchange.

The People's Telephone Company of Akron has decided to install an automatic exchange in the new building that is to be erected on the site of the old one, that has been torn away.

The managers and traffic men of the Central Union Telephone Company for Northwestern Ohio held a meeting at the Valentine Cafe recently and discussed subjects relative to their business. A banquet was served.

One thousand new main-line telephones will be added to the plant of the Newark Telephone Company in Newark, and 45,000 feet of new cable will be put up. Of this over 9,000 feet will be underground.

The Todd Corners Telephone Company of Wakeman has been incorporated with a capital stock of $3,000 by C. H. Todd and others.

Incorporation papers have been issued to the Stillwater Mutual Telephone Company of Flushing. The capital stock is $10,000, and A. J. Murphy, F. A. Graves and others are among the incorporators.

C.

Michigan Telephone Matters.

John McNabb has been awarded the contract for the additions to the main exchange of the Michigan State Telephone Company at Grand Rapids and work has been begun. The approximate cost of the improvement is $12,000.

One hundred farmers in the vicinity of Kingsley have organized a mutual telephone association and will get long-distance service through the Bell system.

Farmers in Mecosta, Etna, Austin and Deerfield townships, Mecosta County, have organized a telephone exchange and will connect with the lines of the Michigan State Telephone Company.

The Michigan State Board of Agriculture will install an automatic telephone system at the Agricultural College to connect with the Independent system at Lansing.

Construction work on the plant of the Home Telephone Company at Detroit will begin within a few days. Spencer B. Moseley will have charge of the work under the supervision of W. C. Polk, consulting engineer. The plant will cost about $3,500,000.

B.

Indiana Telephone Items.

The Jeffersonville Home Telephone Company has filed articles of incorporation to build and operate a telephone system in Jeffersonville and throughout Clark County. Jacob Eberts is one of the incorporators.

The Cumberland Telephone Company is building a new exchange and making improvements in Petersburg and Pike County, preparatory to a campaign for new business.

The Central Union Telephone Company has begun the long-contemplated improvement in its plant at Richmond. A new exchange building will be erected on North Tenth Street and the latest-pattern automatic switchboard will be installed. The company will also construct a conduit system in Main Street unless the city concludes to put in a large conduit system for all the wire companies.

Louis G. Richardson, president of the Central Union Telephone Company, has confirmed the report that the company is to erect an office building for its own purposes in Indianapolis. Two switchboards, each with a capacity of 9,000 telephones, will be provided. The stockholders held a meeting in Indianapolis on April 18th. Following the election of directors the following officers were chosen: President, L. G. Richardson; vice-president and general manager, H. F. Hill; secretary and treasurer, W. S. Chapman.

The City Council of Shelbyville has granted a franchise to the New Long-distance Telephone Company to establish an exchange in that city.

Powerful opposition is forming against an increase in rates by the Indianapolis Telephone Company. The first public hearing on the petition of the company for important changes in the franchise has been held. The company wishes its franchise extended and asks permission to increase the rates to $54 for business and $30 for residence telephones instead of $40 and $24, respectively, now charged. The board took no action other than to arrange for a public meeting for May 3d, when patrons of the company and others will be heard.

Arrangements have been completed for the construction of a through metallic copper telephone line between South Bend and Indianapolis. President Theodore Thorward of the South Bend Home company was in Indianapolis in consultation with officials of the local company, and an agreement was reached when he departed.

A meeting has been called of the stockholders of the Home Telephone Company of Fort Wayne for April 30th, when the final steps to complete the merger of the Home and the National telephone companies will be taken. The capital stock of the merged company, to be hereafter known as the Home Telephone Company, is to be $600,000. Of the new issue of stock, $100,000 goes upon the market to raise funds for extensions of the toll lines. One of the extensions is to be a direct line to Indianapolis, so as to care for the large volume of business now refused because of the inadequate service. The owners of the South Bend Telephone Company, most of whom live in Fort Wayne, have received an offer from the St. Louis Independent syndicate to take over the South Bend plant, the payment to be made in securities of the new company.

Earl Hupp, cashier of the Andrews Bank in Laporte, received a space-telegraph message from A. P. Andrews on the 24th while Mr. Andrews was in mid-ocean en route to Europe, instructing him to subscribe $1,000 to the San Francisco relief fund. This is the first wireless message ever received in Laporte.

The Cumberland Telephone Company is proposing to install a police-patrol service of at least 75 stations in Evansville, free of charge to the city When installed the service will continue as long as the arrangement is mutually agreeable or satisfactory.

S.

Telephone News from the Northwest.

The Duluth Telephone Company will expend $100,000 in improvements to the local exchange and to the toll lines between Duluth and the Iron Range country.

Hecla, S. D., has granted a franchise for a local exchange to the Dakota Central Telephone Company.

The Northwestern Telephone Exchange Company has let the contract for the erection of an exchange building in Crookston, Minn.

Thomas Schaefer and Charles Christian have started a local exchange for Albany, Minn., with 40 subscribers.

The Current Lake Telephone Company of Balaton, Minn., has been incorporated with $10,000 capital stock.

Citizens of Ellendale, Minn., are considering the installation of a local telephone exchange. L. F. Burnes, F. R. Randall and George Stearns con-

...mittee to ascertain the number of subscribers available.

The Willmar (Minn.) Telephone Exchange Company will expend over $11,000 in improvements to its local system.

The Zenith Telephone Company of Duluth Minn., will make extensive improvements to its system this season to cost $75,000.

The New Richland Telephone Company of New Richland, Minn., has filed article of incorporation with a capital stock of $20,000.

George M. Young of Valley City, N. D. has purchased the system of the North Dakota Central Telephone Company, at Carrington and Fessenden, N. D.

George Schmitz has been made manager of the local telephone exchange at Stewart, Minn.

A new telephone company has been formed at Ida Grove, Iowa, with A. C. Garner as president and I. Hess, secretary.

Southeastern Telephone Developments.

The Rock Hill (S. C.) Telephone Company will erect a new building for the local exchange.

The Gadsden (Ala.) Home Telephone Company will complete its new system about July 1st.

The Piedmont Telephone Company of Gastonia, N. C., has inaugurated a plan to increase the use of the telephone in the rural sections by offering telephones at 50 cents a month on party lines. The plan is said to work well. The company has recently had its charter amended, increasing the capital to $200,000, and has issued considerable new stock in making improvements.

About $40,000 is to be expended by the Bell Telephone Company in its equipment at Charlotte, N. C., in extending underground and aerial connections.

The Shelby (N. C.) Mutual Telephone Company's recently granted charter has been dissolved. There was some misunderstanding about the service, but the Bell representatives and those of the Piedmont Company at Gastonia, N. C., met in Shelby with representatives of the new concern and differences were all adjusted, with the result that there will be no change in the status in that town.

The Chesapeake and Potomac Telephone Company has let the contract for a telephone building in Washington, D. C., to John McGregor. The structure alone will cost about $100,000, but the equipment will represent an expenditure of $300,000 or more. The building will be called the "Lincoln." It will be thoroughly modern, and the switchboard will have a capacity of 10,000 lines.

The Southern Bell Telephone Company proposes to expend $50,000 in Augusta, Ga., in improvements, including underground and overhead cable lines, added switchboard capacity, etc.

The Yorkville (Tenn.) Telephone Company, capital $5,000, is chartered. The company already has about 50 miles of lines connecting a number of towns in the vicinity.

L.

GENERAL TELEPHONE NEWS

The Chelsea (I. T.) Telephone Company has sold its business to the Pioneer Telephone and Telegraph Company.

The Home Telephone Company of Weatherford, Texas, has been incorporated with a capital stock of $50,000, and succeeds the Riddle Independent Telephone Company.

The Southwestern Telephone and Telegraph Company contemplates the reconstruction of the entire system in Temple, Texas. The new exchange will be equipped in the most modern manner.

The Mangum (Okla.) Telephone Company has been incorporated with a capital of $100,000. The incorporators are A. Gordon of Excelsior Springs, Mo., D. D. Taylor and D. H. Wright of Mangum, Okla.

Among the telephone companies recently incorporated are the following-named: Montana Independent Telephone Company, Butte, Mont.; Sargent Independent Telephone Company, Sargent, Neb.; Belt Valley Telephone Company, Belt, Mont.; Bohemian Mutual Telephone Company, Dodge, Neb.; Edna Mutual Telephone Company, Edna, Kan.

The Central Home Telephone Company of Kentucky has filed a mortgage of $5,000,000 at Henderson in favor of the Columbia Finance and Trust Company of Louisville to secure an issue of bonds and the payment of money due the trust company. This company was formed for the purpose of taking over a number of the Independent plants in Kentucky, and the extension of their lines. Ed. L. Barbour of Wauseon, Ohio, is one of the heaviest stockholders.

Arrangements have been completed whereby the Independent Telephone Company of Topeka, Kan., increases its capital stock from $150,000 to $1,000,000. B. F. Pankey, president and general manager of the company, and W. P. Hemphill, secretary and treasurer, state that the increase is for the purpose of taking care of the large growth in the company's business. Theodore Gary of Macon, Mo., vice-president of the National-Interstate Telephone Association and president and part owner of a number of telephone companies in the Southwest, has become interested in the Topeka company.

CORRESPONDENCE

Great Britain.

London, Sp... [illegible] ...ecision ... [illegible] ...ation land ... [illegible] ... Great Brit... [illegible] ... point out ... [illegible] ... h... the matter ... [illegible] ... called that ... [illegible] ... power compa... [illegible] ... ing in an ... [illegible] ... undertaking ... [illegible] ... inequality in ... [illegible] ... ment of the power ... [illegible] ... ral instance ... [illegible] ... by request, ... [illegible] ... there have ... [illegible] ... tenal, and ... [illegible] ... what expensive ... [illegible] ... which, of ... [illegible] ... now that the ... [illegible] ... and the Stockton ... [illegible] ... sent to the Cleveland and Durham Electric Power Company, it is to be hoped that a more liberal feeling will be entertained for the electric power companies than has been manifested by ... local authorities in the past. The terms of the consent of the Stockton Corporation are 15 per cent. of the revenue for five years, and 10 per cent for the next five years.

Whether owing to the existence of a Liberal government or to the persistent efforts of the London County Council, I am unable to say, but at present there is a lively recrudescence of the ambition on the part of local authorities to enter into the electric wiring and fitting business. A good deal of uncertainty as to the law on this subject still exists, although it has been made clear that any local authority wishing to embark upon this business must make special application to Parliament. Several municipalities have secured such powers, but while many have been bound not to do such work except through the medium of a contractor, others, although not so bound, have also fallen into line in this respect. As I have already reported, the London County Council proposal, although hitherto defeated in three sessions, has passed its first stage without opposition. The boldest move of any, however, is a proposal by the Brighton Corporation that the Board of Trade should introduce an act of Parliament making such work part of the duties of a local authority, and so obviate the necessity of each individual town seeking parliamentary powers. To this proposal, although only a few days old, there is already strenuous opposition. The most interesting case of all, however, is that of the Sheffield Corporation, which acquired some years ago the electric-light company in that city. As the company, under its articles of association, took the right to wire premises, the corporation claims the company has acquired this, and that there is no need for it to ask for special parliamentary powers. A test case is to be fought, however, and it will be watched with great interest, for there are a considerable number of local authorities in similar circumstances to Sheffield who might possibly be considerably benefited if the result were in favor of the Sheffield Corporation. The case is being taken up by the Electrical Contractors' Association.

The final constitution of the parliamentary committee, which will deal with the London County Council electric power bill, is now known. Of the nine members there appear to be only two who may reasonably be expected to be opposed to extreme forms of municipal trading, and the view is very generally held that if there is time the bill assuredly will become law. With some knowledge of parliamentary committee procedure, and the fact that the committee will not meet until toward the end of May, it is my opinion that there will not be time to pass the bill through both houses of Parliament.

In addition to the arrangements for welcoming the members of foreign engineering institutions to this country this summer, which I mentioned a short while ago, a joint meeting will also be held of the American Institute of Mining Engineers and the Iron and Steel Institute.

G.

Dominion of Canada.

Winnipeg, Manitoba, April 28.—The contracts for the extension of the Niagara, St. Catharines and Toronto Electric Railway has been awarded to Joseph Battle of Thorald, Ont., by President Fred Nichols and W. T. Jennings, chief engineer. The proposed extension is from Thorald to Welland and Fonthill. The Canada Foundry Company of Toronto Junction was awarded the contract for all the permanent bridges, and the wooden trestle work will be either replaced with steel or filled in with earth, work to commence at once.

The Kensington Land and Development Company of Winnipeg has offered to build an electric street railway 10 miles in length in Brandon, Minn., at an estimated cost of $200,000.

The shareholders of the Toronto Street Railway have authorized the issue of $1,000,000 new shares to provide new cars and equipment, relay rails, extend the routes and for other improvements.

The Ontario government has notified persons who may be interested in water to be utilized for power purposes not to make any further arrange-

[illegible]

New England.

Boston, Mass., April 26.—The Massachusetts Senate has concurred with the House of Representatives in voting "leave to withdraw" on the petition for legislation providing for a referendum on municipal ownership of gas and electric plants.

Both branches of the Massachusetts Legislature have sent a resolution to the governor recommending that the board of railroad commissioners be authorized to expend the sum of $2,500 for the purpose of investigating and testing safety or other devices for use upon street cars, including fenders, wheel guards, emergency tools, ventilating or lighting apparatus or any other device for increasing security or comfort in travel.

The Massachusetts railroad commissioners are considering a petition for greater street-car transfer privileges, presented by five citizens' organizations and improvement associations of the West Roxbury district of Boston. The Boston Elevated Railway Company operates the cars in the section affected, and it opposes the petition on the ground that the giving of the required transfers would allow people to go shopping and return home for one fare.

The Pittsfield Electric Company will build a power house 80 by 100 feet and a boiler house 50 by 100 feet on recently purchased land on the shore of Silver Lake, near Pittsfield, Mass. A spur track from the Boston & Albany Railroad will permit the running of coal cars direct to this plant. The company will install a 350-kilowatt alternating-current generator and two Diesel oil engines of 250 horsepower each. The new buildings and improvements will cost $30,000.

The Western Union Telegraph Company is stringing three copper wires between Boston and New York via the Midland Division of the New York, New Haven and Hartford Railroad.

The Electric Cable Company has completed its plant in Bridgeport, Conn., the main building being 60 by 230 feet. The company was recently incorporated and it has a capital of $500,000. It has obtained control of the Magnet Wire Company and the Peerless Electric Company, both of New York. Its principal product is an insulating compound.

A Connecticut Superior Court judge has issued an order certifying that public necessity and convenience require the establishment of a telephone system in the town of Killingworth, the only town

in that state which has no telephone service. The Southern New England Telephone Company will establish an exchange in Clinton, which will serve the towns of Clinton and Killingworth.

The Naugatuck Valley Electric Company has awarded the contract for its electric railway between Beacon Falls and Seymour, Conn., and is building the section between Naugatuck and Beacon Falls. The road will be eight miles long and it will be controlled by the Connecticut Railway and Lighting Company, connecting with the latter's tracks at Naugatuck and Seymour. This line will cost about $500,000.

Low tide in Boston Harbor stalled Boston street cars between 5:30 and 7 p. m., April 23d. The Boston Elevated Railway Company's power houses at Albany Street and Lincoln's Wharf in Boston, Harvard Square in Cambridge, and Sullivan Square in Charlestown use harbor water to condense exhaust steam. The tide went out so far that the salt water left the condensers, cutting off the supply of water for the boilers and making it necessary to take cold fresh water for steam-making purposes. As a result steam could not be generated fast enough to move all the cars.

The Atlantic Insulated Wire and Cable Company has bought a tract of land at Stamford, Conn., on which it will build a large factory.

The Engineering Specialty Company has acquired the Max-Riddell Hardware Manufacturing Company's property in Stamford, Conn., and will move there from Meriden, Conn. The latter company had finished the foundation for a building 40 by 200 feet, on which the Specialty company will build a factory for motors, generators, sparking dynamos and magnetos and dynamotors for telephone and bell systems. B.

New York.

New York city, April 28.—The New York Electrical Club, which has leased commodious apartments at 14 and 16 Park Place, opened its doors with a reception last Saturday. The club starts with a membership of 150, and during the reception many gentlemen identified with the allied electrical interests were present. In the suite of rooms are included a fine dining hall and a private dining room which promise to become popular among the electrical men. Reasonable prices will be charged. Among those present at the reception were J. P. Hall and R. B. Corey, president and secretary, respectively, of the club; A. L. Deveau, J. E. Lockwood, E. B. Latham, A. S. Terry, B. C. Kenyon, John H. Dale, J. B. Olson, R. M. Downes, George F. Porter, J. H. Hallberg, E. P. Eckert, C. E. Corrigan, Alex Henderson and T. D. Watson.

At a meeting of the Graduates' Club a few nights ago manufacturers and educators interchanged views on industrial education. There were quite a number of able speakers and all agreed that the heads of American industries are confronted with a steadily increasing difficulty of finding skilled mechanics and foremen. Among the speakers was Magnus Alexander, director of the trade school established by the General Electric Company in its plant at Lynn, Mass.

In the annual report of the New York Central and Hudson River Railroad, showing the earnings and various expenditures of the system, President Newman, discussing the Grand Central terminal and the work of electrical equipment, says: "Satisfactory progress has been made on the work connected with the improvement of the Grand Central terminal and the electrification of lines to Croton and North White Plains. The main power stations at Port Morris and Yonkers are nearly completed, and work on substations at various points and transmission lines is well under way. It is expected that operation by electric traction between the Grand Central Station and temporary terminals at Woodlawn and Highbridge will be installed during the coming year."

F. B. Behr, the English engineer who patented the Behr monorail system, appeared before the Aldermanic Committee on Railroads this week and outlined a comprehensive system of railways to bring the most distant parts of the Bronx or of Staten Island to Wall Street in 15 minutes. By adopting his scheme, Mr. Behr says, the city can have a municipally owned railroad at once to run to Coney Island at a 3-cent fare. The cars would run on a single rail laid on top of an A-shaped structure, along the sides of which would run the rails for electric power. The system could be built either as an elevated line or as a subway. Mr. Behr has applied to the Rapid Transit Board for the Coney Island line franchise, and wants the aldermen to indorse the project. He says he is willing to surrender his individual patent rights and turn over his patents to the public if the city will build the Coney Island line to introduce the system.

In view of the widespread comment on the bill introduced in the Legislature by Assemblyman Quinn for a universal transfer system between all car lines in this city, including surface, underground and elevated roads, the traction officials were asked for a statement of their feeling toward the bill. They are against it, not because they do not want to see a universal transfer system adopted eventually, but because they say they consider that the time is not yet ripe for it. Both the operating and financial heads of the street-railway lines in this city regard the universal transfer system as inevitable. They are not against it because it brings a loss in net revenue, for the establishment of nearly every new transfer point has demonstrated that it materially increased the amount of travel; they are against it because, they hold, it would cause endless confusion and delay.

There will be an annual saving of $780,000 a year to the city under the new lighting contracts, which have been approved by Mayor McClellan, Corporation Counsel Delany and Commissioner Ellison of the Department of Water Supply, Gas and Electricity. The saving noted is in comparison with the figures obtained by Commissioner Oakley, which were the last submitted by the lighting companies until the present figures furnished by Commissioner Ellison. For lamps now in use the price bid was $100 per lamp for the first 5,000 or less, with a reduction to $80 a lamp when the number reached 15,000. The company now agrees to count the lamps in Manhattan and the Bronx under one contract. The city now uses 4,650 such lamps and will pass the 5,000 mark before the end of the summer. For all over 5,000 and less than 7,500 the price will be $95 a lamp a year. The greatest saving, however, is in the service of electric current. The new price is 7½ cents per kilowatt-hour; the old price was 12 cents. For power the old price was 10 cents, and the new price is six cents, both showing a large reduction below the legal rate of 10 cents under the Stevens law. In Brooklyn the price is $90 per lamp. The city agrees to the figures, but under advice from the corporation counsel will not contract for the supply until arrangements can be made to replace the lamps with larger ones. The city also demands a modification of the rate asked by the Brooklyn Edison Company (12 cents per kilowatt-hour) for the incandescent lighting of public buildings. The commissioner holds that if the New York Edison, of which the Brooklyn company is a subsidiary company, can furnish the power at that rate the Brooklyn company can do as well.

Next week will close practically all the free lectures of the city and the calendar will be discontinued for the season. The Board of Education's course of lectures on electricity will close at Public School 135 with a lecture on "Electricity and Its Application in Mining," by W. Wallace Ker. C. I. C.

Southeastern States.

Charlotte, N. C., April 28.—The Board of Aldermen of Louisville, Ky., has defeated the Atherton electric-light-franchise ordinance, after a discussion of many weeks. The Louisville Lighting Company has, on the other hand, granted concessions in prices that will amount to an important sum.

The Electric Bond and Share Company of New York city has purchased a controlling interest in the Raleigh (N. C.) Electric Company, which operates the street-car system and electric lights of the town. Marsden J. Perry of Providence, R. I., is the president of the new interests which have assumed control. It is surmised that extensive improvements and expenditures will follow the change of management.

The Winchester and Washington City Railway Company will probably supply power to the Shenandoah Ore and Iron Company, recently chartered, and a trolley will be built from the mines of the company to Millville, W. Va.

The United Railways Company of Baltimore has received 12 of the 100 new electric cars ordered the first of the year from the J. G. Brill Company of Philadelphia, and has put the cars in commission.

A decision has been handed down by the United States Circuit Court of Appeals in the case of the Missouri Edison Electric Company. The case hinges on a $10,000,000 merger of the light and power companies of St. Louis, and, granting the statements of the plaintiff, an attempt is also involved to freeze out certain minority stockholders. This decision reverses that of the lower court and is regarded as practically admitting the legality of the merger under the laws of Missouri.

L. W. Botts and associates of Louisville have bought the Jackson (Tenn.) street-railway and electric-light plant for $115,500, and will make important improvements.

The Cannon Company, one of the largest cotton-mill concerns in the South, with offices at Concord, N. C., is reported to have decided to use electrical power from the Whitney Company's plant, under construction on the Yadkin River.

The Washington, Baltimore and Annapolis Electric Railroad Company has secured right-of-way for nearly the entire distance desired for the road-bed. It is expected that cars will be running into Baltimore within a year.

The Chattanooga Railway Company is the new company owning the former properties of the Rapid Transit Company and the Chattanooga Electric Company, for which the sum of $563,000 was paid.

The town of Goldsboro, N. C., recently sent W. J. Matthews to visit several municipal plants to secure ideas about the operation of electric-light and water plants, which the town desires to install. L.

Ohio.

Cleveland, April 28.—The Indiana, Columbus and Eastern Traction Company was incorporated at Columbus recently with a capital stock of $1,000,000, by W. Kelsey Schoepf, Dana Stevens, W. H. McAllister, S. C. Cooper and F. A. Deverall. This is supposed to be either a holding company or an organization to purchase outright the Appleyard properties, that recently passed into the possession of Mr. Schoepf and his associates. The termini are stated as Zanesville and the state line between Ohio and Indiana at or near St Paris, Ohio. The articles will allow the company to acquire, lease or purchase, build, operate and extend interurban railroads for freight, express and passenger service. In this connection it is reported that J. L. Adams of South Manchester, Conn., has been appointed general manager of the Appleyard roads by Mr. Schoepf. He was formerly with the Hartford, Manchester and Rockville Traction Company.

The new gasoline car built for the Lake Shore and Michigan Southern will soon be completed and ready for testing. The body of the car was built at the Kuhlman shops in Collinwood, near Cleveland, and equipped with gasoline engines at the shops of the Wellman-Seaver-Morgan Company in Akron. The engines are 250 horsepower and are set on the trucks instead of being fastened to the body. This does away with the vibration, which has been one of the principal objections to the Strang and other cars. This also makes it possible to use almost the entire space in the car for seating, as the motorman will use only the vestibule, as in electric cars. A small motor for lighting the car will be used and another will operate the air brakes. The car is 34½ feet long over end panels and 43¾ feet over vestibules, and will seat 26 passengers in the main portion and 16 in the smoking room. The car cost about $12,000.

Considerable interest has been taken in the report that the Widener-Elkins syndicate is experimenting with a car that will be operated with gasoline or crude oil as fuel. It is said that experiments have been made with such a car and that it shows good speed. It is also said that the expense of operation can be reduced 50 per cent. from the cost with electric power.

A franchise has been granted to the Wooster and Mansfield Trolley Company to build and operate a road in Wooster.

From 1893 to 1905 inclusive the earnings of the Cleveland Electric Railway Company were $44,669,137.76, while the operating expenses and taxes were $27,086,775.13, the percentage being 60.64. In 1893 the earnings were $1,872,765.79 and the expenses and taxes were $1,292,791.73. In 1905 the earnings were $5,308,780.50 and the operating expenses and taxes were $3,244,476.37.

Plans have been made by the Toledo, Port Clinton and Lakeside Railway Company to enter the lighting business along its line. The company is now negotiating for the plants at Marblehead, Port Clinton, Oakharbor and Lakeside. It is said that franchises have been offered it by several of the towns, but the officers prefer to purchase the plants already in operation rather than enter into competition with them. Power will be furnished for the plant of the United States Gypsum Company to be opened near Port Clinton.

Most of the underwriting of the Youngstown and Ohio River Railroad Company has been sold, and construction work will be begun within a short time, it is said. Warren Bicknell is at the head of the syndicate. The road is to extend from Youngstown to East Liverpool on the Ohio River.

The car barns of the Lake Erie, Bowling Green and Napoleon Railway Company at Bowling Green were burned Sunday morning. Two new passenger cars and three others were burned.

The Cleveland, Ashland and Mansfield Railway Company, with a capital stock of $100,000, was incorporated a few days ago by T. W. Farnham, G. A. Bartholomew and others. The company will build a line from Ashland to Mansfield.

Fares on the Appleyard roads, recently purchased by the Schoepf syndicate, have been materially reduced, the percentage being about 20 per cent., it is said.

The Cleveland Electric Railway Company has begun the construction of a large car barn at Woodland Hills and North Woodland avenues.

It is said that the Cleveland, Painesville and Eastern has sold $300,000 of its first-mortgage bonds and that the proceeds will go toward paying the floating debt. This action precedes the possible merger of the Cleveland, Painesville and Ashtabula with the company.

The committee on lighting, of Lakewood, has recommended that an issue of $25,000 bonds be authorized to extend and repair the municipal light plant. Lakewood is the western suburb of Cleveland.

Frank O. Newcomb some time ago asked a conductor on a North Hill (Akron) car for $1 worth of tickets and the conductor did not have them. He refused to pay a cash fare, and the conductor put him off the car. Newcomb sued the company for damages and received a verdict for $1,000.

The question of abolishing excess fares on the limited trains in this state is attracting considerable attention, and it is expected that all the roads will eventually take that action. Several have already decided to do so, it is said.

The attempts of the officers of the Eastern Ohio

Traction Company to reorganize the company and place it upon a sound financial basis seem to have met with failure, as the stockholders received a letter a few days ago informing them that the mortgage held by the Cleveland Trust Company would be foreclosed under conditions named in that instrument, the interest not having been paid when due. It is probable that the bondholders will now get together and form a syndicate or a new company to purchase the property under foreclosure proceedings.

Arrangements are being made by the Cleveland and Southwestern to build the belt line at Lorain, for which it was given a franchise a week ago. The line will be about three miles long. It is said that the company also stands a good chance of getting a franchise to build a line into Elyria, where it will enter the business section of the town.

Reports indicate that the Widener-Elkins syndicate has secured the Muncie, Hartford and Fort Wayne Traction Company, which was owned by S. M. Hexter and associates. O. M. C.

Indiana.

Indianapolis, April 28.—It is reported and denied that the Evansville and Princeton Traction Company has been sold to the Clark syndicate of Philadelphia. It is also rumored that the line will at once be extended to Vincennes.

Surveyors are making the final survey of an electric railway between Crawfordsville and Danville, Ill., to be built this summer by the Crawfordsville and Western Traction Company.

Charles Cottingham has begun the work of surveying an electric railway between Covington and Crawfordsville. It is understood that Mr. Cottingham is in the employment of the McKinley syndicate of Illinois, and the plan is to extend the line into Indianapolis.

A petition for a franchise to enter the city of Logansport has been filed with the Board of Public Works by the Indiana Rapid Transit Company, which is building an interurban line from Terre Haute to Logansport. The city will let the company come in over the tracks of the Fort Wayne Company to the present terminal station.

It has been officially announced from the offices of the Indiana Union Traction Company that the interests closely related to that company had acquired the Muncie, Hartford City and Fort Wayne Railway Company, and that the company would operate from the Anderson office. Mr. H. A. Nicoll, who is now general manager of the Indiana Union Traction Company, has been appointed general manager of the Muncie, Hartford City and Fort Wayne Railway Company, and the property will be operated under his direction. It is understood that L. J. Shlessinger, who has been superintendent of the Muncie, Hartford City and Fort Wayne line, will remain in that capacity for the present. It is said that the deal for the road involved close to $1,000,000.

The work of building the new "Steel City" of Gary, involving the expenditure of $10,500,000, was begun at the mouth of the Calumet River this week. The plan calls for huge engineering feats, dredging and straightening of the river, the building of docks, etc. In addition to the branches of the Belt Line and six railroad lines, three interurban lines will pass through the new city. Rights-of-way for these roads have been secured, and the work of building will begin at once. The new Indiana Steel Company is a subsidiary corporation to the United States Steel Corporation. Mr. E. J. Buffington is president and T. J. Hyman secretary. S. S.

Michigan.

Grand Rapids, April 28.—The Grand Rapids-Muskegon Water Power Electric Company, with head offices in Muskegon, has increased its capital stock from $1,000,000 to $3,000,000. The name of the company has been changed to the Grand Rapids-Muskegon Power Company. A $7,500,000 trust mortgage for 25 years running to the First Trust and Savings Bank of Chicago has been filed, covering the property owned by the company and the expenses to be incurred in building the second dam at Croton. It is said that the company has expended $800,000 up to the present time. Thomas Hume of Muskegon is president of the company and George L. Erwin is secretary. The company has provided for an issue of $1,300,000 bonds at the present time and arranged for further bond issues if found necessary. It is believed that the company will take over the Grand Rapids Edison Company.

The Flint Light and Power Company of Flint has purchased the Lewis Paper Mill dam and grist-mill dam on Flint River near the city. The price named is $12,000.

Plans are on foot for the organization of a light and power company with dams on the Flint River at Flint and Flushing. H. R. Loranger, manager of the Genesee County flouring mills of Flint, and Robert O. Hart of the Hart Milling Company of Flushing, are back of the project and have applied for franchises. The present capacity of the two dams is 2,000 horsepower, and the plans are to produce an additional 1,000 horsepower by increasing the capacity of the two dams. A distributing station is to be built in Flint to supply current for power and commercial lighting.

The Bad [illegible] Sherman [illegible] light and power [illegible] concern [illegible]

[illegible] Muskegon Power [illegible] [illegible]

The Grand Rapids [illegible] an annual [illegible] plant [illegible] how the [illegible] and [illegible] that all debts and [illegible] 42219. Gross earnings [illegible] and expenses [illegible] $27,107.07.

The Grand Rapids Edison Company [illegible] electric power and lighting for [illegible] facturer. Building [illegible] equipment [illegible] two 25-horsepower elevators, two [illegible] motors, pumps, 150 arc lights and [illegible] candlepower incandescent lights. Installation of a [illegible] plant was considered.

Plans for rewiring the Grand Rapids City Hall have been completed and auxiliary machinery to generate power installed at the pumping station. The City Hall has been lighted heretofore by private corporations. Now everything is ready for municipal lighting, but there are no conduits to carry the city wires to the building, and the plan must wait.

The annual report of the Board of Public Works of Holland, Mich., gives the value of the municipal lighting plant as $110,69?.77 and the profit from its operation $3,766.85, an increase of $1,?23.85 over the preceding year. Total receipts were $31,174.?8. In the expenditures is figured an item of $1,000, which the plant would pay in taxes if operated by a private corporation. Nearly $5,000 was spent for permanent improvements.

Ontonagon village has awarded a contract to Lane & Bodley of Cincinnati for a new electric light plant. Equipment will consist of 140-kilowatt dynamo, 225-horsepower Corliss engine, switchboard and 16 arc lights. The price is $8,165.

Houghton again has street-car service after a space of one year, during which the bridge across Portage Lake, which was destroyed, was being rebuilt.

Negotiations are under way for the building of an electric road from Grand Rapids to Battle Creek by way of Hastings and Alaska. Some of the right-of-way is secured and arrangements made for the preliminary survey. J. J. McVain, consulting engineer of Grand Rapids, will have charge of the preliminary survey. Alfred C. Sekell and John C. More are interested in the project. The road will be about 50 miles in length.

Burnham Bros. of Pontiac propose to build an electric road from Frankenmuth to Vassar, Caro and Cass City, with a branch from Tuscola to Flint.

The Grand Rapids, Holland and Chicago Railway has completed arrangements with the Grand Rapids-Muskegon Power Company for 1,500 horsepower daily to be delivered at the interurban power house at Jenisonville, which will be turned over to the power company.

The Jenison Park Amusement Company has been formed at Holland to conduct the park on the line of the Grand Rapids, Holland and Chicago Railway. Officers of the electric road are at the head of the amusement company. Stratherne Hendrie is president and Charles A. Floyd vice-president and general manager.

The Terry-Bending Engineering and Construction Company has established offices in Grand Rapids and will carry on a business in general engineering and construction of electric lines. J. C. Terry is president, E. A. Bending vice-president and general manager, and J. D. Bicknell secretary and treasurer.

The village of Elk Rapids has granted a franchise to A. B. Dougherty for a lighting plant. The franchise calls for an all-night service, with a price of $75 per arc light for the first 25 lights and $70 above 25 lights. Six months are allowed in which to get the plant in operation.

The Grand Rapids-Muskegon Power Company has begun work on its new dam at Croton. The dam is to be 35 feet high and will have eight flood gates, eight wheels and generators. There will be used 700 tons of steel interlocking piling, 300,000 feet of form lumber, 2,500 wood piles and 20,000 barrels of Portland cement.

The Michigan Power Company of Lansing has been granted a franchise to build a power dam across the Grand River in Danby Township, Ionia County. Dudley O. Watson of Coopersville is secretary of the company.

The Continental Engine Company, which is removing its plant from Chicago to Menominee, Mich., will be reorganized with a capital of $40,000. It will employ 50 skilled mechanics and electricians.

The Commonwealth Power Company has completed its power house in Lansing. It is built of brick and stone, with concrete floors throughout, and is two stories in height. Two switchboards, three transformers and three rotary converters will be installed. The company will furnish power for the Lansing-St. Johns interurban road as soon as the feeders are connected by the company.

It is said that work will be resumed on the [illegible]

Illinois.

[illegible]

building [illegible]

[illegible] room, buffet and the [illegible] sengers.

The City Council of Streator has granted a franchise to the Peoria, Streator and Ottawa [illegible] through the city. If it cannot make arrangements with the local railway company the company will build its own entrance. The entrance [illegible] has not been secured as yet.

The Illinois Central Railway has granted its telegraphers an increase in salary amounting to $25,000 a month on the entire system.

The Illinois Traction Company has established at Danville a school for motormen.

Articles of incorporation have been filed for a new interurban to run from Old Salem to Peoria and is to be known as the Salem, Springfield and Peoria Railway. The capital stock is $[illegible] and principal office in Chicago. The incorporators are Johnathan P. Reeves, Albert M. Trueb, John J. Dick, Fred W. Krohm and Edward H. Senneff, all of Chicago.

Work is progressing on the new interurban power house. J. Hoagland, chief engineer of the Illinois Traction Company, has staked it out and excavating has commenced. Two large stacks are to be built, 200 feet in height, 14 feet in diameter at the base and 10 feet at the top, of steel and lined with brick. V. N.

Northwestern States.

Minneapolis, April 28.—The Merrill (Wis.) Paper Company will build a dam and power house, and it is expected that possibly 5,000 horsepower will be developed.

The Hastings (Minn.) Electric Light and Water-power Company has been incorporated with a capitalization of $50,000. J. Rosholt is president and N. Enge secretary.

The council of Owatonna, Minn., has declared the franchise of the Owatonna Gas, Electric and Heating Company forfeited.

A franchise has been granted at Hibbing, Minn., to the Northern Traction Company, and the construction of an electric railway between Chisholm, Hibbing and other range towns is assured. The preliminary survey has already been started.

The Commercial Club at Staples, Minn., is agitating a proposition to establish a municipal electric-light system in that village. R.

PERSONAL

W. H. Auker, who has been with the Piedmont Electric Company of Anderson, S. C., as local manager, has taken a position with the Westinghouse Electric and Manufacturing Company in Pittsburg, in the engineering department, assuming his new duties May 1st.

F. C. Stieler, who has been an assistant to E. W. Olds, superintendent of rolling stock of the Milwaukee Electric Railway and Light Company, has resigned his position to enter the employment of the Westinghouse Electric and Manufacturing Company at Pittsburg.

James Rawley, until now treasurer of the J. G. Brill Company, has been elected president of the company, succeeding the late G. Martin Brill. Other officers elected, following the promotion of Mr. Rawley, are as follows: Vice-president, John A. Brill; treasurer, Edward Brill; secretary, M. Herman Brill; general manager, Samuel P. Curwen. Mr. Rawley is a graduate in civil engineering of the University of Pennsylvania and is a

Philadelphian. He entered the old firm of J. G. Brill & Co. in 1872 and was for a number of years in the service of the Pennsylvania Railroad.

The University of Edinburgh recently conferred the honorary degree of LL.D. on Alexander Graham Bell. Mr. Bell is a native of Edinburgh and left Scotland in 1870.

W. H. Butler has resigned as manager of the Portage County Telephone Company of Ravenna, Ohio, to assume the management of the Lincoln Sand and Gravel Company of Lincoln, Ill. Mr. Butler built the first telephone lines about Ravenna and finally furnished service for every township in Portage County.

F. L. Martin has resigned his position as advertising manager of the Stromberg-Carlson Telephone Manufacturing Company of Rochester and has returned to Chicago, where he will be associated with White's Class Advertising Company, making a specialty of telephone advertising, with which his experience makes him especially familiar.

Henry E. Hawley, vice-president and general manager of the Hudson River Telephone Company, died suddenly in Albany, N. Y., on April 27th from heart disease. He was to have been transferred to the home office of the Bell company soon. Mr. Hawley was a member of several clubs in Albany and Troy, the Transportation Club of New York and all the local Masonic bodies. He was 44 years old.

This interesting item of news was telegraphed from Detroit to the daily newspapers on April 27th: "This city is to witness the unusual spectacle of a traction magnate running for mayor against a municipal-ownership candidate. It was announced today that Jere C. Hutchins, president and general manager of the Detroit United Railways, would enter the contest with Alderman Jeffries, champion of city ownership and operation, and Mayor Codd, who advocates a broad traction subway scheme." Mr. Hutchins is very well known and highly esteemed by street-railway men. In 1902-03 he was president of the American Street Railway Association.

ELECTRIC LIGHTING.

Belleville, Kan., has voted $20,000 in bonds to put in an electric-light plant.

Fire has damaged the electric-light plant of H. B. Day in New Madrid, Mo.

Matthews & Barnes have obtained a franchise for an electric-light plant in Eureka Springs, Ark.

The Abilene (Kan.) Light and Power Company has been incorporated with a capital stock of $200,000.

The Shattuck (Okla.) Electric Light and Power Company has been incorporated with a capital of $3,000.

The Hawkeye Electric and Power Company of Farmington, Utah, has been incorporated with a capital of $50,000.

Owen Ford, 710 Security Building, St. Louis, Mo., is preparing plans for a municipal lighting plant for Covington, Ky.

The city of Grand Island, Neb., has sold its bonds and is now receiving bids on the construction of its electric-light plant.

The Washburn (N. D.) Water and Light Company has been incorporated with a capital stock of $25,000 by Karl Klein, W. A. Persey, Aug. E. Johnson and others, all of Washburn.

The Brownwood Gas and Electric Company of Brownwood, Tex., has been incorporated with a capital stock of $80,000 by S. P. Coggin, B. S. Boysen, R. B. Rogers and others, all of Brownwood.

The committee on lights recommend that a city electric-lighting plant be established in Lynchburg, Va., in connection with the waterworks of the city. The estimated cost of the electric-lighting plant is $50,000.

N. W. Bower of Nyssa, Ore., is promoter for the Interstate Electric Power Company. It is proposed to build a 20,000-horsepower plant at Eagle Rock. The estimated cost of the plant is $60,000. The plant will be located about 20 miles from Weiser.

The Boulder (Colo.) electric-light and power plant will be sold to the Henry Company of New York city. The price asked, $250,000, will be turned over to the citizens of Boulder for investment in other enterprises. The new company, with far greater capital behind it, will carry out improvements and extensions.

According to the Biological Society of Copenhagen an interesting experiment is to be made in the northern portion of the narrow straits called the Little Belt, between the Baltic Sea and the Cattegat. Electric lamps are to be used at the bottom of the straits in order to prevent conger eels from making their way out into the open sea, to the great detriment of the coast fishing industry. The eel shows a marked fear of light, and it is said that the conger eel will not migrate to the open sea when the moon is at the full. It is this weakness that it is hoped to turn to account to confine the congers within the limits of the Little Belt.

The Union Central Light and Ice Company of Hubbard City, Tex., has been incorporated with a capital of $35,000 for the purpose of constructing and operating electric-lighting and ice-making plants. W. August Bass is president; Allen & Scott, Waco, Tex., are the architects and engineers.

The first installation of Cooper Hewitt mercury-vapor lamps for exterior lighting in England is now to be seen outside the London Tribune offices in Bouverie Street, E. C. There are six lamps installed, each of 800 candlepower. The lamps are of the ordinary type used for interior lighting and operate on a 200-volt circuit.

The proceeds of the recent increase in capital stock of the North Shore Electric Company from $2,000,000 to $3,000,000 are to be used in purchasing outright the La Grange (Ill.) Service Company, formerly simply controlled, and for completion of new power stations now being constructed at Maywood, Waukegan and Blue Island, Ill.

Sealed proposals will be received May 15th for the furnishing of all labor, material and supplies necessary for equipping and installing a complete electric-light plant and lighting system for Belleville, Kan., and for making certain improvements in the waterworks. Specifications and instructions are on file at the office of the city clerk of Belleville and at the office of the city's consulting engineer, W. K. Palmer, 718 Dwight Building, Kansas City, Mo. The proposals are to cover the following items: Brick power house, steel stack, one tubular boiler, two high-speed engines for direct connecting to alternators, steam piping, valves and covering, steam specialties, two 75-kilowatt alternating-current generators and exciters, switchboard, line material, arc apparatus, transformers, station wiring, etc.

ELECTRIC RAILWAYS

The Iowa City-Muscatine Interurban Railway proposes to issue bonds for the construction of a road. Colonel W. G. Doss of Iowa City, Iowa, is interested. The estimated cost of construction is placed at $1,000,000.

The New Jersey Assembly has passed the Galvin bill taxing franchises of trolley companies on their gross receipts upon a sliding scale, beginning at 2½ per cent. and increasing ½ cent each year until a 5 per cent. rate is reached.

Articles of incorporation of the Ottumwa and Southeastern Iowa Interurban Railway Company have been filed. The new company has begun the work of securing the consent of freehold property-owners and of making surveys for the proposed

C. H. Weeks, Cyrus Bradley and Benjamin J. Weeks of Spokane and W. W. Cannon of Centralia, Wash., have acquired all the property, franchises and rights of the Centralia-Chehalis Electric Railway and Power Company and will immediately build a line connecting those two cities, which ultimately will be extended to Tacoma and Portland.

An electric railway connecting Spokane and Cheney, Wash., seems assured. Charles P. Lund of Spokane has applied to Cheney for a franchise for an electric railway in that town. Mr. Lund and associates will soon file articles of incorporation for the Spokane, Cheney and Southern Railway Company. The company has a traffic agreement with the Washington Water Power Company to use a part of its present Medical Lake line. Mr. Lund also applied to Cheney for a local light and power franchise.

Extensive improvements are to be made by the Montreal Street Railway Company, which has just ordered new equipment from the Canadian Westinghouse Company. This was necessitated by the rapidly growing traffic of the company. The order included 20 quadruple equipments of 101-B railway motors, complete with controllers and details; also a 1,000-kilowatt, 600-volt, direct-current engine-type generator for installation in the main power house and three 500-kilowatt, three-bearing, motor-generator sets, consisting of type C motors and 550-volt direct-current generators. These latter are similar in capacity to those now installed in the company's various sub-stations, which feed directly into the trolley circuits.

All the Williams-Middendorf traction, electric-lighting and gas properties, securities and franchises have been merged into the Norfolk, Portsmouth and Newport News Company, and the name of that corporation changed to the Norfolk (Va.) and Portsmouth Traction Company, with a capital of $14,000,000. The merger will become effective June 1st, and immediately thereafter active work will begin upon the many contemplated improvements, principal among which are the erection of a new $1,000,000 power plant, the extension of lines to the Jamestown exposition site and the extension of lines out from Portsmouth to Suffolk. The following-named were elected officers of the company: R. Lancaster Williams of Richmond, president; Caldwell Hardy of Norfolk, first vice-president; G. M. Serpell of Norfolk, second vice-president; W. J. Kehl, secretary and treasurer; E. C. Hathaway of Norfolk, general manager. The general offices of the traction company will remain in Norfolk, and the management of the Norfolk Railway and Light Company will assume practically the whole management of the consolidated properties.

The recent announcement regarding Mexican stocks has been somewhat confusing. The facts seem to be that the Mexican Light and Power Company was negotiating for the purchase of the City of Mexico tramways from the Wehrner-Beit interests. The price was considered too high, and the option taken was allowed to expire. Immediately, however, the tramway company was bought out through a third interest for the Canadian interests, the actual purchasers being a Canadian syndicate composed, for the most part, of directors of the Mexican Light and Power Company. A new company is to be formed. It is bonds of this new concern, to the amount of $8,000,000, with 35 per cent. stock bonus, which are now to be offered for sale.

Willis E. Fertig of Titusville, Pa., has purchased the street railway and all property of the Shawnee (Okla.) Traction Company at a receiver's sale. The sale was a matter of form, as Fertig had previously purchased practically all of the $150,000 in bonds of the company, to satisfy which the sale was ordered. The full value of the system has been estimated at from $50,000 to $75,000. Both the electric-light plant and the street railway in Shawnee were thrown into the hands of a receiver over a year ago. The electric-light plant was purchased several months ago by Flynn & Ames of Oklahoma City, representing Chicago and Denver capitalists, and it is now being completely reorganized and the system rebuilt. The interurban line between Shawnee and Tecumseh is now well under way.

POWER TRANSMISSION.

A scheme is on foot to provide a number of small communities in Upper Hesse, Germany, embracing the districts of Schotten and Büdingen, with electric power generated by the River Nidda, which is capable of furnishing 700 horsepower for that purpose. There are 40 or more small towns and villages situated within a radius of 18½ miles.

The Shoals Milling Company of Washington, Ga., has petitioned the Superior Court for the privilege of changing the name of the corporation to that of Anthony Shoals Power Company, and also for the privilege of increasing the capital stock from $100,000 to $5,000,000. This company owns the waterpower at Anthony Shoals, which is recognized as one of the best waterpowers in Georgia. The power was purchased several months ago by T. M. and J. H. Fitzpatrick. It is the purpose of the promoters to build a large dam across Broad River at Anthony Shoals, to erect a power house and transmit the power to nearby towns and cities to be used for commercial purposes.

The York Haven Water and Power Company has awarded to Spahr Brothers of York, Pa., a contract for the erection of a sub-station at Harrisburg, Pa., for the transmission of current from the York Haven plant to the capital city. A site for the station has been secured just beyond the limits of Harrisburg. Current from the big hydro-electric plant near the Falls of the Susquehanna is now being supplied to Middletown, Steelton and York. Harrisburg will be the fourth town to use the York Haven current. Other towns will be added to the company's lighting and power system within the next year, and additional machinery, increasing the capacity of the plant, will be installed at York Haven.

PUBLICATIONS.

An unusually comprehensive bulletin issued by the Allis-Chalmers Company of Milwaukee describes crushing rolls for crushing ore, etc.

The Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass., has issued a new bulletin on the Wright demand indicator. The uses of the maximum-demand indicators, in connection with demand system and contract system of charging, is explained in the bulletin. There is also contained a complete description of the apparatus.

An article in the Engineering News, by Arthur Giesler, describing the "10,000-horsepower Single-wheel Turbine at Snoqualmie Falls, Wash.," has been republished in pamphlet form. At the time of the writing of this article Mr. Giesler was chief engineer of the Platt Iron Works Company, though he is now a consulting engineer in New York city.

SOCIETIES AND SCHOOLS.

The sixth session of the summer school for artisans held under the direction of the College of Engineering of the University of Wisconsin will open on June 25th and will continue for a period of six weeks. Courses are offered in "Engines and Boilers," "Applied Electricity," "Mechanical Drawing and Machine Design," "Materials of Construc-

tion, Fuels and Lubricants," "Shop Work" and "Manual Training." This school, which was the first of its kind, offers to those unable to take a regular four years' course an opportunity of obtaining a working knowledge of the methods of testing and the use of instruments, together with such theoretical principles in each case as the nature of the subject and the preparation of the student may permit. A bulletin describing the work of the school in detail will be sent on application to Frederick E. Turneaure, dean of the College of Engineering, Madison, Wis.

MISCELLANEOUS

City Electrician Carroll of Chicago, who last year introduced the vertical signs and made plans to install them on the lamp posts throughout the city, has found that the city has not the money necessary to do the work.

Production of anthracite coal in 1905, according to the United States Geological Survey, amounted to 69,339,152 long tons, which had a value of $141,879,000. The average price per ton was $2.25. In 1904 the amount of coal mined was 65,318,490 long tons, valued at $138,073,020.

Following a report made by City Electrician Carroll to the council finance committee of Chicago a few days ago, showing that Chicago can save $2,651.58 a year by maintaining its own gas mantles, all bids were rejected for doing the work, and the finance committee ordered that the municipal experiment should be made.

An electric hair-drying machine is a new device which combines both electric heat and electric power. It consists of a casing which incloses coils of resistance wire and an electric fan. The fan sucks air into the casing over the resistance wires and the latter heat the air to any desired temperature under control of the operator. A flexible tube communicates with this casing and receives the current of heated air, permitting the operator to direct the current where desired. When properly handled it is said that 12 persons can be treated in one hour at a cost of but a fraction more than one cent each.

TRADE NEWS

The Electric Manufacturing Company of St. Paul, Minn., has been incorporated with a capital stock of $150,000.

The Lincoln Electric Company has opened an office at 114 South Thirteenth Street, Lincoln, Neb., with P. L. Klingerman as manager.

General sales offices of the Wisconsin Brake and Electric Company, successor to the National Electric Company, will hereafter be located at 519 First National Bank Building, Chicago.

The Abner-Doble Company, engineer and waterwheel manufacturer of San Francisco announces that its works and offices at Fremont and Howard streets were entirely destroyed by the fire of April 18th. Temporary offices have been opened up at the residence of President W. A. Doble, 2611 Broadway, between Scott and Devisadero streets, San Francisco, where the [illegible] be conducted for the time.

The H. B. Co[illegible] maker of [illegible] on May 1st to the [illegible] Fifth Avenue and [illegible]

The contract for the generating [illegible] talled in the new building of the [illegible] and Adams streets, Chicago, [illegible] by the Commercial Nations[illegible] to the Western Electric Company [illegible] from consist of two 125 kilowatt generators [illegible] two 200 kilowatt generators.

The Bureau of Supplies and Accounts of the Navy Department is inviting sealed proposals until May 22d for furnishing [illegible] and [illegible] following supplies: Schedule 527, [illegible] schedule 528, searchlights; schedule 529, motor hoists. Specifications and blank proposals can be obtained at the Navy Pay Office in San Francisco or upon application to the bureau at Washington.

The secretary of the treasury is inviting sealed proposals until May 22d for supplying United States buildings under control of the Treasury Department east of the Rocky Mountains, electric fittings and materials and electric wires and cables, as the requirements of the service may demand during the next fiscal year. Specifications and proposal blanks will be furnished upon application to the Treasury Department, Washington, D. C.

The report of the Chicago Pneumatic Tool Company for the quarter ended March 31st shows profit for that quarter of $233,322.59. After counting off for depreciation, etc., bond interest and sinking fund reserve, there was a profit available for dividend of $155,744.82. The dividend paid was $61,087.83, which left a balance carried to surplus of $94,656.99. The surplus carried forward to the second quarter was $605,949.14. Since its organization in 1901 this company has disbursed $1,120,881.98 in dividends to its stockholders.

New York financial writers report that Kean, Van Cortlandt & Co., for themselves and associates, have bought control of Westinghouse, Church, Kerr & Co. and will reorganize it by taking out incorporation in New York state. The new corporation is to have a capital of $12,000,000, part common and part preferred, and will begin business, it is said, with cash resources of $7,000,000. John F. Wallace, lately chief engineer of the Panama Canal, is to be president, and the vice-president will be a banker, nominated by Kean, Van Cortlandt & Co. The Westinghouse interests will be represented and George Westinghouse will probably be a director.

The American Conduit Company is pleased to announce the removal on May 1, 1906, of its Chicago offices to more central and more commodious quarters in the Marquette Building, rooms 501 to 503, where Mr. A. L. Waterbury, general manager of the sales department, will be glad, as in the past, to receive the friends and patrons of the company, and where all inquiries, by mail or otherwise, will receive prompt and careful attention. The increase in the business of the American Conduit Company is decidedly gratifying and gives satis-

BUSINESS

[illegible]

The Canadian [illegible] ing the [illegible] Company [illegible] 300-kilowatt, direct-current, [illegible] generation, to be used in part of the present [illegible] power plant, which [illegible] up-to-date direct-current plants [illegible] equipped throughout with Westinghouse [illegible]

Among recent switchboard orders received by the Western Electric Company is one for a 32 panel 2,200 volt board to be installed at Crystal City, Mo., at the new plant of the Pittsburg Plate Glass Company. The Illinois Steel Company has also recently purchased from the same company a 500 kilowatt direct-current generator, which will be installed at its North Works, Wabansia, Noble and McHenry Street, Chicago.

The Wrigley steel toggle bolts, manufactured by Thomas Wrigley & Co., 300 Dearborn Street, Chicago, are said to be enjoying constantly increasing sales. The trunnion nut style is the most recent one put on the market and is particularly adapted for use on finished work of various kinds, such as on marble slabs, telephone boxes, etc. This bolt screws clear through the toggle key the full length and has a nut on the end, which can be taken off after the bolt is inserted, so as to allow the fixture to be placed in it.

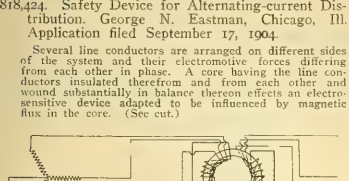
The Central Electric Company, Chicago, has recently sent out to its trade a new price list and discount sheet dated April. This price list applies to the company's 1906 general catalogue No. 24, and contains the very latest prices in force in all electrical material. Special attention is called to the fact that new prices are quoted on D. & W. enclosed fuses and safety devices for which the Central Electric Company is general western agent. Any buyer who has not received a copy of the price list can procure one by wiring to the company.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 24, 1906.

818,424. Safety Device for Alternating-current Distribution. George N. Eastman, Chicago, Ill. Application filed September 17, 1904.

Several line conductors are arranged on different sides of the system and their electromotive forces differing from each other in phase. A core having the line conductors insulated therefrom and from each other and wound substantially in balance thereon effects an electro-sensitive device adapted to be influenced by magnetic flux in the core. (See cut.)



NO. 818,424.—SAFETY DEVICE FOR ALTERNATING-CURRENT DISTRIBUTION.

818,449. Portable Electric Light. Conrad Hubert, New York, N. Y. Application filed May 19, 1905.

A casing holds the batteries and contact members which supply current to a small incandescent lamp in the end of the casing. The circuit is closed by a push button on the side of the casing.

818,460. Sparking Ignition-controlling Means for Explosive Engines. Joseph S. Moreland, Rochester, N. Y., assignor of one-half to Moss Mosely, Rochester, N. Y. Application filed April 21, 1904.

A single shiftable controlling member is constructed to vary the time of making and breaking the primary circuit of the induction coil and to place the secondary circuit in sparking condition during an invariable portion of the engine piston travel. A governing means automatically shifts the controlling member.

818,477. Printing Telegraph. Robert J. Sheehy, New York, N. Y. Application filed May 22, 1903.

In a printing telegraph there are the combination of the type wheel and shaft, a main line battery and a circuit interrupter included in the main line, and actuated by the shaft to change the condition of the line circuit at each step or movement of the type wheel. There is also a main line relay, two local circuits controlled at the front and back stops of its armature lever, a local battery for the circuits, a double wound print magnet having a coil in each local circuit, a magnet in each local circuit for effecting a movement of the type wheel each time the condition of the circuit of the line is changed. (See cut.)

818,495. System of Operating Railroad Switches. Aldred K. Warren, New York, N. Y., assignor to the American Automatic Switch Company, New York, N. Y. Application filed June 24, 1905.

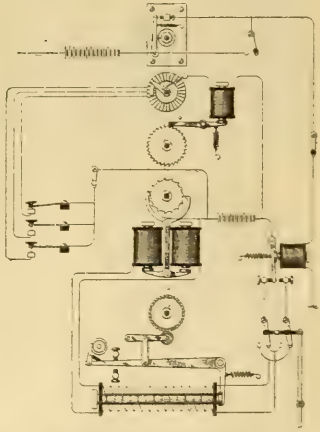
In a system of electrically operating railroad switches are an indicating board and switch mechanism including a lever for throwing the switch and contacts electrically connected with the indicating board and adapted to cooperate with the lever to close circuits through the indicating board to indicate the position of the switch.

818,512. Power Mechanism. Bion J. Arnold, Chicago, Ill. Application filed June 12, 1900.

Associated with a rotatably mounted support are a load-driving eccentric carried thereby and movable from or toward the axis of the support and means including a motor carried by the support for effecting the adjustment of the eccentric.

818,513. Electromagnetic Governor. Daniel Bacon, New York, N. Y. Application filed April 17, 1905.

A circuit closer is adapted to be operated by a governing device upon reaching a predetermined point of



NO. 818,477. PRINTING TELEGRAPH.

high or low speed. An electromagnetic device mounted upon the controlling stem of the apparatus to be governed is adapted to turn the stem in either direction as may be required to increase or diminish the speed of the apparatus.

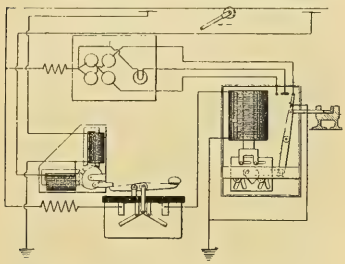
818,515. Electric Signal System. Victor W. Ber-

genthal, Chicago, Ill. Application filed July 21, 1904.

Contact pieces are supported above the normal line of the trolley wire which has means deflecting the wire out of its normal line between the ends of the contact pieces. The contact pieces are so disposed as to guide the trolley wheel in the normal line of the trolley wire, one of the pieces being electrically connected to the trolley wire.

818,527. Telephone Trunking System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed July 14, 1902.

A calling telephone line is adapted to connect with the outgoing end of a trunk line. A called telephone line is adapted to connect with the incoming end of the trunk line. A polarized relay at the incoming end of the trunk, a signal at the incoming end whose actuation depends upon the relay, and means for normally sending current through the relay in one direction and to send it through the relay in the opposite direction by the act of making the connection at the outgoing end of the trunk, are the other features. (See cut.)



NO. 818,527.—TELEPHONE TRUNKING SYSTEM.

818,534. Apparatus for Indicating the Character of Electrical Effluvia. Léon Gerard, Brussels, Belgium, assignor to Percy Thompson, East Orange, N. J. Application filed June 14, 1905.

In a propelling device are the combination with a suitable support, of a frame revolubly mounted thereon, wings connected to the support and to the frame whereby when the latter is revolved the wings are brought into and out of operative position.

818,540. Telephone-exchange System. Edmund Land, Grand Rapids, Mich. Application filed March 20, 1905.

Combined with a sub-station telephone are a central office, a line connecting the telephone with the central office, a relay in the central office, a visual signal in the central office, automatic switch in the central office and a circuit including a central-office source of electrical potential, the relay, the line, the telephone, circuit conductors passing through the automatic switch and the visual signal.

818,561. Switch. Edward P. Robbins, Mansfield, Ohio, assignor of one-half to Herman E. Homberger, Mansfield, Ohio. Application filed October 20, 1905.

A trunnioned support is secured to the trolley pole underneath the trolley wheel. Rotating levers are mounted on the triunnion and rollers are secured to the free ends of the levers. Pawls are pivoted to the levers with means for retaining the levers in a predetermined position under tension. Means for releasing the levers permit them to rotate. Means conduct an electric current to a shifting rail mechanism connected to the pivotal rail of the switch alternately closing and opening the switch at the will of the operator. (See cut.)

818,589. Electric Hammer. William F. Wegner, New York, N. Y., assignor of one-half to Alex Wendelburg, New York, N. Y. Application filed September 9, 1905.

An electric hammer includes successive coils wound in opposite directions, a hammer proper arranged to reciprocate within the coils, a tool having its shank projected within the hammer and means for energizing and de-energizing the coils.

818,602. Attachment for Desk Telephones. Joseph C. Belden and Albert Beutler, Chicago, Ill., assignors to the Belden Manufacturing Company, Chicago, Ill. Application filed July 2, 1904.

A bracket for holding the telephone is described.

818,614. Electrical Switch and Cut-out. Charles M. Dorman, Reginald A. Smith and Herbert G. Baggs, Salford, England. Application filed March 28, 1905.

Associated with a base are contact blocks, a switch arm, a brush and springs for raising the switch arm. Means are provided for translating the force and pressure of the springs to cause the brush to press tightly against and grip the contact blocks when the switch arm is in the on or working position.

818,631. Trolley-wire Support. James H. Lane and Uriah Gulnick, Newark, N. J. Application filed May 4, 1905.

A trolley wire hanger comprises an upper member, flanges projecting horizontally therefrom, the flanges being of an even plane throughout their entire surface, and arms depending from the central portion of the hanger.

818,673. Signal Bell for Telephone Systems. Charles E. Egan, Columbus, Ohio, assignor to the Egan Electric and Telephone Manufacturing Company, Petersburg, Ill. Application filed February 27, 1903. Renewed September 21, 1905.

A combined ringer and condenser for telephones, included in one frame, is described.

818,675. Telephone Signal. Andreas Vilhelm (called Wilhelm) R. Fechtenburg, New York, N. Y. Application filed December 8, 1904.

Subscribers' stations connected with the central office are provided with means whereby interconnected subscribers can send call signals to each other while the central office cannot call either of the connected subscribers.

818,686. Means for Automatically Controlling the Operation of Beer or Other Pumps and Similar Devices. Alfred C. Griscom, Newark, N. J., assignor to the Griscom-Lehing Manufacturing Company, New York, N. Y. Application filed filed July 6, 1905.

Apparatus of the class described consists of a motor, a power mechanism operated thereby, a motor circuit make-and-break device operated by the motor and means controlled by the power mechanism for controlling the make-and-break device.

818,698. Telephone. Samuel P. Levenberg, New York, N. Y. Application filed January 16, 1905.

Transmitting mechanism, a member mounted adjacent the transmitting mechanism and provided with an opening, a mouthpiece adapted to fit the opening and provided with a flange resting against the member and an adjustable collar adapted to hold the flange against the member are the parts of the telephone.

818,715. Means for Transmitting Power by Electric Currents William Stanley, Great Barrington, Mass. Application filed July 19, 1904.

The patent contemplates the combination of means for producing frequency differing currents, mains leading therefrom, a motor having rotor and stator elements energized thereby and means for short-circuiting one of the elements at one time and for connecting both of the elements with the mains at another time and means for changing at still another time the connections to the mains.

818,750. Cluster Lamp Socket. John H. Dale, New York, N. Y. Application filed February 4, 1905.

Details are described.

818,767. Telephonic Device. Isidor Kitsee, Philadelphia, Pa. Application filed June 15, 1903.

Means are specified to connect to outlying circuits consisting of two jacks carrying the terminals of the outlying circuits, the jacks normally connected to one source of current and adapted to be disconnected from the source and connected with a second source through the insertion of the plugs of the connecting means.

818,768. Electrical Controller for Electric Vehicles. Karsten Knudsen, Chicago, Ill. Application filed January 13, 1902.

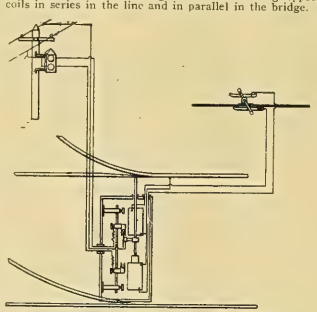
A motor having two field coils is associated with a generator. Means connect the coils in series or in parallel relation, and a resistance is in circuit with one winding of the motor.

818,791. Plug Socket for Electric Lamps, etc. Frank J. Russell, New York, N. Y. Application filed July 12, 1905.

Patentable features are a metallic plug holder, a core of non-metallic material formed with a longitudinal axial screw hole, a headed terminal wire binding screw extending through the axial screw hole in the core and a nut at the rear of the core with which the screw engages, whereby the head of the central screw is utilized to bind a wire terminal and as a contact for the plug.

818,793. Lock-out Telephone System. Louis A. Schmidt, Chicago, Ill. Application filed August 21, 1905.

At each of the subscribers' stations is a normally open bridge having associated therewith a telephone set including means for closing the normal opening of the bridge. A relay controlling the continuity of the line beyond the bridge has opposite coils in parallel in the line and in series in the bridge. A bridge relay controls the continuity of the normal bridge connection having opposing coils in series in the line and in parallel in the bridge.



NO. 818,561.—ELECTRIC TRACK SWITCH.

818,795. Railway Signaling Device. Charles H. Smith, Lebanon, Pa. Application filed March 30, 1905.

In an electrical signaling apparatus are a pair of solenoids having a common axially movable core or armature, means electrically connecting the solenoids and the armature-contacting points with signaling devices and means for manually controlling the action of the parts.

818,855. Railway Signal System. Alfred L. Ruthven, Topeka, Kan., assignor of one-half to William Peterson, Topeka, Kan. Application filed September 1, 1905.

Overlapping circuits arranged along the track have suitable connection with the train. A signaling device on the train, a battery, a pole-changer with several contacts and an operating device therefor whereby in normal position a continuous signal is given, and in shifted position an intermittent signal is given, are the other essential features.

818,892. Telegraphy. Sterns F. Jones, New York, N. Y., assignor of one-half to the Postal Telegraph-cable Company, New York, N. Y. Application filed November 21, 1905.

A telegraph line having means for transmitting and receiving code signals by varying the length and sequence of groups of alternating impulses is provided with a local circuit and a transformer at one station. The transformer has three coils, one coil in the main line, a transmitting coil and a receiving coil, and means whereby both receiving and transmitting coils are included in circuit in series with the receiving apparatus during the operation of receiving. (See cut.)

818,897. Telephone System. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed June 25, 1904.

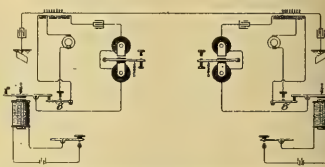
Circuit connections in this system are so arranged that the entire supply of current will flow through the transmitter, while the receiver will be connected between points of equal potential for constant electromotive force on the line, but unequal for fluctuating electromotive forces.

818,982. Extension-arm Telephone. Thomas J. Skelley, Collinwood, Ohio. Application filed April 25, 1904.

Mechanical features of a telephone extension arm are described.

818,999. Fire-extinguishing Apparatus. Charles E. Buell, North Plainfield, N. J., assignor to the General Fire Extinguisher Company, New York, N. Y. Original application filed April 20, 1892. Divided and this application filed September 4, 1901.

An alarm for automatic sprinklers comprises a dry-pipe valve mechanism with pipe connections from the mechanism at a point from which the water is normally excluded to a water motor, an electric generator adapted to be operated by the motor, wire connections to a remote point and a local alarm that is adapted to be made operative by the motor.



NO. 818,892.—TELEGRAPH CODE SIGNAL SYSTEM.

819,009. Electric Incandescent Lamp. Otto Feuerlein, Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Application filed June 14, 1904.

In an electric incandescent lamp are a glass rod, two groups of radially projecting glass arms thereon, hooks at the outer ends of the glass arms and a continuous metallic filament strung back and forth between the two groups upon the hooks in substantially straight lengths or sections, no two lengths or sections being parallel.

819,028. Method of Transmitting Power by Electric Currents. William Stanley, Great Barrington, Mass. Original application filed July 19, 1904. Divided and this application filed November 10, 1904.

The method of transmitting power at varying speeds by alternating currents consists in impressing upon the rotor element of a motor a field due to alternate currents of one frequency, and impressing upon the stator element a field due to alternating currents of a different frequency and varying the relative direction of rotation of the impressed fields.

REISSUE.

12,473. Electric Circuit Controller. Harry W. Leonard, Bronxville, N. Y. Application filed July 13, 1905. Original application dated September 3, 1901.

An electroresponsive device in series with a shunt field-winding of an electric motor co-operates with a resistance-controlling switch controlled thereby and an electrically controlled switch electrically connected therewith, the two switches being functionally connected.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on April 30, 1906:

402,166. Galvanic Battery. William P. Kookogey, Brooklyn, N. Y.
402,190. Distribution of Electricity by Secondary Batteries. G. B. Prescott, Jr., Newark, N. J.
402,191. System of Distribution by Secondary Batteries. G. B. Prescott, Jr., Newark, N. J.
402,199. Distribution of Electricity by Secondary Batteries. G. B. Prescott, Jr., Newark, N. J.
402,200. Pole Piece for Dynamo-electric Machines. J. G. Statter, London, County of Middlesex, England.
402,249. Electric Cut-out. J. L. Kimball and H. C. Wirt, Boston, Mass.
402,264. Multiple Switchboard. C. E. McIntyre, Brooklyn, N. Y.
402,290. Electric Motor. F. Yeiser, Tampa, Fla.
402,298. Combined Telephone and Telegraph System. W. Burnley, Northeast, Pa.
402,311. Electrolocomotive Engine. S. Ziani De Ferrenti, Hampsted, County of Middlesex, England.
402,329. Electric Striking and Repeating Clock. A. M. J. Jansen and V. J. A. M. Jansen, San Willibrordo, Curaccoa.
402,332. Electrical Gas Lighter. D. C. Knowles, Boston, Mass.
402,347. Thermometric Indicator. W. R. Patterson, Chicago, Ill.
402,349. Distribution of Electricity by Secondary Batteries. M. Pfatischer, New York, N. Y.
402,367. Electric Belt. W. L. Van Dorn, Brooklyn, N. Y.
402,408. Railway Telegraph. F. J. Crouch, Oakland, Ore.
402,410. Meter for Alternating Currents. D. L. Davis, Salem, Ohio.
402,414. Telegraphy. M. W. Dewey, Syracuse, N. Y.
402,415. Telegraphy. M. W. Dewey, Syracuse, N. Y.
402,481. Incandescent-lamp Socket. F. C. Rockwell, Hartford, Conn.
402,484. Containing Cell for Secondary Batteries. P. Schoop, Zurich, Switzerland.
402,506. Electric Signal. J. T. Carter, Baltimore, Md.
402,507. Duplex Fire-alarm Telegraph. S. A. Chase, Evart, Mich.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVIII. CHICAGO, MAY 12, 1906

Electric Elevators and Power Plant in Majestic Theater Building, Chicago.

One of Chicago's new tall office buildings which has been erected within the last year is the Majestic Theater Building, located on Monroe Street, between State and Dearborn streets. The building rises 20 stories from the street level, and on account of its height and small cross-section, together with the handsome effect of its white terra-cotta and enameled-brick walls, it is one of the prominent features of the downtown district. The structure is used for an office building and also contains the Majestic Theater, the stage for the latter being located in an annex at the rear of the higher portion. No expense has been spared in the construction work, and the interiors, especially of the theater and lobby, are rich and elaborate. Fig. 2, on the next page, shows the Majestic Theater Building as it appears among the lower surrounding buildings.

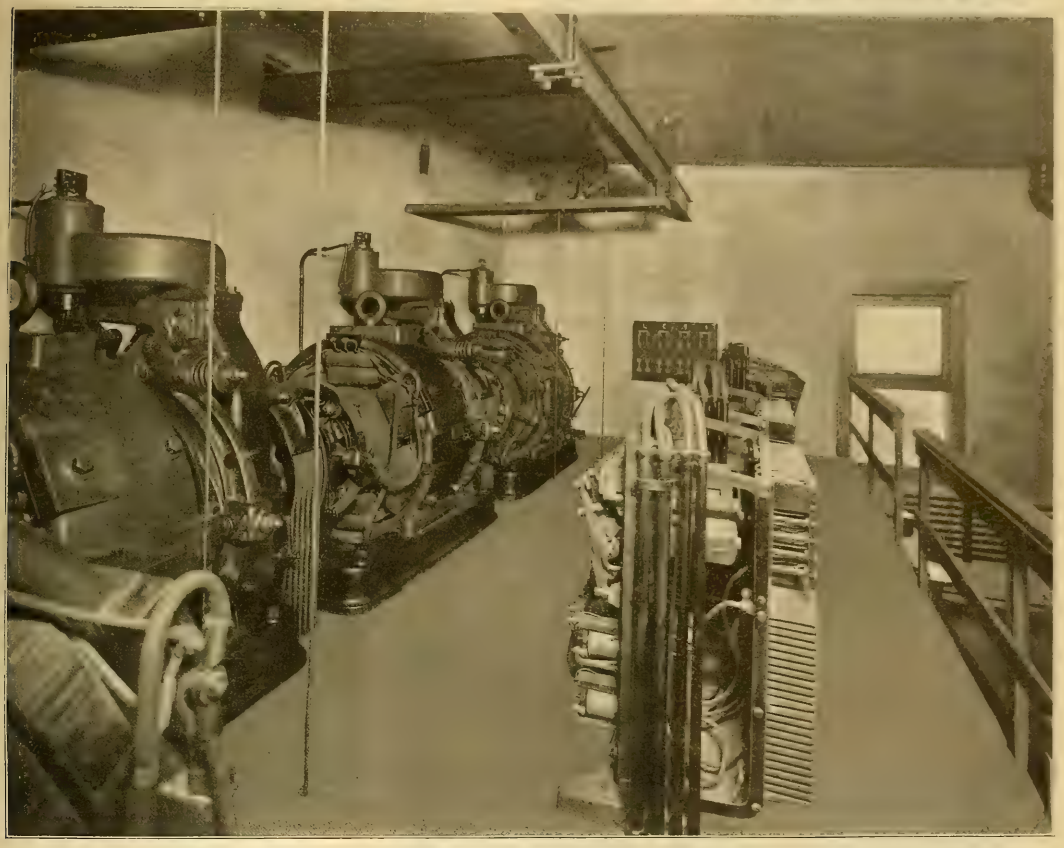


FIG. 1. ELECTRIC ELEVATOR MOTORS AND CONTROLLING APPARATUS IN MAJESTIC THEATER BUILDING, 265 FEET ABOVE STREET LEVEL.

Partly owing to the height of the building, electric elevators were installed, and the lift, which is 249 feet six inches, is among the greatest accomplished by electric elevators in this country, and is higher than any other electric-elevator system in Chicago. The power plant which furnishes current for the lighting of the building and theater, and for power purposes also, is located in the basement, and embodies several features which are of sufficient originality to merit description.

Electric Elevator Equipment.

The high-speed electric-elevator equipment was furnished by the Otis Elevator Company of New York. These elevators are four in number, one being of somewhat heavier construction and designed for freight service, while the remaining three are for passengers. They operate from the first floor to the attic, a total distance, as stated, of 249 feet six inches. The three passenger elevators are designed for a load of 3,000 pounds and a speed of 450 feet a minute, while the freight elevator will carry 4,000 pounds at a somewhat slower speed. Two of the passenger elevator cars are to carry an average of four passengers each, while the other is to carry six passengers. The freight elevator is to make six stops and have one elevator leaving the main floor every 67 seconds.

Four motor equipments for the operation of the elevators are located in a small building built on the roof of the main building, each hoist being located directly over its shaft. Fig. 1 is a view of the interior of this motor house and shows the motor equipments. The motors are direct-current machines of 35-horsepower capacity, operating at about 60 revolutions a minute when the car has attained normal speed. The motors are designed to take 150 amperes at 220 volts, but ordinarily only 90 amperes is required at starting, which promptly falls back to about 30 when the motor is up to speed.

Sheaves and not drums are used for the hoists. Each motor has mounted on one end of its armature shaft a grooved driving sheave 32 inches in diameter. Under this sheave is an idler return sheave 37 inches in diameter. The cable, which is of wire five-eighths inch in diameter, comes from the cage and passes over the driving sheave, down around the idler sheave, back over the driving sheave, and then to the counterweight. The cable is of such length that when the car is at the bottom of the shaft the counterweight is within a few feet of the top of the shaft, and when the car is at the top of the shaft the counterweight is within a few feet of the bottom of the shaft. The cable is thus given a wrap of 180 degrees around the driving sheave, which is sufficient to prevent slipping. The cable is also given a wrap of 180 degrees around the idler sheave, which is sufficient to keep the cable from jumping off the sheave. The cable is also given a wrap of 180 degrees around the idler sheave, which is sufficient to keep the cable from jumping off the sheave.

In addition to this there is a centrifugal device, which is common in installations of this class, which, when the speed of the car in either direction attains dangerous proportions, automatically operates the brakes on the car. To this governor is to be added a device which opens the motor circuit automatically when the speed has gone beyond the limit. In each elevator shaft, near the upper and lower limits of travel, are placed three limit switches which are operated by the car successively as it approaches the top or bottom of the shaft. By means of these limit switches the car is brought slowly to a standstill, entirely independent of the operator, and independent of any device placed on the operating machine itself. Besides the devices described, there are placed on the bottom of the car and counterweight special oil buf-

FIG. 2. MAJESTIC THEATER BUILDING IN CHICAGO (ELECTRIC ELEVATORS RISE 249 FEET.)

fers as a protection against shocks, should the car overtravel.

For the control of each elevator there is provided a special magnet controller. The controller contacts and the resistances may be seen to the right in Fig. 1. The controller contacts are provided with carbon breaks, which do away with any difficulty from welding. There are five points on the controlling switch in the car for "down" and five for "up." The control contacts on the control board are interconnected, with the exception of one, which operates in cases of heavy overload. The control contacts act simply to cut in or out resistance in the motor-field circuit, regulating the speed of the motor.

Each elevator is over-counterbalanced by means of a counterweight traveling in steel tee guides. The amount of weight is adjusted to the average load to be lifted, so as to produce the most economical conditions of machine operation.

Power-plant Equipment.

Light, heat and power for the uses of the building are derived from an isolated plant in the basement, which, like the other appointments of the building, has had unusual care bestowed on its design and construction. This power plant contains a number of features in its design which will appeal to engineers as perhaps somewhat out of the usual lines prescribed in the construction of plants for tall office buildings.

A good general idea of the appearance of the interior of the power plant may be had from inspection of Fig. 6, which shows the main generating apparatus. The plan of the plant, Fig. 3, shows to better advantage the location of the principal apparatus. In describing the plant, the simplest procedure will be to start with the coal-handling apparatus.

The small isolated plant, as a rule, is not so fortunate as to be provided with a mechanical coal-handling equipment, principally on account of the fact that expensive equipment of this sort is not deemed of sufficient economy in the saving of labor to warrant its installation under the ordinary conditions prevailing. But in the Majestic plant is found an installation which is largely an outgrowt of the facilities which are afforded by the subway of the Illinois Tunnel Company in the delivery c coal and the removal of ashes. As a consequenc of this service, largely, the plant is provided wit a coal-handling equipment, and there are severa features about this part of the installation that ar unusual.

The power plant not being built on a level with

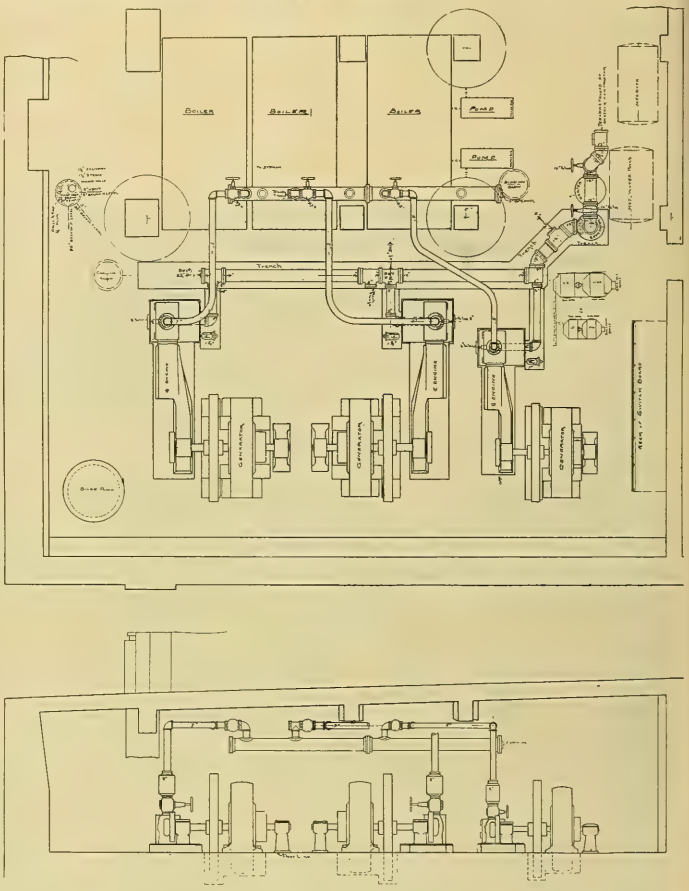


FIG. 3. PLAN AND ELEVATION OF POWER PLANT IN MAJESTIC THEATER BUILDING.

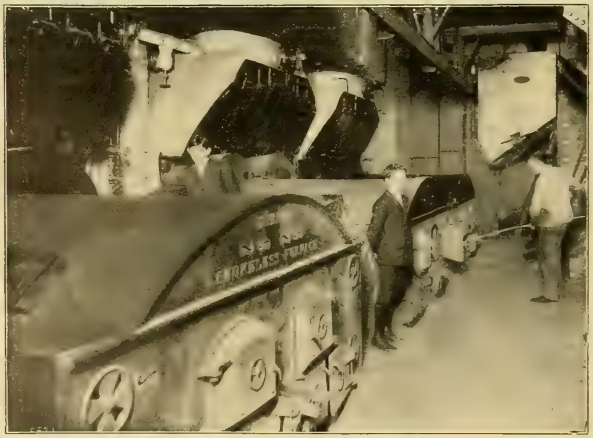


FIG. 4 BOILERS, SMOKELESS FURNACES AND COAL-HANDLING APPARATUS IN MAJESTIC THEATER PLANT.

the tunnels, which are 40 feet below the street surface, the coal from the subway cars must of necessity be elevated to the basement of the building, where the plant is located. Since the coal is raised by a coal conveyor, it is but another step to discharge the contents of the conveyor into a large hopper carried on rails, and which may be moved along in front of the furnaces, discharging to each, through a trap in the bottom, as much or as little coal as desired. Fig. 4 is a view of the boiler fronts, with the movable hopper in position to receive its load from the conveyor. Fig. 5 is a side and end elevation of the coal-handling apparatus. As will be noted, the conveyor is motor driven, the buckets traveling in an endless chain down a shaft to the tunnels and back up, delivering the coal direct to the hopper.

For taking away the ashes no mechanical equipment is provided. They are simply wheeled in barrows to a long chute or funnel, which extends down to the tunnels and provided at its lower end with damper or valve. The chute is filled with ashes from above, and by tripping the damper at the lower end the contents are allowed to run out directly into the cars. This is by far the simplest method of getting rid of them, as there are but three boilers, and the labor of wheeling them to the mouth of the chute is slight.

Three Scotch marine-type boilers furnish the necessary steam. They are of 250-horsepower capacity each, and were made by Freeman & Co. of Racine, Wis. These boilers are furnished with furnaces of the "Dutch oven" type made by James

V. Burke of Chicago. These furnaces are self feeding and give practically smokeless combustion. They are shown plainly in Fig. 4. In the operation of the furnaces the proper amount of air is combined with the hydrocarbon gases from the coal, and as the gases come in contact with the arch, which is heated to 3,000° F., they ignite and pass under the boiler. The door in front is for cleaning purposes only, the coal being fed through the top of the arch and sealing the furnace. The advantage of this construction is that there is no inrush of air to the furnace due to the opening of doors for feeding, and this keeps the temperature under the boiler sheets practically constant, insuring at the same time complete combustion of the gases.

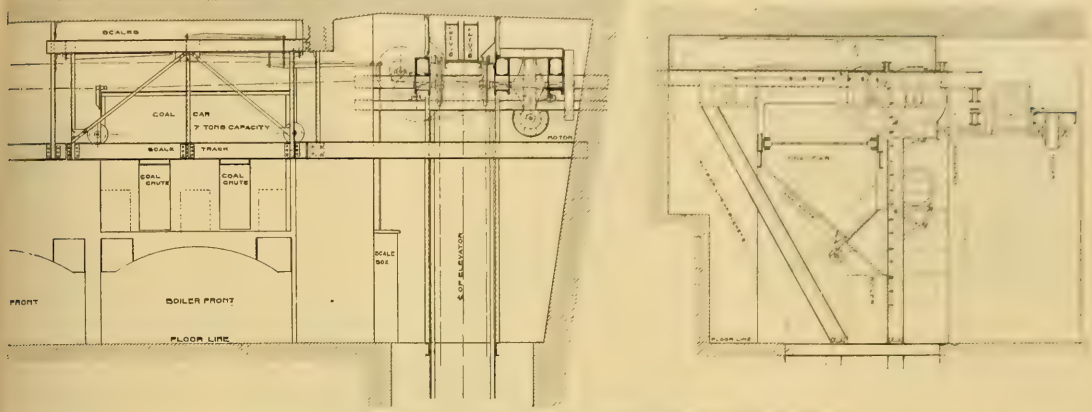


FIG. 5. SIDE AND END ELEVATION OF COAL-HANDLING APPARATUS IN MAJESTIC THEATER PLANT

Draft for the furnaces is provided by a stack 306 feet high, from the boiler room floor. This stack is six feet in diameter and is made of steel, lined with three-inch asbestos block. The boiler-feed pumps are two in number, made by the Prescott Steam Pump Company of Milwaukee. They are 10 by 6 by 10 inches in dimensions. The feed-water heater is of the Bundy type. It is of 600-horsepower capacity. The heater may be used or not, according to the demands on the exhaust steam for heating purposes. When it is in the system, the temperature of the feed water may be raised to practically 200° F. Exhaust steam from the engines passes first through an oil separator before going to the heater. When it is necessary to use the exhaust to heat the building, the heater is cut out by a simple valve arrangement, and the steam passes on through the various pipes of the heating system.

Following the common practice in plants of this character, three generating units were installed, two of them of 200 kilowatts capacity and the third of 100 kilowatts. This allows of a choice of units which will operate with economy on any point of the daily load curve, and also insures a spare unit at all times for emergencies. [illegible] of horizontal Cor[illegible] to 240-volt direct-current generators. [illegible] ing apparatus as well as the [illegible] pensators were furnished by the [illegible] Company. The generating apparatus is of the standard type and requires no special description.

Passing to the switchboard and its [illegible] explanations will be made clearer by inspection of Fig. 7, which is a view of the board showing [illegible] the compensators in the foreground. Distribution panels of the switchboard have nothing to distinguish them in particular from standard practice. The generator panels, however, are unusual in that they are equipped entirely with single-pole switches. By means of the single-pole switches it is believed by the designer of the plant that more satisfactory results may be obtained in the paralleling of the machines.

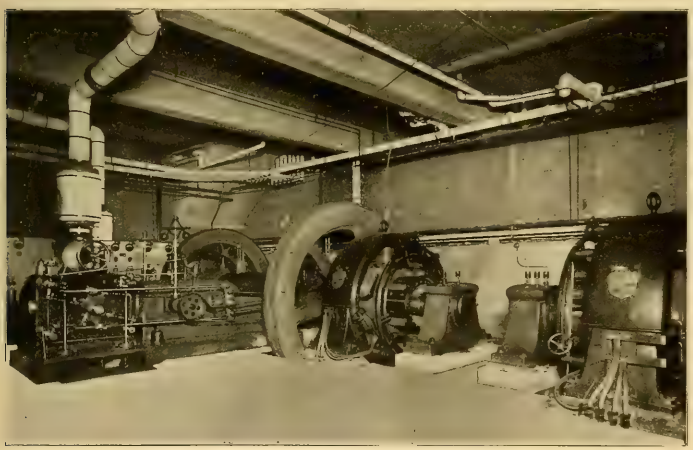


FIG. 6. GENERATING APPARATUS IN POWER PLANT OF MAJESTIC BUILDING.

Two entirely separate sets of bus-bars are used, one set distinctly for light and one set distinctly for power. By this arrangement it is possible to run any possible combination of the three generating units. All of them may supply current for light or all for power, or all or any of them may produce both light and power current.

Current is furnished to the standard three-wire system, the load on the two sides of the neutral being balanced by means of two compensators. One of the compensators is of 15 kilowatts capacity and the other of 45 kilowatts, and they are connected in parallel, being controlled from a single panel. At first sight the wide difference in size of these two compensators might arouse comment, but the conditions under which they operate are peculiar, and the necessity of this arangement will be evident when the nature of the load is explained. It will be remembered that part of the current coming on the generators is furnished to the vaudeville theater, which gives a continuous performance from [illegible] so that it is often the case that there is an extremely heavy unbalanced current in the neutral wire more than could be taken care of by a compensator which, under ordinary circumstances, would do the work easily. Therefore the large compensator was installed in parallel with the smaller one. When the performances are going on the large compensator, or even both, are used to balance the load. At times of light load, when no unusual demands are liable to come on the system, the smaller compensator is operated and the large one, which consumes considerable energy, is allowed to remain idle.

In a compartment separate from the engine room are located the house pumps, refrigerating apparatus and the automatic dust removers. Motors aggregating over 40 horsepower are used to drive this apparatus. The dust removers consist of vacuum pumps, motor driven, which exhaust the air from a system of piping extending into the theater auditorium, smoking room, waiting rooms, etc. By means of dust and refuse collectors this vacuum is utilized to clean these various rooms, and it is said that the collectors not only take out every particle of dust from the upholstery, but will pick up pieces of paper, hairpins, and any other litter which may collect on the floors.

Lighting Features.

Features of electrical illumination have been worked out with especial regard for artistic effects. All corridors throughout the building are finished in marble, which lends itself admirably to the reflection of the lights. In each corridor is a row of artistic brass electroliers, uniform in size and design through the whole building. In the theater auditorium the lights are so placed as to give a powerful illumination without being visible to the audience. In the center of the ceiling of the audi-

FIG. 7. SWITCHBOARD AND COMPENSATORS IN MAJESTIC PLANT

torium is a dome, the interior of which is set off by rows of incandescent lamps.

A pleasing example of the skill of the illuminating engineer is shown in the smoking-room connected with the theater part of the building. This room is fitted up to represent a cabin in the steamship Majestic, after which the building was named, and the scheme has been worked out with great ingenuity. Fig. 8 is a view in this room. A large central ceiling light adorns the middle of the apartment. Openings to correspond to the deadlights

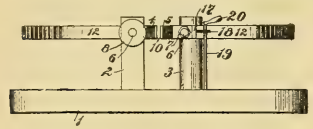
FIG. 8. LIGHTING FEATURES IN SMOKING ROOM OF MAJESTIC THEATER.

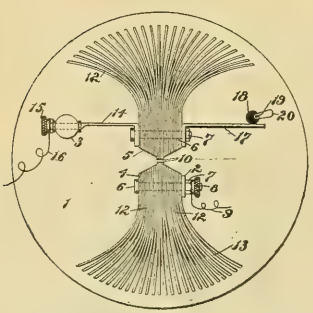
and portholes in a ship's cabin are cunningly arranged with lights behind the glass. The lights in the portholes are colored and give a very pleasing effect in contrast to the other decorations in the room.

The consulting engineer who designed the power-plant equipment up to the point of distribution is Charles G. Atkins of Chicago. The McFell Electric Company of Chicago was the contractor for the building wiring and the stage equipment. W. P. Lundy is the chief engineer of the power plant and J. G. Boswell has charge of the elevator equipment.

Ultra-violet Lamp with Heat-radiating Qualities.

The quality of the light produced by the usual ultra-violet lamps (operated by a condenser discharge) is said to decrease as the lamps get heated, and the ultra-violet rays quickly cease on overheating of the lamps, so that it is practically impossible to maintain the ultra-violet ray continuously for effective work for any comparatively long period. It is desirable, if not necessary, in many instances that the production of this ray shall be not only continuous, but substantially uniform and





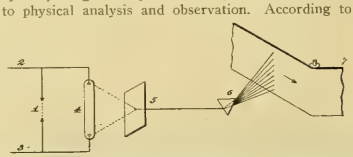
ULTRA-VIOLET LAMP WITH HEAT-RADIATING QUALITIES.

reliable. Accordingly Thomas B. Kinraide of Jamaica Plain, Mass., has devised a particular form of lamp for accomplishing the desired result, upon which he has received a patent.

Mounted on a suitable base, as shown in the accompanying illustration, are opposite standards, supporting the opposite electrodes (4) (5), the former in fixed position and the latter in adjustable position. Each electrode is composed of a large number of thin plates clamped compactly together adjacent one end by suitable means, as by a bolt (6), which in the adjustable electrode is shown as simply provided with a tightening nut (7) and in the fixed electrode is shown as provided also with a binding nut (8) for holding in place a terminal wire (9). The central plates (10) are composed of material suitable for producing to the best advantage the desired results, such as iron or steel, and at the opposite sides are similar thin plates (12) of like material or of copper, aluminum, or any heat-dissipating substance, the plates converging as close to the discharge points of the electrodes as feasible without interfering with their proper working, and at their opposite ends extending rearwardly from the arcing point to a considerable distance and separated from each other by fan-like formation, as clearly shown at (13), forming between them air passages. This formation, under the heating influence of the electric current, causes a rapid flow of cooling air, tending to absorb and remove the heat radiated by the flaring rearwardly extending plates (12).

Apparatus for Indicating the Character of Electrical Effluvia.

In the production and utilization of electrical effluvia in chemical operations, such as for ozonizing air for the purification of water, the efficiency of the operation depends upon the character of the electrical effluvia. This may be to a certain extent ascertained by the ordinary electrical measuring or indicating instruments, such as voltmeters, ammeters and wattmeters. But a more accurate indication of the conditions producing desirable physical and chemical actions is said to be furnished by shunting the discharge gap by a vacuum tube and by subjecting the rays emitted by the vacuum tube to physical analysis and observation. According to



APPARATUS FOR INDICATING THE CHARACTER OF ELECTRICAL EFFLUVIA.

Mr. Léon Gerard of Brussels, Belgium, who recently received a United States patent for an apparatus embodying the above principle, the efficient character or condition of the effluvia is accompanied by the production of special rays by the vacuum tube, and the absence of these rays will indicate the necessity for the adjustment of the apparatus to re-establish the most effective conditions. The physical analysis of the rays emitted by the vacuum tube can be made by means of appliances suitable to the particular character of the rays which it is desired to observe, whether these be luminous rays, X-rays, or cathode rays. In the case of luminous rays the observation can be made and permanently recorded by means of a traveling photographic sensitive strip upon which the rays will be received, and, where the conditions require it, the rays can be separated spectroscopically before being received upon the photographic surface. This last method is particularly useful where the electrical effluvia is produced by high-frequency oscillations, since the efficient character or condition of the effluvia in this case is accompanied by the production of ultra-violet rays by the vacuum tube. The light emitted by the vacuum tube being separated into its constituent elements by a suitable prism before being projected upon the photographic sensitive surface, the presence of the ultra-violet rays can be readily observed. In cases where the photographic sensitive surface is employed, it may be fed through the apparatus with a constant rate of progression by suitable clockwork and through proper developing and fixing baths, thereby giving a continuous record of the result.

In the accompanying illustration there is shown diagrammatically one means for carrying the invention into effect. At the gas gap (1) the silent electrical discharge or effluvia is produced, which gas gap is connected with a circuit (2) (3), in which flow oscillatory currents of high frequency. A vacuum tube (4) is connected with the circuit in shunt to the gas gap. The screen (5), preferably of metallic lead, is provided with an opening to produce a pencil of light from the vacuum tube. A suitable prism (6) separates the pencil of light into its constituent rays, and (7) is the traveling photographic surface.

In the case of the analysis of cathodic or X-rays the prism (6) will be omitted and the pencil of rays will be thrown directly on the surface (7), which will be placed close to the screen (5). In the opening of this screen would be placed aluminum, ivory, or other suitable material to strain out a certain part of the rays.

The San Francisco Situation.

[From the regular correspondent of the Western Electrician.]

Oakland, Cal., May 2.—Leopold Michels of the San Francisco Coke and Gas Company has received New York wires from Leopold Wallach, authorizing the placing of the plant in good repair and resuming service as soon as possible. Several thousand meters have been ordered to replace those destroyed. While some of the buildings were burned, the gas-generating units were not destroyed, and the plant can be placed in operation shortly. After a two-hour test on the morning of the earthquake, which showed that the mains were in comparatively good condition, the gas was released from the holders to prevent danger of explosion. Leopold Wallach said that he and his business associates had great confidence in the future of San Francisco and would continue to invest capital in lighting and other enterprises. The plans for a local electric-lighting plant, to be operated in conjunction with the San Francisco Coke and Gas Company's system, will be carried out. When the Stanislaus Electric Power Company's new transmission lines reach San Francisco, the current will be distributed through the conduits which are to be laid by the capitalists behind the San Francisco Coke and Gas Company.

The Pacific Gas and Electric Company and its many subsidiary corporations, including the San Francisco Gas and Electric Company, have their temporary operating offices in the office building of the Oakland Gas Light and Heat Company, at Thirteenth and Clay streets, Oakland. Fine progress has been made on repairs to conduits and underground electric mains in San Francisco. There is ample electric power available to supply the city. Over 800 arc street lights are already in operation. No attempt will be made to operate commercial circuits until the house wiring has been thoroughly inspected, but everything will be in readiness on the distributing system in good time.

The main generating station in the Potrero is in perfect condition, and improvised sub-stations will be available for the distribution of the comparatively small amount of current that will be needed in the downtown districts for several months to come. The big gas-engine plant in Vistacion Valley, six miles from San Francisco, is still in course of completion, but the large frequency-changers are in use in connection with the transmission of high-tension current from Electra to the city. Current is received at the Potrero station and at the Eighth and Kansas Street sub-station. The new sub-station fitted up by the United Railroads in the Eleventh and Bryant Street power house is reported to be in good condition for supplying current received from the California Gas and Electric Corporation's lines for the use of the electric car lines. The North Beach generating plant of the United Railroads is ready for operation again. The building was somewhat damaged by earthquake. There was no serious earthquake damage to the hydro-electric plants of the California Gas and Electric Company, operating in this state, although river beds sank in some localities and streams were dammed up by landslides in the mountains.

That all things come to those who wait is realized by Patrick Calhoun, managing owner of the United Railroads of San Francisco. Less than a month ago he left San Francisco for the East, disappointed in his efforts to secure concessions for the substitution of overhead-trolley lines on the existing cable lines, amounting to about 14 miles of double track. The company was very desirous of having a uniform system throughout the city for many good reasons. The principal city officials and the majority of citizens were steadfastly opposed to any extension of overhead trolleys in the cable-road districts, especially on the broad thoroughfare of Market Street. An underground trolley was demanded as the only system that would be acceptable, and the citizens preferred to endure the bad features of the cable road rather than to allow overhead lines to be erected. The city had let contracts for the reconstruction of the Geary Street Railroad as a municipal underground conduit road, and the deadlock continued as to United Railroads extensions of electric lines. Plans had been prepared by the company for the rebuilding of the Sutter Street cable system on more substantial lines. Then came the earthquake of April 18th, and the subsequent fire which destroyed every cable-road power house in the city with the exception of the

one of the Geary Street Railroad, which was soon to be abandoned, owing to the proposed change to electric power. This made an entire change in the complexion of things. For 10 days no street car service of any kind existed. As soon as the wreckage could be cleared away, the United Railroads prepared for an emergency service on its electric lines.

The city authorities were very glad to permit the United Railroads to plant temporary poles on Market Street to the ferries, and on April 27th the first car ran down to the Ferry Building at the foot of that street. Several days before a few trips had been made on Fillmore and Eddy streets by United Railroads and city officials, but it had been considered unsafe to inaugurate regular service on account of the bare possibility of crossed wires causing fires. The lack of sufficient water supply for fire purposes necessitated this precaution.

The inability to secure gas for cooking purposes is a great hardship, as all of the cooking except that for the refugees at the military camps at the Presidio and Fort Mason has to be done in the streets on stoves or improvised brick ovens without proper chimneys.

On the morning of the earthquake, while the fires ravaged whole telephone districts, the employes of the telephone company risked their lives to preserve connections with hospitals, and when the fire was conquered they worked night and day to establish quick communication between army and civic officials and the forces that these officials were directing. The company established for the Associated Press the first telephone circuit working out of San Francisco. Service from San Francisco to Oakland was kept up during all stages of the fire, working from the ferry office, and at times six lines were in operation. The company has about 1,000 lines in operation in San Francisco, and as soon as it can get power from the electric-light concerns, it will be able to furnish service to all persons in the unburned district. Services are now being supplied to the Merchants' Exchange, Custom House, the postoffice, the headquarters of the harbor commissioners, the railroads, the Union and Risdon Iron Works. Public stations have been established at Pine and Steiner, Ferry Building, Twenty-fifth and Valencia and Butchertown, where the public can reach all outside points the same as heretofore.

The Oakland telephone service was damaged to the extent of $10,000 by the earthquake, and it took 600 men three days to repair the damage. As a result of the migration of people from San Francisco, 1,000 new telephones have been installed, and of this number 600 are for commercial purposes. A.

Structures shown, from left to right, are entrance to Lick House, Bullock Jones Building and San Francisco Saving Bank. United States Regulars are in foreground. Electricians with magneto and coil of wire are behind.

A VIEW IN RUINED SAN FRANCISCO AT MONTGOMERY AND SUTTER STREETS.

From another source these additional facts, dated May 3d, are obtained:

The damage to the electrical properties in San Francisco due to the earthquake and fire has been variously estimated at from $1,000,000 to $3,000,000, no exact figures having as yet been compiled. The San Francisco Gas and Electric Company lost its generating station near Fourth Street and eight of its sub-stations. It still has intact the Independent plant in the Potrero district as well as the gas plant at that point. The gas plant at North Beach was badly wrecked and cannot be readily be put are already waiting for this power to resume business operations.

The loss to the United Railroads of San Francisco consisted principally in the destruction of four power stations and in the disabling of two or three others. The Market and Valencia Street, the Sutter Street and the Washington and Mason power houses were entirely ruined by the fire. Two of the company's sub-stations were somewhat damaged by the earthquake. The Bryant Street electric power house was saved by means of a large salt-water main, and it is from this station that power has been supplied to run the electric cars that were placed in operation on April 27th.

Many of the tracks were twisted and dropped out of position by the seismic disturbance and in some places, where new rails were being laid and the pavement had not been placed, the rails were badly twisted out of shape by the heat of the fire, in some cases being nearly brought together. At other points iron trolley poles were melted and bent double. The overhead work throughout nearly all the burned district is a well-nigh hopeless tangle of wire. The copper is alone good for scrap.

It was an event of great moment when Mayor Schmitz operated the electric car that placed the system of the United Railroads once more in regular operation on April 27th, the tenth day after the great calamity. The line thus placed in operation extends on Filmore Street from Broadway to Sixteenth Street, thence to Mission Street, Fifth Street and Market Street. On the following day the cars were operated on Market from Fifth Street to the Ferry Building, this being the first time in the history of San Francisco that electric cars had ever been operated on Market Street. The cable systems have been put out of commission for the time being and a temporary permit for a trolley line on Market was granted by the mayor, to be revoked at his pleasure. The necessary trolley poles were set and

[redacted]

[redacted] Building, but still has [redacted] being given throughout the unburned [redacted] of the underground cables [redacted] and with the little work on the [redacted] connection can be made [redacted] district. Out of a total of [redacted] the company lost about 10,000 [redacted] loss in revenue is considerable.

The total loss to the company [redacted] estimated by General Manager [redacted] mately $1,800,000, on which there [redacted] of over $1,000,000. The company [redacted] into shape to care for new business in the [redacted] section and will shortly issue a new [redacted] ering the large number of changed [redacted] subscribers.

Oakland, Cal., April 28.—The Century Electric Company, which lost its large electric supply store on Second Street by the fire of April 18th, has announced that a six-story fireproof building costing $100,000, will be erected and a $50,000 stock put in. A site will be secured as near as possible to the Rialto Building, in the heart of the best retail business district of San Francisco. This firm is temporarily making headquarters at its branch store at 1321 Broadway, Oakland.

The A. J. Coffee Company, agent for the Gamewell Fire Alarm Telegraph Company, which was burned out in the Clark Building, has taken temporary offices in Oakland.

The Western Union Telegraph Company has constructed since the fire a new two-story frame and corrugated-iron office building on Oakland Mole, which will take the place of the San Francisco main office until a new building can be put up in San Francisco. There is room for 150 tables in the new building, which will be equipped with its own generators, gasoline engines, etc., making it independent of outside sources for current. The Oakland office has been badly overworked since the fire put a stop to business in San Francisco.

The Postal Telegraph-cable Company had its facilities overtaxed by handling the business of San Francisco and Oakland from its office in the latter city for a week after the fire. A big tent has been pitched in front of the Hobart Building, where the Postal company had its main office in San Francisco. Messages for transmission are received there and taken to the company's temporary office in the Ferry Depot Building on the water front. A.

The sales office of the Electric Storage Battery Company, formerly located in San Francisco, has been transfered to 325 Thirteenth Street, Oakland, Cal. All business connected with the Pacific Coast territory will be handled from this office.

It is reported in a newspaper dispatch, dated May 3d, that C. E. Loss of the contracting firm of C. E. Loss & Co., which some time ago was awarded the contract to reconstruct the Geary Street cable railroad as a municipal electric conduit system, has said that it is no longer practicable to build a conduit system in San Francisco. The trolley lines resumed within a few days after the fire, while it will be months before any of the cable lines will be started.

A New Definition of Locomotive Engine.

The American Railway Association has a code of words used in railroading. With each word is a definition written by the association in such a way as to make employes familiar with the things they deal with in daily operation. Changes have recently been made by the train rules committee in some of the definitions. One change especially significant is that to the word "engine." Formerly an engine according to the association's code, was "a locomotive propelled by steam." Now an engine is "a locomotive propelled by any form of energy." The change was made to include electric, gasoline or other motors which are coming into use on American railroads.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

Electric Elevators and Power Plant in Majestic Theater Building, Chicago. Illustrated 373, 374, 375, 376
Ultra-violet Lamp with Heat-radiating Qualities. Illustrated. 376
Apparatus for Indicating the Character of Electrical Effluvia. Illustrated 376
The San Francisco Situation. Illustrated 376, 377
A New Definition of Locomotive Engine 377
Editorial 378
American Electrochemical Society. (Ninth general meeting at Ithaca, May 1-3, 1906) 379, 380, 381
Carl Hering, President. Portrait 379, 381
The Starting of a Large Turbo-generator. Illustrated 381
Black River Power Transmission 381
Mr. Marconi Makes Promises 381
Annual Report of the General Electric Company 382, 383
Cutler-Hammer Self Starters for Alternating-current Motors. Illustrated 383
Arrangements for Southwestern Electrical Convention 383
New Chicago Electric-light Ordinance Proposed 383
Chattanooga Convention of American Society of Mechanical Engineers 383, 384
Hydro-electric Power for Large Pacific Coast Cement Plant .. 384
Hotels at Atlantic City 384
The Care and Maintenance of Electric Meters. By A. W. Zahm 384
Metric Bill Adversely Reported 384
Book Table 385
Solomon's "Meters" 385
Punga's "Single-phase Motors" 385
Alexander's "Electrical Engineering" 385
Report of International Waterways Commission 385
Indiana Telephone Items 385
Ohio Telephone Notes 385
Telephone News from the Northwest 385
New Telephone Exchange in Council Bluffs 385
Texas Independent Telephone Association 386
Meeting of Indiana Telephone Men 386

DEPARTMENTS.

Correspondence 386, 387, 388
Great Britain 386
Dominion of Canada 386
New England 386, 387
New York 387
Southeastern States 387
Ohio 387
Michigan 387, 388
Indiana 388
Illinois 388
Northwestern States 388
Pacific Slope 388
Personal 388, 389
Electric Lighting 389
Electric Railways 389
Power Transmission 389
Publications 389, 390
Societies and Schools 390
Trade News 390
Business 390, 391
Illustrated Electrical Patent Record 391, 392

DATES AHEAD.

Southwestern Electrical and Gas Association (annual convention), Galveston, Tex., May 16th, 17th and 18th.

Indiana Independent Telephone Association (annual meeting), Claypool Hotel, Indianapolis, May 17th and 18th.

Central Electric Railway Association (bi-monthly meeting), Algonquin Hotel, Dayton, Ohio, May 23d.

American Institute of Electrical Engineers (annual convention), Hotel Pfister, Milwaukee, May 28th to June 1st.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

Canadian Electrical Association (annual convention), Clifton House, Niagara Falls, Ont., June 19th, 20th and 21st.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Cleveland, Ohio, July 18th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

SAN FRANCISCO is the terminus of some of the high-tension long-distance hydro-electric power-transmission lines which have made California famous throughout the world for daring and originality in this form of electrical design and construction. Fortunately, the latest reports indicate that these plants, the generating stations of which are located many miles from San Francisco, were not seriously damaged. Therefore, as soon as a few sub-station repairs and reinstatement of distribution circuits can be effected, electric current for light and power will be available from this source. Other cities, not so well situated in this respect, would not have had this resource to fall back on.

In all respects the electrical interests of the afflicted city are bestirring themselves with energy and courage to rehabilitate their plants and businesses. San Francisco is so finely situated for commerce that it cannot fail to be a great city if it would. It is a place that will always have important electrical interests and carry large stocks of electrical material. We have not the slightest doubt that the new metropolis of the Pacific Coast will be stronger, better and finer than the old San Francisco, and the electrical men will be in the van in the great work to be done to reach this inspiring result.

ALTHOUGH comparatively young, the electrochemical industry has already assumed an importance which places it in a leading position among the various branches of electrical development. One of the valuable exponents of this new industry is its official representative in the United States, the American Electrochemical Society, which has just held its ninth general meeting in Ithaca, N. Y., as detailed elsewhere in this issue. The American Electrochemical Society, although not so large in membership as some of its contemporaneous organizations, makes up what it lacks in size by the enthusiasm and earnest work which are manifest at each successive meeting. Thirty papers were read at the Ithaca meeting, which were about equally divided between theory and technology. This is a wise policy on the part of the programme committee. The theoretical phases of this or any other branch of applied science are necessarily of very great importance in the upbuilding of the art, but it is equally important that the practical side be given due consideration, especially as electrochemical processes are now of great commercial importance. The society was particularly favored in the location for its meeting, being the guest of Cornell University, that famous institution which has so many features which are interesting to technical men. Carl Hering of Philadelphia, one of the founders of the society and a well-known electrical engineer, was elected president, and the choice is an excellent one.

FRANKLIN was the most distinguished man of science that this country has ever produced, according to the estimate of Dr. Edwin J. Houston in his recent address on "Franklin as a Man of Science and an Inventor," delivered before the Franklin Institute in Philadelphia. Many persons will perhaps question this statement, giving the honor to Joseph Henry or perhaps to Asa Gray or some one of the several others among the Americans who have achieved distinction in scientific work. And yet when one goes over the long list of experimental investigations made by Franklin and reflects how little he was indebted to his predecessors and how much to his own remarkable brain power and patience, one will hesitate to dispute Dr. Houston's conclusion. The lecturer further compared Franklin and Edison. "The two men are alike in many respects. Benjamin Franklin, a utilitarian, an apostle of thrift, a self-educated man. Thomas Edison, eminently utilitarian, as well as self-educated. * * * * Benjamin Franklin was a man who thoroughly appreciated the value of time, and who always made the most of the time he had at his disposal. * * * * Thomas Edison holds to similar views. When once asked as to the principal inspiration that led to the wonderful results that he has achieved in applied physical science, he remarked: "It is not inspiration but perspiration." But in the many-sided aspects of Franklin's character Edison is undoubtedly outclassed. Living in a different time, under different conditions, the earlier man was not only a physicist and inventor, but also a printer and a man of letters, a statesman and philosopher, a politician and man of affairs. He was a truly remarkable man, whose career excites the deepest admiration and affords many opportunities for emulation and study.

MANY FACTS of general interest are included in the annual reports of the General Electric Company, and that for the year ended January 31, 1906, now made public, is no exception to the rule. A summary will be of interest.

Considering first the development of electric traction, it is to be noted that the company received orders for railway motors aggregating about 750,000 horsepower in capacity during the year. Of this amount over 300,000 horsepower was for heavy traction motors—that is, motors of from 125 horsepower to 200 horsepower each for use on what in other days would be steam-railroad conditions. The first of the New York Central electric locomotives has been subjected to a mileage test under the control of the railroad company. On April 2d the total run was 40,324 miles. The performance has been entirely satisfactory. The total maintenance cost, as reported by the railroad company, is only about one-fourth the average maintenance cost of a steam locomotive. During 172 days the average daily run of the electric locomotive was 171 miles, the maximum being 347 miles in 834 hours. The single-phase railway is reported as progressing satisfactorily. Contracts for the equipping of five roads with this apparatus are enumerated. The multiple-unit system of train control has been adapted to these motors with success. The motors are constructed to operate with either alternating current or direct current and also to change from the one to the other while running at high speed.

Stationary motors have been redesigned and the cost of making reduced, resulting in a great increase in sales.

Long-distance transmission continues to demonstrate its usefulness. Electrical energy is transmitted 100 miles or more, and much greater distances are now considered practicable.

Transformers are growing larger in size. Units of 10,000-horsepower capacity are now manufactured.

Steam-turbine units are also made in very large sizes. A number rated at 12,000 horsepower each, capable of delivering a maximum output of 18,000 horsepower each, have been sold. It has been impossible to keep pace with the demand for steam turbines. Up to February 1st orders for 535 had been taken and 346 had been shipped to customers. Orders for 44 turbines have been received from 11 foreign nations.

The metallized-filament incandescent lamp is referred to as "a most important advance in the art of electric lighting." Little reference is made to arc lighting.

The financial part of the report shows that the electrical manufacturing business now runs into large figures. The sales billed amounted to over $43,000,000. The amounts billed have increased from $12,700,000 in 1895 to $43,100,000 in 1905, an average increase of 13 per cent. a year—a truly remarkable showing. The profit for the year was $7,300,000. The total assets are placed at $70,500,000, of which $19,000,000 is represented by stocks and bonds of other companies. The capital stock outstanding is $54,200,000 and the surplus $12,000,000. Debentures outstanding amount to $2,100,000. During the year $3,800,000 was paid in cash dividends. The average number of supply orders for each working day was 694. This does not include contracts. The company has about 439 acres of land in its three plants, 4,350,000 square feet of floor space and 22,500 employes. It is one of the great manufacturing industries of the country.

As to the future, the outlook is promising. There is every indication that the business for this year will tax the maximum factory capacity. Unfilled orders on April 1, 1906, were considerably in excess of such orders at any other date in the history of the company. All told, this important company presents a satisfactory report, whether viewed technically, industrially or financially.

AMERICAN ELECTROCHEMICAL SOCIETY.

The ninth general meeting of the American Electrochemical Society was held at Ithaca, N. Y., on the first three days of May. The society was the guest of Cornell University. The hospitality of the local committee and of the authorities of Cornell University, the large number and high grade of the papers presented, and the interesting electrochemical and other laboratories at this great educational institution which were thrown open to visitors, combined to make the meeting one of the most successful which has been held. The one disappointing feature was the comparatively small attendance. About 70 were registered, and of this number about 20 were local members.

The mornings of the three days were devoted to the reading and discussion of papers and the afternoons to sightseeing and inspection trips. In the well-equipped electrochemical laboratories many interesting experiments were in progress, including the production of electrolytic chromium and the manufacture of calcium carbide and carborundum on a laboratory scale. An electrolytic plant which supplies oxygen and hydrogen to the various laboratories was in operation, and the liquid-air machine attracted much attention. The magnificent hydraulic laboratories, the power plant in the gorge, the filtration plant and the new Physics Building were visited. The works of the Ithaca Gun Club and of the Remington Salt Company were open for inspection. The features of especial interest at the salt works were the pumping machinery lifting the brine from a depth of one-half mile, evaporation of the brine in a huge vacuum pan, the drying of the crystalized salt by the centrifugal process and the final drying in a rotary drum.

The members of the association also had the privilege of attending lectures by Mr. E. G. Acheson and Dr. H. W. Wiley, chief of the Bureau of Chemistry of Washington. The former addressed the engineering students of Cornell University on "Invention," and Dr. Wiley's address, given before the chemical students, related to the work which is being done by the United States Department of Agriculture on the food investigation. The address of the retiring president, Dr. W. D. Bancroft, was given on Tuesday evening, the title being "The Electrochemistry of Chemistry." In this address it was urged that there is no sharp line distinction which can be drawn between chemical and electrochemical reactions. This was followed by a complimentary smoker at the Town and Gown Club. The subscription dinner in the Dutch Kitchen, which was held on Thursday evening, was attended by 50 members, and the most notable feature of this banquet was the address given by Mr. E. G. Acheson of Niagara Falls, discussing the agitation looking to legislation for preventing the further use of Niagara Falls for power purposes. He showed that the general public alarm was unwarranted; that the amount of power now being used was not diverting sufficient water from the falls materially to alter its appearance, and that there is little prospect of the falls being destroyed by industrial development, even should no legislation be enacted.

One or Two Meetings a Year?

The question of one or two meetings a year was again the subject of discussion by the board of directors, and while no policy for the future was definitely decided upon, it is the plan of the society to hold the next meeting some time in October, the place of meeting to be New York. This will be followed in the spring by a general meeting, the place not having been decided upon as yet. It appears to be the feeling of the majority of the members of the society that two meetings a year constitute too much of a tax upon the members and officers, and the compromise plan will undoubtedly be adopted of holding one meeting each year in New York in connection with some other chemical or engineering society and of holding the general meeting in the spring at places to be determined upon each year. By following this plan the two volumes of Transactions per year will be published as in the past.

Election of Officers.

The secretary announced that the count of the ballots for officers for the ensuing year gave the following results:

President—Carl Hering, Philadelphia.

Vice-presidents—S. P. Sadtler of Philadelphia, J. W. Richards of Bethlehem, Pa., and Samuel Reber of Washington, D. C.

Managers—C. J. Reed of Philadelphia, E. G. Acheson of Niagara Falls and C. F. Burgess of Madison, Wis.

Treasurer—Pedro G. Salom, Philadelphia.

Secretary—S. S. Sadtler, Philadelphia.

Character of Papers Presented.

Of the 40 papers presented a fair [illegible] distribution between theory and technology [illegible] noted. High temperature work [illegible] papers on principles of resistance furnace design, physical properties of fused magnesium oxide, disintegration of carbon cathodes in a fused electrolyte, a new silicide of molybdenum, the reduction of metal sulphides, laboratory resistance furnaces, the electric vacuum furnace, fused [illegible] the electrolysis of caustic soda, and [illegible] pyrometry. Another line of work to which [illegible] attention was given both by the papers and discussion is the corrosion of metals.

Prof. W. H. Walker of Massachusetts Institute of Technology in his paper on "Instructive Laboratory Experiment in Applied Electrochemistry," outlined the method for studying the most economic conditions for operating an electrochemical process. The paper, which cannot be abstracted to advantage, advocated methods of analysis of the problems of chlorine and caustic production, which methods take recognition of energy efficiency, efficiency of utilization of material, and costs.

CARL HERING, PRESIDENT OF AMERICAN ELECTROCHEMICAL SOCIETY.

Mr. Lamar Lyndon's paper on "Electrolyte Density in Storage Cells" made claims that the capacity of the lead storage battery depends to a certain extent upon the density of the acid which is used; that there is a certain density which gives a maximum capacity and that this density is in the neighborhood of 1.3.

Brief abstracts of other papers follow:

Some Principles of Resistor-furnace Design.

BY C. L. COLLENS, 2D.

Thermokinetics of electric-furnace design and operation was ably dealt with by Mr. C. L. Collens, 2d. The treatment deals specifically with the furnace of the intermittent-resistance type, such as are employed in the carborundum and artificial graphite industries.

Through mathematical formulæ taking cognizance of the more important factors controlling economical design and operation four general principles are to be followed:

1. Increase as far as possible the ratio that the "surface of productive heat diffusion" bears to the surface of "non-productive heat diffusion."

2. Increase up to the economical commercial limit the rate of energy supply per unit of surface of productive heat diffusion.

3. Avoid as far as possible in the furnace design, shapes or conditions which give lines of flow of heat which are widely diverging.

4. Surround the productive zone of the furnace with materials which are as refractory as possible, both as regards thermal conductivity and thermal capacity, and which will still withstand the conditions to which they are exposed.

The "surface of productive heat diffusion" is the term applied to the surface of the resistor in which the transformation from electrical to thermal energy takes place, and the "surface of non-productive heat diffusion" is that surface within the charge where the temperature is just below that at which the desired reaction will occur. Between these two surfaces lies the zone of productive heat utilization.

"Cathodic Disintegration of Carbon in Fused Chloride Electrolyte," by G. I. Kemmerer, described the rapid corrosion which carbon undergoes when used as the cathode in a fused salt bath. A carbon cathode will last only a few minutes when a high-current density is used. This rapid wearing away is ascribed by the author to the formation of a sodium carbide, which carbide is in turn de-

[illegible]

[illegible] it was not possible.

The method by which [illegible] were manufactured [illegible] use of an arc furnace in which [illegible] melted in a graphite boat. Irregularly [illegible] of the fused substance [illegible] rods or pieces of the desired [illegible] cut by means of carborundum [illegible] fused oxide when pure [illegible] surface resembling glazed porcelain [illegible] structure is influenced by the rate of cooling. Its specific gravity was found to be [illegible] melting point was determined by [illegible] mere small fragments of the oxide in a graphite tube resistance furnace and observing the temperature by means of an optical pyrometer. After a series of measurements [illegible] below 1,890° C. the fragments did not fuse, but above 1,940 they always melted. [illegible] that the melting point of magnesium oxide [illegible] the neighborhood of 1,92[illegible]. Results [illegible] conductivity were given for various temperatures, the conclusion being drawn that magnesium oxide is a much better insulator than porcelain, at least to temperatures below 1,100°. Fused magnesium oxide possesses in a remarkable degree the ability to withstand chemical action of many neutral salts at high temperatures and is therefore admirably adapted for use in vessels and apparatus for containing such salts in high temperature working.

The paper was discussed by Mr. Hering, who criticised the authors for the use of the term "specific conductivity," claiming that the term "specific conductance" would be more accurate; also that the authors' data is not sufficiently clear as to what units were used. Messrs Fitzgerald and Bennie in a communicated discussion pointed out that the properties of the fused oxide vary in a large degree, depending upon the purity, stating that a small percentage of impurity alters to a large extent the melting point, hardness, conductivity and other physical properties.

A New Silicide of Molybdenum.

BY DR. O. P. WATTS.

The writer referred to his attempts at the preparation of a series of compounds of metals with both silicon and boron, i. e., silico-borides. Among other metals employed was molybdenum, and working with this he found that while a silico-boride was not produced he obtained a compound containing more silicon than is present in the hitherto known silicide of this metal. He ascribes to this new compound $MoSi_2$ as against the formula Mo_2Si_3, which was prepared previously by Vigoroux.

The Reduction of Metal Sulphides.

BY OLIVER W. BROWN.

This paper described an investigation in the Applied Electrochemistry Laboratories of the University of Wisconsin on the reduction of various sulphides in the electric furnace. The most important fact discovered was that molybdenite can be reduced by the combined action of lime and carbon producing a well-melted ingot with only a trace of sulphur. The reaction takes place in accordance with the formula

$$MoS_2 + 2\ CaO + 2\ C = Mo + 2\ CaS + 2\ CO.$$

It was pointed out that this might well constitute a technical method of reducing this metal, having the advantage over the existing methods that complete reduction takes place, that a high purity may be obtained, and that losses incidental to roasting and volatilization which exist in the commonly used methods may be avoided. The paper also describes results on the reduction of lead and antimony by a similar method, but the author does not believe that it can be commercially applied.

Migration and Flocculation of Colloids.

BY DR. H. E. PATTEN OF THE BUREAU OF SOILS.

Consideration was given to the movements of particles of colloidal substances under the action of electric potentials, and the application to the

study of agricultural physics was pointed out. Mr. Hering in discussing the paper said that the movement of suspended particles could be well observed by means of the microscope in such instances where the particles happened to be large enough to come within the range of magnification now available.

Electrochemical Processes as Station-load Equalizers.

BY E. A. SPERRY.

The form of the load curve on all central stations indicates the possibility of securing from existing stations cheap electrical power. The station manager has for a long time been looking for an outlet for power which will increase his load-factor, and electrochemical methods seem to offer the best solution of the problem. From data obtained from a large number of electrical companies the author concludes that power may be obtained at a figure which will compete with waterpower, placing the figure at from 0.28 cent per kilowatt-hour to 0.41 cent.

While there are many electrochemical processes which might profitably utilize power at this figure, no process seems to be in sight which can be adapted to the central-station needs, due to the fact that the power can be furnished only for a portion of the 24 hours, that is, when the demand for lighting and power purposes is not at its greatest. This indicates that the electrochemical processes must be capable of intermittent operation.

C. F. Carrier, Jr., stated that he has been endeavoring to make an arrangement to secure power from central stations, but the best figure he has been able to obtain is one cent per kilowatt-hour. Mr. Ashcroft was of the opinion that central-station power is not adaptable to present existing electrochemical processes and that the power cannot compete with cheap waterpower. Dr. J. W. Richards asserted that the only intermittent electrochemical processes which might be at all adaptable to utilizing the electrical machine of central stations are electric-furnace processes, and only such as might be operated intermittently. Mr. Henry Howard asserted that a more practicable method for relieving central stations is in the use of exhaust steam and the steam plant during periods of light load for purposes of evaporation of brine or other liquids by triple-effect methods and in connection with the chemical industries; and Dr. Bancroft informed the society that it was to visit the plant of the Remington Salt Works, where the exhaust steam from a lighting station was used in a single-effect evaporator.

The Electric Vacuum Furnace.

BY W. C. ARSEM.

An electric furnace which has been recently devised in the laboratories of the General Electric Company was described. The essential features of it are a helical carbon-tube resistor mounted vertically in water-cooled terminals in a cylindrical vessel which is maintained in a state of high vacuum. The radiation losses from the resistor are reduced by a carbon cylinder surrounding the resistor. The crucible containing the substance to be heated is mounted and supported within but not touching the resistor. A mica window on top of the furnace serves as a means for observing the reactions, and it has been found possible to carry on all the experiments which have been described by Moissan as well as many others and using only a few grams of material. Temperatures up to 3,000° C. can be attained, but with these high temperatures the carbon resistor volatilizes and lasts only a few hours, while below 2,000° it will last indefinitely.

The paper was discussed by Messrs. Bancroft, Hering, Richards and others, from which it appears that this ingeniously designed furnace should be of great importance both in scientific and technical investigations at high temperatures. The limitation that the furnace was of too small capacity, allowing the treatment of only a fraction of a pound of material, and that the material had to be allowed to solidify before being removed from the furnace, brought forth the information that a much larger furnace was in process of development and also one which will allow of the pouring of the melt.

Electrolytic Corrosion of Copper-tin Alloys.

BY B. E. CURRY.

Work which has been carried on at Cornell University includes the preparation of a large number of copper-tin alloys. These were used as anodes in various solutions and the rates of corrosion observed. The efficiency of corrosion varies and is dependent upon the metallographic constituents. The remarkable facts are pointed out that with certain percentages of the two alloying metals little or no corrosion may take place, the anodes becoming almost completely passive. Such bronzes, therefore, are highly resistant not only to electrolytic but to chemical corrosion.

Electrolytic Corrosion of Structural Steel.

BY MAXIMILIAN TOCH.

The question which is frequently asked, "Do steel members embedded in cement in the foundation of large buildings become subjected to electrolytic corrosion?" furnished a theme for investigation conducted by the author. He embedded two strips of iron in cement blocks of a variety of composition, moistened the same, after setting, with a five-per cent. sodium chloride solution and applied an electrical pressure between the two strips placed in each block for a given period of time. It was found that in all cases the anode became corroded while the cathode remained practically clean, and the products of corrosion in some cases caused a pressure around the metal which resulted in a rupture in the cement block. It was found, however, that by applying a waterproof insulating varnish to the metal before it was embedded in the cement, corrosion could be prevented. The paper was discussed by Messrs. Rodman, Hering, Acker and others, Mr. Hering maintaining that zinc forms a most efficient protection, and Mr. Acker described his experiences during the study of the corrosion of underground pipes in the city of New York.

Observations on the Corrosion of Iron by Acids.

BY C. F. BURGESS AND S. G. ENGLE.

Various grades of iron, including chemically pure iron, cast iron, steel and sheet iron, were subjected to the corrosive action of normal sulphuric acid solutions. The rate of corrosion was shown to vary enormously with the various grades of iron, depending upon their constitution, and it was argued that the physical condition of the iron as well as its chemical constitution may be responsible for the variation. Unheated electrolytic iron corrodes with great rapidity and liberates hydrogen much more rapidly than does zinc, and it is suggested that should sufficient demand for it arise, electrolytic iron will be a far better source for this gas than is zinc on account of the greater purity of the gas, the greater rapidity of generation and the decreased cost. The writers believe that electrical potentials set up by various grades of iron against corroding solutions do not afford a correct indication as to the rapidity with which the iron would become attacked. Mr. Rodman stated that he has been using ordinary grades of iron for the generation of hydrogen, finding it preferable to zinc. He purifies the gas by passing it through a solution of potassium permanganate.

The Development of the Nickel-plating Industry.

BY ISAAC ADAMS.

Mr. Adams, pioneer electrometallurgist, gave an interesting history of nickel plating. The deposition of this metal was first practiced nearly 50 years ago in a small room on Fourth Street in Boston. The first article to be nickel plated commercially was patented in 1865, this patent being the first one ever taken out on nickel plating.

The nickel-plating industry led a most precarious existence for a number of years, the first decided improvement being the use of the cast nickel anode. The author introduced the art in England and in France in 1870, and for a few years both in this country and abroad had no competition.

The paper was concluded by the statement that "The art is today carried on substantially as it was in 1869-70, with the same solutions, the same anodes, the same details of shop manipulation."

To this statement exception was taken by Mr. Carl Hering, who said it was hard to understand how such an important branch of electrochemistry could have stood still during the last 30 years while the electrochemical development in general had been phenomenal.

Dr. Bancroft pointed out the various possibilities of improvement in nickel plating as now practiced. Cast nickel anodes are universally employed—containing over six per cent. of iron as an impurity. Without this impurity the anode becomes passive and the tank inoperative, but the disadvantage is that the iron gets into the solution as an impurity, is deposited as impurity in the nickel and greatly reduces the durability of the protective coating. He referred to a discovery recently made in his laboratory that the addition of a small amount of chloride to the ordinary nickel-plating solution will allow of pure rolled nickel anodes being used and the efficiency of deposition maintained near 100 per cent.

Electrolytic Precipitation of Lead from Acetate Solutions.

BY RALPH C. SNOWDON.

The deposition of lead in a dense, adherent form from acetate solutions has been considered most difficult if not impossible, but the author showed that it is quite possible to get a good plating deposit by adding one gram of gelatine per liter of solution, keeping temperature near 30° and rotating the cathode at a high speed.

Structure of Electro-deposits.

BY C. F. BURGESS AND O. P. WATTS.

By a series of lantern slides the results of a photographic and microscopic study of electrolytic deposits of metals were described. The observations were made in connection with an investigation of electrolytic iron at the University of Wisconsin under a grant from the Carnegie Institution and dealt mainly with phenomena presented in electrolytic iron.

Among the important factors which influence the physical structure of deposits are circulation, the lack of which may cause grooving, and gases dissolved in the electrolyte, which give rise to pitting. Hydrogen has been generally held responsible for the defect, but air is shown to be more troublesome.

The various surfaces and internal structures of iron were demonstrated to be simply duplications of structures furnished in nature by the deposition of hematite, manganite and various other ores from solutions. It was pointed out that the geologist seeking a better understanding of the natural deposition of minerals from solution might experiment in the laboratory and with the aid of the electric current observe the growth and obtain in a few weeks forms which in nature require years for production.

Electric Chromium.

BY M. LE BLANC.

The paper by this noted German electrochemist was presented in abstract by Mr. C. F. Carrier. It consisted largely in a reply to Mr. Carveth and others who have criticised the various methods of producing chromium outlined in Dr. LeBlanc's book on chromium. Messrs. Patten, Bancroft and others asserted that the methods published by LeBlanc are not sufficiently explicit to enable the metal to be deposited in accordance therewith. Mr. Carveth stated that chromium can be satisfactorily deposited from chromic acid and that such deposits are capable of industrial use. While only thin deposits have been obtained, he sees no reason why the process may not be carried on indefinitely with the result of producing any thickness of deposit desired.

Report on Experiments with Fused Sodium Peroxide on the Regeneration of Air for Submarines.

BY GEORGE F. BRINDLEY AND RICHARD VAN FOREGGER.

Oxone is the name of a new substance recently placed upon the market, consisting of fused sodium peroxide, which has the property of liberating oxygen when brought in contact with moisture. While this substance is useful for laboratory and industrial purposes where oxygen is to be generated, it is also adaptable to the regeneration of air for submarines and for other enclosed spaces where life is to be maintained. The experiment carried out by the authors consisted in noting the effect of the oxone in maintaining the life of rabbits enclosed in an air-tight box. It is asserted that an average man requires 25 litres of oxygen per hour, and since 100 grams of oxone furnish 13 litres of oxygen, one kilogram of oxone will sustain a man for five hours and 12 minutes, provided he has to breathe the same air over and over again. These figures, which were obtained from calculation, agree almost exactly with those obtained by the author's experiments.

This fused sodium peroxide when uniting with water decomposes according to the following reaction:

$$Na_2O_2 + H_2O = 2\ NaOH + O.$$

The oxygen replaces that which has been consumed in the process of breathing and the carbon dioxide which is exhaled is taken up by the sodium hydrate, forming sodium carbonate, so that the metal performs the double function of supplying the oxygen and of absorbing carbon dioxide. The authors also assert that a third advantage is offered by the material in the elimination of the toxic parts of excreted air through an oxidation taking place upon the vitiated air and the oxone while in a state of reaction.

Mr. E. A. Ashcroft discussed the importance of methods of regenerating air in this manner, asserting that there is likely to be a great usefulness for it. Mr. Henry Howard detailed an incident where he had employed sodium peroxide for restoring life in a man who had been overcome by gas and in whom respiration had entirely ceased.

The Electrolysis of Caustic Soda.

BY J. W. RICHARDS.

This paper gave a history of the production of sodium through the electrolysis of caustic soda, beginning with the first work done by Sir Humphry Davy, and carrying the account through the century up to the present time.

A New Process for the Manufacture of Sodium.

BY E. A. ASHCROFT.

The society was fortunate in having in attendance Mr. Ashcroft, the noted metallurgist of Great Britain, who presented a paper dealing with the future of metallic sodium and describing the method which he proposes for cheapening the production. Among the uses suggested for this metal the most important are the manufacture of cyanides and of sodium peroxide. If a slight reduction in the price of sodium can be effected this metal will dominate the production of cyanides, and the rapidly increasing use of sodium cyanide for gold extraction indicates that the sodium industry for the production of this substance alone may reach enormous proportions. It is stated that 1,200 tons of sodium are made annually in America, while abroad the output is much larger. It has been reduced from 60 cents to 25 cents per pound during the last few years, and

the author gives as a cost per pound of producing the material by the Castner process, in which fused caustic soda is decomposed, the following estimate:

Caustic soda, five cents; power, one to five cents, labor, 0.2 cent; upkeep, two cents.

This makes a total of from 10 to 14 cents per pound. By the use of sodium chloride, instead of the caustic, the price can be reduced to from five to nine cents per pound, and with this realized the uses for the metal should increase enormously.

The author's purpose is to decompose sodium chloride in a specially constructed cell in which melted lead serves as a diaphragm similar to the mercury diaphragm in the Castner process for electrolyzing aqueous solutions. The fused salt is placed in the anode compartment, chlorine being liberated at the graphite anode and sodium being deposited on and alloying with the lead. By means of a circulating device operated by a magnetic field the lead amalgam is kept in motion. In the cathode compartment a bath of fused caustic soda is maintained. The sodium leaves the lead amalgam and is deposited upon an iron cathode and is subsequently drawn off and solidified.

Mr. Ashcroft pointed out that his apparatus was a combination of the Acker cell which is now used at Niagara Falls and the Castner cell used at the same place for the manufacture of sodium.

Mr. C. E. Acker criticised the proposed plans, saying that no provision was made for preventing the formation of a crust on the lead surface; that the diaphragm is likely to become clogged and that the circulating device does not seem to be efficiently constructed. Mr. C. E. Carrier also criticised the plans, claiming that the magnetic method of circulation is an old idea; that it is as inefficient as it is old.

In reply Mr. Ashcroft stated that he had made provision for all of these difficulties, but that certain circumstances relating to patent matters made him prefer to leave the explanation until a later day. He stated that while the magnetic method of circulation may not be efficient as far as the use of energy is concerned, it does the work which is required of it and that the amount of power necessary to operate it is so very small that the low efficiency becomes a matter which is of almost no importance.

Errors in Pyrometry.

BY B. E. S. SHEPARD.

While a marked improvement has been made in methods of measuring high temperatures, there still remains quite a discrepancy as far as accuracy and convenience is concerned when comparing even the best pyrometric methods with the ordinary thermometric. The pyrometers of the platinum type are liable to become contaminated by the solid, liquid or gaseous products whose temperatures are being determined, and this may introduce an error amounting to several hundred degrees. An error is introduced by variations of temperature in different portions of the furnace or in different parts of the body being measured, and errors are also introduced through not allowing sufficient time for the pyrometer to attain its maximum reading.

Mr. Fred Schuetz claimed that the errors which were pointed out apply more to the platinum type of pyrometer than to those made of certain other metals, including iron, nickel, chromium, tungsten, etc., which have recently been put upon the market. He referred particularly to the Bristol instrument, claiming that while the temperature range is not as great as with the platinum type, the maximum being 2,600° F., the couples remain absolutely permanent. Mr. Sperry confirmed what the last speaker had said, stating that the instrument is proving highly satisfactory in practical use and that at the low price at which it is furnished, large numbers f them culd now be practically employed. C. F. Burgess stated that he had used this instrument and had obtained fairly satisfactory results, the principal criticism being that the dealers of the instruments do not make it a point to inform the purchaser as to the composition of the couples. This may give rise to the damaging of them through exposing certain metals to substances which will react upon them.

Other papers which were presented were "Laboratory Furnaces," by G. R. White; "Cadmium Standard Cell," by G. A. Hulett; "Electro-deposition of Bronze," by B. E. Curry; "Ferro-manganese Anodes," by G. R. White; "Free Energy of Some Halogen and Oxygen Compounds Computed from the Results of Potential Measurements," by M. DeK. Thompson, Jr.; "Alternating-current Electrolysis with Cadmium Electrodes," by G. R. White; "Differences of Potential Between Manganese and Lead Peroxides and Various Aqueous and Non-aqueous Solutions" by L. Kahlenberg and A. S. McDanniel. C. F. B.

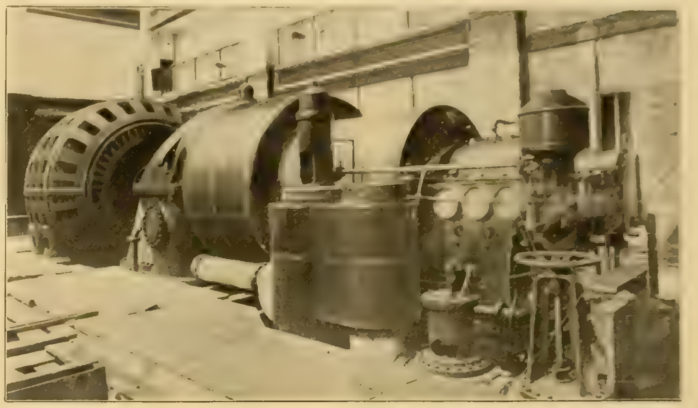
The New President.

Carl Hering, the new president of the American Electrochemical Society, is the well-known consulting electrical engineer of Philadelphia. He is past-president of the American Institute of Electrical Engineers, having served in that capacity in the years 1900 and 1901. He graduated from the University of Pennsylvania in 1880. He has devoted much attention to the problems of electrochemistry and has been prominent in electrical expert work at expositions.

The Starting of a Large Turbo-generator.

A large steam turbo-generator [illegible] Chalmers Company has recently [illegible] successfully under peculiarly trying [illegible] has been referred to [illegible] capacity, installed in the [illegible] of the Brooklyn Rapid Transit Company [illegible] and its direct connected [illegible] for operation on February [illegible] condensing apparatus, piping, etc. [illegible] until late in March.

While lying idle for nearly two months [illegible] uncompleted station, the insulation of the [illegible] windings naturally became damp and [illegible]



5,500-KILOWATT ALLIS-CHALMERS TURBO UNIT IN WILLIAMSBURG STATION, BROOKLYN RAPID TRANSIT [illegible]

as soon as steam was available for running the turbine it was started up at part speed to dry out the generator. This drying-out process was going on when, on the morning of March 27th, a mishap at another power house left the railway company short of power. The urgency of the situation was explained to the Allis-Chalmers representatives at about 10 o'clock, and they were asked whether they could help out with the afternoon load, and it was decided to put the turbine into regular operation, notwithstanding the fact that it had never been under load, nor had it even been up to speed except when running unloaded at the West Allis shops.

Additional boilers were therefore fired up and other hurried preparations made for starting. The turbine continued to run slowly until 12 o'clock to dry out the generator. It was then shut down and the engineers proceeded with progressive tests of the insulation, testing up to such a point as they considered safe for the radiated voltage of 6,600, but not considering it wise to risk too high a test in view of the damp state of the generator.

The insulation tests were completed at 1:56 p.m. and the turbine was again started up and run up to the full speed of 750 revolutions per minute for the first time since installation at the power house. At 2:20 p. m. the engineers, after carefully assuring themselves that everything was working well, reported that they were ready, and an increasing load was immediately put on, until at 3:05 the turbine was carrying a little over 3,000 kilowatts, which was all that the railway company needed at that time.

As more load was called for it was put on, and at 3:45 p. m. the unit was carrying over 4,000 kilowatts. On the following day the load ran up to over 5,000 kilowatts, and on the succeeding day it reached 7,000 kilowatts, the turbine taking heavy loads during the morning and afternoon peaks and running until late each night.

On March 30th the other apparatus of the Transit company being again in working order, an opportunity was given to lay off the turbine and open it up for examination. When the turbine was opened up, however, it was found that the compensation for distortion had been slightly overdone and the cylinder had sagged a small amount, and this, together with the high position of the drum, had caused the blading to rub hard for nearly a third of the length of the turbine. With the older types of construction such contact would immediately have made itself manifest by the noise of the rubbing blades, and the blades would have been ripped out before the turbine could be stopped. In this turbine, however, there had, while in operation, been no indication of the blades rubbing and no damage whatever had been caused: the only sign of contact having taken place was a slight wearing away of the flanges of the channel-shaped shroud ring which protects the tips of the blades in the Allis-Chalmers construction.

Not only has the steam end of this outfit realized all the expectations of the builders, but the

[illegible]

during any run, notwithstanding heavy overload, is 25.5° C.

Points about the operation of this turbine which have attracted considerable attention are the perfect balance of the rotating parts, both of turbine and generator, resulting in a minimum of vibration, quiet operation of the generator, notwithstanding the fact that it is not enclosed, and the remarkable coolness of the bearings.

Black River Power Transmission.

The Black River is a tributary of the Mississippi lying wholly in the state of Wisconsin. At H[illegible]field, in Jackson County, in a distance of about three-quarters of a mile, there is a drop of 55 feet in the river, and this head, combined with the volume of water, is such that it is estimated that about 12,000 horsepower of energy is available for useful work. The principal markets for this power would naturally be La Crosse, Wis., and Winona, Minn., it being about 40 miles from H[illegible]field to La Crosse and 50 miles to Winona. The La Crosse Water Power Company, with authorized capital stock of $5,000,000 ($3,500,000 in common stock and $1,500,000 in preferred stock), has been organized to develop this power and transmit it electrically to the cities named, and also to smaller places in the vicinity. The officers of this company are: President, Samuel Insull of Chicago; vice-president, E. G. Boynton; secretary, O. Holway. The Trowbridge & Niver Company of Chicago has been named as the fiscal agent of the new hydro-electric company, while the State Bank of Chicago is the trustee for a bond issue of $5,000,000. Sargent & Lundy of Chicago have been retained as the consulting engineers for this interesting project, but the actual details of construction and operation have not yet been worked out.

Mr. Marconi Makes Promises.

Dispatches from London say that William Marconi has completed a new space-telegraph apparatus whereby wireless messages can be directed to any specified point. The apparatus will, it is said, overcome the intercepting of wireless messages, permitting the waves to be sent to a single ship or the particular land station desired. Marconi is said to have assured the shareholders of his British company that wireless communication between America and Great Britain will be thoroughly established for full commercial purposes by next September. The station at Cape Breton, Nova Scotia, is said to be in daily unbroken touch with the station at Poldhu, Cornwall, a distance of 3,000 miles, but the European station will henceforth be located in the County Galway, Ireland. Messages will be accepted at 12 cents a word, with reductions for press and government messages.

Annual Report of the General Electric Company.

The fourteenth annual report of the General Electric Company has been issued. It covers the business of the company for the year ended January 31, 1906. Besides, it gives details of sales, finances, and manufacturing and engineering developments. What follows is taken from the report:

PRESIDENT C. A. COFFIN TO THE STOCKHOLDERS.

The profits of your company for the last year (including $173,389.52 from securities sold, and $798,539.27 from royalties, dividends, sundry profits, etc.), after deducting all patent, general and miscellaneous expenses, and allowances for depreciation and losses, and $1,838,362.46 from factory plants and machinery, were $7,319,160.61; paid in dividends during the year, $3,861,062; profits for the year, $3,458,098.61; 50 per cent. of the company's patent account now written off, $1,000,000; surplus for the year, $2,458,098.61; amount of surplus at the end of last fiscal year was $9,569,196.48; total surplus January 31, 1906, $12,027,295.09.

The sales billed by your company to its customers for the last year were about $4,000,000 more than for the previous year, showing an increase in business done of about 10 per cent.

It will be observed that the amount written off factory plants and equipment is substantially 78 per cent. of the cash expended thereon during the year.

SALES (FIRST VICE-PRESIDENT EUGENE GRIFFIN).

Sales and Orders.—Total sales (amount billed to customers) during the year were $43,146,902; total orders received were $50,044,272. A comparison with the six previous years is as follows:

Year ending January 31st.	Amount Billed.	Orders Received.
1901	$28,783,275	$27,969,341
1902	32,338,036	34,330,340
1903	36,685,598	37,944,454
1904	41,609,617	39,060,038
1905	39,231,328	35,094,807
1906	43,146,902	50,044,272

"Orders received" include only apparatus manufactured by the General Electric Company, and do not include such items as services of experts, labor of installation, freight and transportation, supply material, boilers, engines, etc., of outside manufacture, and bare copper wire. All these items are included in "amount billed." In the last 10 years the amounts billed have increased from $12,730,058 in 1895 to $43,146,902 in 1905, an average increase of 13 per cent. per year.

Heavy Traction Motors.—During the year we have received orders for over 300,000 horsepower of heavy traction motors. Our orders for all railway motors for the year were about 750,000 horsepower capacity.

The number of cars equipped with Sprague-General Electric train control increased from 2,595 on January 31, 1904, to 4,026 on January 31, 1906.

Curtis Steam Turbines.—While our factory facilities for the production of turbines have been greatly increased, it has been impossible to keep pace with the customers' requirements, and considerable business has been lost through our inability to make the deliveries demanded. Up to February 1, 1906, we had received orders for 535 turbines and had shipped to customers 346. During the last year, in addition to sales of 214 turbines to our domestic customers, we received orders for 44 turbines from 11 of the principal foreign countries.

Single-phase Alternating-current Railways.—In August, 1904, this company placed in operation between the cities of Schenectady and Ballston, N. Y., a car equipped with single-phase motors constructed to operate with either alternating or direct current, and also to change while running at high rates of speed from one current to the other. This was the first single-phase alternating car to be placed in actual commercial operation in the United States. The official run of the car was witnessed by many representatives of the technical and daily papers, and the excellence of its service and the radical innovation and far-reaching results of the system were widely commented on. Since that time we have taken many contracts for the equipment of railways with single-phase alternating-current apparatus, among which are the Pontiac and Joliet Railway, Toledo and Chicago Interurban Railway, Milwaukee Electric Railway and Light Company, Central Illinois Construction Company and the Richmond (Va.) and Chesapeake Bay Railway Company.

New York Central Locomotive.—This is the first of an order for 35 100-ton locomotives for the operation of the New York Central terminal. This locomotive has, during the last year, undergone a mileage test conducted by the officials of the New York Central Railroad Company on the tracks of that company west of Schenectady. On January 31, 1906, the total mileage was 29,568 miles. The total maintenance cost, as reported by the New York Central company, is only about one-fourth the average maintenance cost of a steam locomotive. The actual running time of the locomotive was 172 days. During this time the average daily run was 171 miles. The maximum for one day was 347 miles in 8¾ hours.

Daily Supply Orders.—During the year we received about 208,229 separate supply orders (not including contracts), an average of 694 per working day. The average daily orders indicate the growth of the business as follows: Year ended January 31, 1898, 381; 1900, 473; 1902, 533; 1904, 570; 1906, 694.

Future Business.—The outlook for the coming year is promising. The orders for February and March exceed the orders for the same months of 1905. There is every indication that our business for this year will tax our maximum factory capacity to the utmost. Our unfilled orders today [April 1, 1906] are considerably in excess of such orders at any other date in the history of the company.

Organization.—The sales and the handling of orders have been effected under trying conditions during the last year, and the managers and salesmen deserve the highest commendation for their zealous, loyal and efficient work.

MANUFACTURING AND ENGINEERING (THIRD VICE-PRESIDENT E. W. RICE, JR.).

Manufacturing.—Expenditures aggregating $2,338,362 have been made during the year for real estate, erection of new factories, extensions to existing buildings, additional machinery, patterns, special tools, furniture, etc.

The following table shows approximately the floor space and the number of employes during the last five years:

	Floor Space.	Employes.
1902	2,500,000	15,000
1903	3,000,000	18,000
1904	3,700,000	17,000
1905	4,100,000	18,000
1906	4,330,000	22,500

The land area of all three plants is now about 439 acres.

The total book value of the Schenectady, Lynn and Harrison factory plants, including both land and buildings, is $4,843,812.88, or about $1.10 per square foot of manufacturing floor space.

At the Schenectady works we have erected a building of 23,000 square feet for use as an armature and tinsmith department; also several other buildings aggregating 33,000 square feet. There are now under construction and nearly completed a brass foundry and additions to the iron foundry and pattern-storage buildings, amounting to 113,000 square feet.

At the Lynn works we have completed a blacksmith shop containing approximately 16,000 square feet, and added about 92,000 square feet to existing buildings properly to handle motor manufacturing and provide increased storage and shipping facilities. We have also under construction buildings for the manufacture of railway and stationary motors, transformers, etc., of 177,000 square feet, and an extension of 45,000 square feet to the turbine building.

No additions have been made during the year at the Harrison works.

Engineering.—During the last year our engineers have been largely occupied with the improvement and extension of our existing lines of apparatus. The number and variety of useful applications of electrical machinery have greatly increased, and considerable special apparatus has been designed to meet novel conditions.

Our types of stationary motors, both for direct and for alternating current, have been largely redesigned, and the cost thereby reduced without sacrifice of quality; a corresponding reduction in selling price has resulted in a great increase in the sales of such motors.

Long-distance transmission of electricity has proved so successful that the number of plants has greatly increased, and many of the existing plants have been largely extended. In some cases the electrical energy is transmitted 100 miles or more, and much greater distances are now considered entirely practicable. An interesting instance is that of the Kern River development, where the Edison Electric Company of Los Angeles, Cal., is installing four 7,000-horsepower General Electric Company generators to transmit the electric power a distance of 115 miles to Los Angeles. Another interesting plant is that of the Jhelum River in Kashmir, India, where 5,500 horsepower of our electrical generators will be used to transmit power about 60 miles for industrial purposes, and eventually for the operation of a 156-mile electric railway. This contract was largely due to the highly successful operation of the 11,000-horsepower 92-mile transmission plant in Mysore, India, for which we supplied the electrical apparatus some three years ago.

The size of the transformers used in lowering and raising the voltage in alternating-current work has steadily increased until we are now regularly manufacturing units of 10,000-horsepower capacity.

Our line of steam-turbine generators has been extended and improved. We have designed and sold a number of turbines of 12,000-horsepower rating, each capable of delivering a maximum output of some 18,000 horsepower. We have delivered to the New York Central Railroad four of the eight 7,000-horsepower turbo-generators ordered last year.

The first of the New York Central locomotives, mentioned in my last report, has been subjected to a mileage test under the control of the New York Central; on April 2d, the total run to that date was 40,324 miles. The performance has been extremely satisfactory.

One of the notable contracts which we have taken during the last year is for the electrification of the West Jersey and Seashore Railway, between Camden and Atlantic City, N. J., a distance of 64 miles. This is the first instance of the electrical equipment of an important steam railroad from terminus to terminus. The contract covers the complete installation, including buildings for power house and sub-stations, motors, car equipment, and everything pertaining to an electric-railway system.

The operation of the single-phase alternating-current railway motors which we have sold has proved entirely satisfactory. Our engineers have adapted the Sprague-General Electric multiple-unit control to the operation of these motors with great success. Our alternating-current railway system now possesses the same advantages which have been demonstrated by the use of the multiple-unit control in connection with our direct-current railway system on some 4,000 car equipments and by over 100 different railway companies. Single cars or complete trains equipped with our alternating-current apparatus can also be operated, without change, over existing direct-current systems in terminal cities. We are now prepared to completely equip railways and interurban tramways with this system, and we are recommending its use in all those cases where our direct-current apparatus, which has operated with such extraordinary success on the Manhattan and Interborough railways in New York, the underground roads in London, and on thousands of tramways in all parts of the world, is not distinctly preferable because of existing conditions.

We have continued to improve the design of our switchboards for the control and regulation of electrical energy and have received most of the important orders for such work.

Our metalized-filament incandescent lamp, invented by the chief of our research laboratory, constitutes a most important advance in the art of electric lighting.

Our engineers have continued to perfect and extend the various small articles of our manufacture, such as arc lamps, regulators, meters, instruments, switches, controllers, etc.

As far as practicable, letters patent have been applied for to protect the numerous new and important engineering designs and devices.

It is a great pleasure to heartily commend the work of our engineers and factory managers.

FINANCIAL REPORT.

The financial statement of Treasurer H. W. Darling is summarized in the balance sheet and statement of profit and loss herewith. It includes the assets and liabilities and profit and loss accounts of the Edison General Electric and Thomson-Houston electric companies (which, for convenience of bookkeeping, are consolidated with those of the General Electric Company) on January 31, 1906.

During the year there was expended in acquiring sundry patents, for the use of patents, and in patent litigation, $431,247.13, which has been treated as ordinary expenses of the year. In addition, the amount of $1,000,000 has been charged to profit and loss, leaving the company's patents, franchises and good-will standing at $1,000,000.

The total book cost of the factory plants is $23,370,901.07, but there has been written off a total allowance for depreciation of $15,370,901.07, leaving their book value on January 31, 1906, $8,000,000.

Real estate other than factory plants includes the investment in the Edison Building, New York city, and sundry parcels of land in various places, mostly improved and rented, which have been acquired at various times, chiefly in payment of debts. All are free from mortgages.

The total par value of stocks and bonds owned by the company, excepting those carried at $1, is $20,700,879. These securities are carried at an aggregate book value of $19,104,450.30.

The net amount of sales billed to customers during the year was $43,146,902.42. Of some 17,000 regular customers on the accounts receivable ledgers, an increase for the year of 1,000, there were debit balances against 7,000 at the close of the fiscal year.

During the year the cash collections from notes and accounts receivable exceeded $40,000,000. On January 31, 1905, the face amount of notes and accounts receivable was $17,731,738.17, all of which have been settled during the year except $1,961,160.91. A considerable percentage of this remaining amount of notes and accounts is made up of the obligations of manufacturing, lighting and railway companies owned or controlled by the General company, and which will be liquidated as the securities of these companies are sold.

The company has no note payable.

Total debentures outstanding at the date of the balance sheet amounted to $2,102,000.

At the same date the capital stock outstanding was $54,286,750. The total capital authorized January 31, 1906, is $60,000,000.

Following are figures from the consolidated balance sheet of January 31, 1906:

ASSETS.

Cash	$ 6,356,093.77
Stocks and bonds	19,104,539.30
Real estate (other than factory plants)	359,013.86
Notes and accounts receivable	16,287,018.01
Work in progress	2,496,205.78
Merchandise Inventories—	
At factories	14,083,710.46
At general and local offices	1,782,678.47

Consignments	155,901.91
Factory plants	8,000,000.00
Patents, franchises and good-will	1,000,000.00
Total	$70,5[illegible],161.5[illegible]

LIABILITIES.

3½ per cent gold coupon debentures	$ [illegible],047,000.00
5 per cent gold coupon debentures	55,000.00
Accrued interest on debentures	[illegible]
Accounts payable	2,100,86[illegible].89
Unclaimed dividends	1,79[illegible]
Capital stock	54,286,7[illegible].00
Surplus	12,027,29[illegible]
Total	$70,525,161.[illegible]

Following is the consolidated profit and loss account of January 31, 1906:

EXPENSES.

Cost of sales (including depreciation of plants, $1,838,362.46)	$37,025,346.61
Interest on debentures	75,1[illegible].54
Profit for the current year	7,319,160.61
	$44,419,612.76
Patents written off	$ 1,000,000.00
Dividends paid in cash	3,861,062.00
Surplus at January 31, 1906, carried forward to next year	12,027,295.09
	$16,888,357.09

EARNINGS.

Sales	$43,146,902.42
Royalties, dividends and interest on stocks and bonds, and sundry profits	798,539.27
Interest and discount	300,781.55
Profit on sales of stocks and bonds	173,389.52
	$44,419,612.76
Surplus brought over from last year	$ 9,569,196.48
Profit for the year ended January 31, 1906	7,319,160.61
	$16,888,357.09

Cutler-Hammer Self Starters for Alternating-current Motors.

Self-starters for alternating-current motors, as manufactured by the Cutler-Hammer Manufacturing Company of Milwaukee, are shown in the accompanying illustrations. Fig. 1 shows a starter

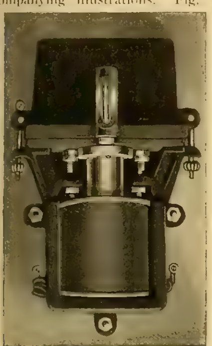


Fig. 1. Starter for Single or Polyphase Motors.

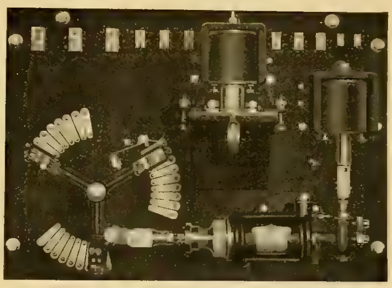


Fig. 2. Slip-ring Type.

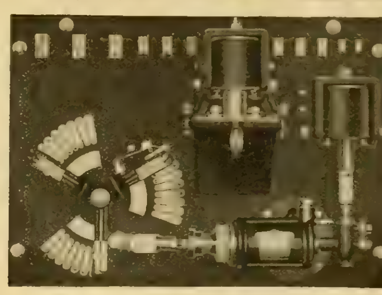


Fig. 3. Starter for Squirrel-cage-type Motors.

CUTLER-HAMMER SELF STARTERS FOR ALTERNATING CURRENT MOTORS.

for use with single, two or three-phase motors, which are capable of being thrown directly on the line. Fig. 2 is a type for use with two or three-phase induction motors, the armatures of which are wound in sections and provided with slip rings. Fig. 3 is a type adaptable for motors having the squirrel-cage type of armature.

The type illustrated in Fig. 1 consists of a double pole, oil-immersed, solenoid-operated switch, which may be controlled by either a pressure regulator or float switch, depending upon the system used. With a compression-tank system the pressure regulator is to be used, and the motor will be stopped and started automatically at the two limits of pressure for which the regulator is adjusted. With an open-tank system the float switch is to be used, and the motor will be stopped and started at the two limits of water level in the tank for which the float switch is adjusted.

The solenoid switch consists of a double-pole knife switch immersed in oil and controlled by a single-phase solenoid. The magnet frame is of cast iron and supports the entire switch. The plunger is laminated and the design of the switch is such that it will run very cool and absorb a minimum amount of energy. The switch parts are mounted on a plate of insulating material, in turn mounted on the magnet frame. The plunger is arranged to give the switch parts a hammer blow both for closing and opening the switch, thus insuring positive action. On account of the small force required to hold the switch closed the solenoid magnet does not have the objectionable feature of "humming." The oil tank is of cast iron, in one piece, and is supported from the magnet frame by a thumb nut on either side, so that the tank may be lowered away from the switch parts for inspection without disturbing any of the parts. The tank is provided with an oil gauge and should be kept nearly full of a clear mineral oil. Machine oil must not be used.

Starters for slip-ring-type motors, as shown in Fig. 2, consist of a slate panel containing a double pole, oil immersed solenoid operated line switch, resistance commutator and resistance, a device for moving the rheostat lever and a solenoid for the control of this device. It may be controlled by pressure regulator or float switch, depending upon the system used. For compression-tank systems the pressure regulator is to be used and the motor will be stopped and started at the two limits of pressure for which the regulator is adjusted. For open-tank systems the float switch is to be used and the motor will be stopped and started with the variation in water level in the tank. The motor is started by the closing of the main line switch which closes the primary circuit to the motor and thereafter the mechanical device operates to cut the starting resistance out of the armature circuit and bring the motor up to speed. The motor is stopped by the opening of the main line switch when the rheostat is automatically returned to the starting position so as to be ready to start a second time.

The mechanical device for operating the rheostat lever consists of a cylinder and piston arranged for operating both ways with power, and its operation is controlled by a valve, in turn controlled by an alternating current solenoid. Water or air at moderate pressures may be used to operate this device.

Fig. 3 illustrates the type of starter for squirrel cage-type motors. It is of a construction much similar to that of the second type described. The solenoid switch consists of a double-pole knife switch immersed in oil and controlled by a single-phase solenoid. The magnet frame is of cast iron and supports the entire switch. The plunger is laminated. As in the other types, the switch parts are mounted on a plate of insulating material, in turn mounted on the magnet frame, and the plunger is arranged to give the switch parts a hammer blow both for closing and opening the switch.

Arrangements for Southwestern Electrical Convention.

Final arrangements have been completed for the annual convention of the Southwestern Electrical and Gas Association, which is to be held at Galveston, Texas, May 16th, 17th and 18th. An interesting and attractive programme, as outlined in the Western Electrician of April 28th, has been prepared by the committee. Mr. Stichter, editor of the Question Box, reports that widespread interest has been shown by the members of the association and outside electrical, gas and telephone companies in the questions and answers. A pleasing entertainment has also been provided for each day of the convention, including a tour of inspection of the grade-raising work of the city, the sea wall and the dredging apparatus used in connection therewith. There will also be an excursion down the harbor and to the jetties, and at all times during the convention the fine surf bathing and fish dinners, for which Galveston is so famous, will be available for those wishing to partake. Additional entertaining features will be prepared for the ladies present.

On the night of the 17th, the Sons of Jove will hold a grand rejuvenation and initiate their new members into the mystic orders of their association, and will have their parade, which is to be more spectacular than on any previous occasion. The Galveston Business League's rooms in the Tremont Hotel have been selected as headquarters of the convention, and many applications for reservation of rooms have already been received. Special prices may be obtained by addressing Mr. H. S. Cooper, chairman of the entertainment committee, care of the Galveston Electric Company.

New Chicago Electric-light Ordinance Proposed.

Negotiations between the Chicago council committee on gas, oil and electric light and the Chicago Edison and Commonwealth Electric companies relative to rate reduction and involving changes in the companies' franchises have been resumed. The electric companies have prepared a special ordinance for presentation to the commit-

[illegible]

Chattanooga Convention of American Society of Mechanical Engineers.

The [illegible] American Society of Mechanical [illegible] Chattanooga, Tenn., [illegible] Hall on the evening of May [illegible] of the [illegible] the first [illegible] 126 persons had registered [illegible] ladies being among the number. [illegible] welcomed the delegates to the city [illegible] swered by President F. W. Taylor. [illegible] concluded the day's proceedings [illegible] the papers were taken up for discussion. The ballroom of the Masonic Temple was handsomely decorated for the occasion and the event was [illegible] one.

On Wednesday, May 2d, a large part of the programme was carried through at the morning session, as many of the delegates wished to attend the Damrosch symphony concert, and the evening session was done away with for that reason.

Prof. R. T. Stewart of Allegheny, Pa., presented a paper on "Collapsing Pressures of Bessemer Steel Lap-welded Tubes Three to Ten Inches in Diameter." These tubes are of the type used in boiler construction. The paper embodied the results of a series of tests undertaken to supply an urgent demand for reliable information on the behavior of wrought tubes when subjected to fluid collapsing pressure. The tests were carried on at the McKeesport works of the National Tube Company under the supervision of Mr. Stewart.

One of the interesting features of the programme was a paper by Prof. William H. Bristol of Hoboken, N. J., upon "A Low-resistance Thermo-electric Pyrometer and Compensator." The instrument described is similar in principle to the Le Chatelier pyrometer, but is of low resistance, and instead of the extremely delicate suspension galvanometer a Weston special dead-beat millivoltmeter is used, and in place of the costly platinum-rhodium elements inexpensive alloys are employed for the couples. The low cost of the couple makes it possible to keep an extra one on hand for use as a standard to quickly and easily check the one that is in regular service. The paper contained a complete description of the apparatus. The description had already been presented at the January (1906) reunion in New York city, where it had excited considerable discussion.

Other papers presented Wednesday were the following: "A History of the Introduction of a System of Shop Management," by James M. Dodge; "New Liquid-measuring Apparatus," by George B. Wilcox; "Report of Committee on Standard Proportions of Machine Screws;" "Report of Committee Co-operating on Pennsylvania Railroad Locomotive Tests;" "Effect of a Blow," by A. W. Moseley and J. L. Bacon.

In the afternoon the delegates and ladies visited Lookout Mountain in a body. Fortunately for the excursionists, the Hon. H. Clay Evans constituted one of the party, and standing on Point Lookout he was prevailed upon to address the visitors. Mr. Evans in his address took up in detail the military maneuvers of the armies which struggled for supremacy around the historic heights. The afternoon atmosphere was clear, and as he geographically depicted the movements of opposing armies he pointed out the various places to which the great struggles have given lasting distinction.

Three papers were read at the session on Thurs-

day. Two of these were upon waterwheel regulation and were "Some Stepping-stones in the Development of a Modern Waterwheel Governor," by Mark E. Replogle of Akron, Ohio, and "The Regulation of High-pressure Waterwheels for Power-transmission Plants," by George J. Henry, Jr., of San Francisco. The third paper was by Thomas E. Murray and was presented to the society by George A. Orrok. It was upon the subject of the work of improving the Tennessee River. Mr. Murray outlined the extensive work which is being done at Hales Bar, Tenn., and his remarks were of particular interest to members of Chattanooga, where interest in the proposed development is strong, owing to the possibilities of cheap power for that city. The site of the development is 188 miles from Chattanooga, but within the bounds of practical electrical transmission.

In the afternoon the party visited Chickamauga National Park, going out on the electric cars and returning in tally-hos by way of the Missionary Ridge government road. Fort Oglethorpe was visited, after which the party proceeded to the more prominent places on the great battlefield. Captain Chamberlain was one of the party and he favored the visitors with an address, historical in its nature, which greatly added to the enjoyment of the trip.

Hydro-electric Power for Large Pacific Coast Cement Plant.

The Washington Portland Cement Company's new plant, located in Skagit County, Washington, on the Skagit branch of the Great Northern Railway, between Aancortes and Rockport, about 104 miles northwest of Seattle, which was begun early last spring, is ready for operation. The equipment both for power and cement making is in many respects worthy of note, being furnished by a single concern, the Allis-Chalmers Company of Milwaukee.

It is the intention of the building company to bring the capacity of the plant up to 3,000 barrels a day by adding two kilns at a time. The initial installation will consist of a complete machinery equipment for a two-kiln plant, using the dry process by means of waterpower and electrical drive. The raw material to be used consists of limestone and shale, the former located in deposits 1,500 feet from the plant and the latter 500 feet, both connected by an electric road over which the material will be transported. The company has three sidetracks from the main line of the Great Northern to the works. A dam across the Baker River at a distance of a mile from the power plant is being constructed to be connected by a flume six by 10 feet from the dam to the power house. The Baker River flows in a southerly direction at the point where the dam is being built, and the flume follows the east bank, the flume intake being close to the bank and immediately above a small island in midstream. The waterpower, which is capable of developing 3,000 horsepower, will operate a 1,150-horsepower Allis-Chalmers twin turbine with center disks and cantilever-type bearings from a fall of 50 feet. The discharge will be 250 feet per second and the speed 360 revolutions per minute.

For convenience in the operation of the various processes of cement making the equipment has been laid out in different groups or plants known respectively as the raw-material plant, calcining plant, clinker-grinding plant, stock house, etc., each of which has its own peculiar equipment.

Each principal machine, such as the crusher, disintegrator, dryer, ball mills, tube mills, etc., will be driven by direct-mounted individual motors. The auxiliary machinery, such as the elevators, conveyers and feeders, will be driven in groups by motors. As far as possible the object has been to avoid the use of shafting, belts and pulleys.

Motors of 20 horsepower or over are type H, not enclosed, and the smaller motors are type B and enclosed. The electrical equipment will be very complete. The generator, direct connected to the turbine, will be a 750-kilowatt waterwheel-type alternator, three phase, 60 cycles, 600 volts, excited from a direct-coupled exciter of 20-kilowatt capacity. There will be 34 induction motors installed, in capacity from 1½ to 100 horsepower and aggregating 870 horsepower. In addition to the interior equipment for the mill an electric locomotive will operate between the mills and the shale and limestone deposits. The locomotive will haul 16 1½-yard cars and be capable of a speed of six miles an hour. The company intends to erect lime kilns for the production of lime for the Seattle market.

Mr. N. L. Warford, late of the Standard Portland Cement Works of Napa Junction, Cal., is superintendent of the plant.

Hotels at Atlantic City.

In connection with the meeting of the National Electric Light Association at Atlantic City, June 4th to 9th, Mr. Arthur Williams, chairman of the convention committee, has just issued a special circular as to hotel accommodations. It gives a list of no fewer than 49 hotels, all guaranteed by the Hotel Men's Association to give good service at the rates scheduled. For each hotel, except three, the fullest details are given as to rooms, and as they are all on the American plan the delegate and his friends can estimate closely the outlay to be made. The circular gives other useful data as to badges, registration, etc., and includes a most useful little map, showing the location of every scheduled hotel and the distances along the ocean front and board walk in 1,000-foot spaces. The circular is a good evidence of the painstaking care exerted to do all that is possible in advance to secure the comfort and satisfaction of those attending the meeting.

The Care and Maintenance of Electric Meters.[1]

By A. W. Zahm.

The electric meter is one of the foremost agencies in the development of the central station. Electricity today holds first place as the illuminant of the world and fully 70 per cent. of all electric lights in use are sold by central-station companies to consumers, the amount used by each consumer being usually registered by meter.

In the early stages of this industry lights were oftentimes sold on a flat rate, and this is still true of a number of the small plants throughout the country, but it has long since been recognized that the only equitable and profitable basis on which lighting can be done is to pay for the exact value received as registered by a meter, the same as is done in any other commercial business where goods are sold by weight or measure.

The importance of giving a meter proper care and attention at regular intervals after the same has been installed is, however, overlooked by the majority of the smaller stations and by many of the larger plants. The majority of meters will register full loads correctly for several years after they are installed, but very few if any will register correctly on from four to 10 per cent. of their rated capacity after they have been installed for six months. This is especially true of the commutator type of meter.

In view of the fact that it is customary to install a meter of ample size to take care of the maximum number of lights installed, whereas but a small percentage of this number are burned, excepting possibly for a very short period each night, makes it all the more important that a meter should register correctly on from four to 10 per cent. of its rated capacity.

Two of the main factors necessary to secure the successful operation of a central station are the correct registration of the current sold and the correct reading of the meter by the meter reader. True, an error made in reading a meter one month will no doubt correct itself the following month, but it will cause a great deal of dissatisfaction nevertheless.

The net loss to a central-station company selling current by meter and not giving its meters proper and systematic attention is not less than 15 per cent., and in many cases more than 25 per cent. of their gross income. The meter loss is for current actually used by a consumer which the meter fails to register. The general expenses of the station are not altered whether or not these losses are prevented, hence they are of such a nature as to directly affect the earnings.

Many companies will spend large amounts to economize in their fuel consumption or engine efficiencies, yet will neglect the meters where an even greater saving could be effected. In one instance that came to my notice a municipal lighting plant in this state reluctantly consented to have a meter-repair company overhaul 100 of its meters. Two members of the City Council were present during the tests made on these meters, and they were so dumfounded at the results that they immediately called a special meeting of the council to authorize that the remaining meters, some 300 in number, be inspected and calibrated. Out of the first 100 only two were found to register on a 16-candlepower lamp, the remainder requiring from two to six 16-candlepower lamps to start them. Every meter tested was found to be from 10 to 50 per cent. slow. None of the meters had been sealed, and it was found that a great many meters had been tampered with. One meter had a broomstraw brake applied to the armature, another had a shingle nail attached to the magnet rubbing on the disk, still another had a small piece of wood on the disk, and it required the current of six incandescent lamps to move it. This, of course, is an extreme case, but it merely shows the importance of giving meters proper attention at stated intervals, preferably during the summer months.

Very few of the small stations have the necessary instruments to properly test their meters, but there are a number of reliable companies that are properly equipped to do this work that will come to a city and calibrate meters for a nominal charge ranging from $1 to $1.50 each, depending upon the number to be inspected. This method commends itself for several reasons. First, meters will be overhauled and tested, which, if left to the employes, will oftentimes be neglected. Second, as the work is done by disinterested parties the consumer will be more apt to place confidence in them. Third, these companies, having specialized this work and equipped themselves with the proper and necessary tools and instruments, are better equipped than most central-station companies, and it is only in the larger cities where several thousand meters are installed that a special and properly equipped meter department is maintained. If a meter-testing company be employed to test the meters it would be advisable to give the matter considerable publicity by inserting notices in the daily papers or sending a letter to each consumer, stating that arrangements have been made to have meters tested and requesting that any who are in doubt as to the correctness of their meters notify the company so that it can have the meters inspected. Also request them to be present at these tests. As previously stated, in nine cases out of 10 the meter will be from 10 to 25 per cent. slow, and it will be found that the consumers will have more confidence in the meter and there will be less complaints that meters are running too fast.

I would, however, suggest that every company using meters procure a standard portable wattmeter and a stop watch for the purpose of testing meters when a consumer makes a complaint. A consumer's complaint should be given immediate attention, and if perchance the meter is found to be fast, he should be rebated a liberal amount for this error. The best method of testing a meter is to adjust the load so that it will require exactly 60 seconds to complete the desired number of revolutions. Six hundred watts is a good load for this purpose and can readily be obtained by installing a bank of lamps of various candlepowers and by using a small rheostat for the final adjustment. If the constant is one-half and the meter is correct it will make 20 revolutions in 60 seconds. If the constant is 1, it will make 10 revolutions, etc., the formula used being as follows: Revolution of disk × 3,600 × meter-testing constant divided by time of test in seconds equals watts. A valuable table for readily determining the per cent. of error will be found in the catalogue of the Duncan Wattmeter Company, copies of which can be procured from it.

In conclusion I wish to make the following suggestions:

First, number every meter installed, serially.

Second, keep a card index or book record according to the serial number of each meter with the following data:

		Our serial number	
Factory number		Date purchased	
Make	Type	Capacity	
Voltage	Constant	Testing constant	

Installed.	For Whom.	Removed.	Cause.

Date Tested.	By Whom.	Per Cent. Fast.	Per Cent. Slow.

Third, make monthly comparisons of bills, and if a consumer's bill, in your judgment, is too large or small, have the meter removed and tested at once.

Fourth, have every meter properly sealed at the time of installation by using a special sealing tool, having some distinguishing number or letter, and have the meter reader report for inspection any meters where the seals have been removed or tampered with.

Fifth, watch the meters after an electric storm. Have the trouble man make an order to inspect the meter in every case where lightning has blown any fuses, as in nearly every case it will be found that the meter has either been burned out or seriously injured.

Sixth, when systematically overhauling a large number of meters do so in midsummer, as when a meter is found to be considerably slow the increased charge thereafter will not be so noticeable on account of the short hours of darkness at this time.

Try at all times to gain and maintain the confidence of the customers by giving them all possible information in regard to their meters. Show them the working mechanism and instruct them in reading and verifying their readings, and by so doing it will be found that there will be less complaints to contend with.

1. Paper read before the Iowa Electrical Association at Des Moines, April 18, 1906. Mr. Zahm is general manager of the Brice Gas and Electric Company of Mason City, Iowa.

Metric Bill Adversely Reported.

By a vote of seven to five, it is said, the House committee on coinage, weights and measures on April 27th took adverse action on the Littauer bill to establish the metric system as the standard of weights and measures in transactions with the government.

BOOK TABLE.

ELECTRICITY METERS. By Henry G. Solomon. London: Charles Griffin & Co. (Philadelphia: J. B. Lippincott Company.) 1906. Pp. (6¼ by 9 inches), 323, with 307 illustrations.

Although there is much literature extant on the subject of electric meters, a work which collects in systematic order the large amount of available data on meters will be found to fill an important place in electrical literature. Although, perhaps, most of the data here given has before appeared, there is probably some that will be new to many, especially as regards the limitations of three wire meters, single-phase meters for polyphase circuits and the results obtained from polyphase meters incorrectly installed. The work is divided up into three main divisions as follows: Continuous-current, induction and tariff meters. This matter is given in eight chapters. While it is hard to keep absolutely up to date in a work on such a rapidly changing device as the electric meter, it is evident upon perusal of the book that the author has made an honest and successful endeavor to embody as far as possible the latest improvements in electric meter practice.

SINGLE-PHASE COMMUTATOR MOTORS. By Franklin Punga. London: Whittaker & Co. 1906. Pp. (5 by 7⅜ inches), 187, with 81 illustrations. Price, $1.75.

A thorough knowledge of the elements entering into the successful commutation of single-phase motors is of more importance in that class of machines than in direct-current practice, and a work upon single-phase motors develops largely into a treatise on the sparking problem. Although the book under consideration is not of a pretentious nature, the author has attacked this problem effectively, and for this reason, if for no other, the work deserves commendation.

Nearly one-half the book is devoted to the subject of sparking, the elements which enter its origin being first considered, after which the means toward eliminating the trouble are taken up. In view of the growing importance of the single-phase motor in the field of electric traction and as a substitute for the direct-current series motor in other classes of work, the chapters on the compensated repulsion motor and the single-phase series motor will be found of particular interest. The latter part of the volume is devoted to the calculation of the series and repulsion motor and to an appendix wherein the theory of the repulsion motor is worked out mathematically.

ELEMENTARY ELECTRICAL ENGINEERING IN THEORY AND PRACTICE. By J. H. Alexander. London: Crosby, Lockwood & Son (New York: D. Van Nostrand Company). 1906. Pp. (4¾ by 7¼ inches), 208, with 181 illustrations. Price in the United States, $2.

Much is embodied in this book, which, although it is not of imposing size, covers a surprising number of subjects with thoroughness sufficient to give the beginner a fair knowledge of the elements underlying electrical engineering. The matter which is given is also of a thoroughly practical nature, and the author has refrained from giving abstruse formulas which tend rather to confuse than enlighten the beginner, for whom the book is primarily intended. Following the opening chapters on the fundamental principles and the use of electrical measuring instruments, the subjects of alternating and direct-current dynamo-electric machinery are taken up in turn, the principles of their operation being briefly explained, followed by instructions of a practical nature regarding the characteristics of the machines. Other subjects are then considered, including transformers, storage batteries, arc and incandescent lamps, switches and fuses, conductors and cables, meters, etc. The electric generating station as a whole is also taken into consideration, giving the reader who is not familiar with the modern methods of generating electrical power a fair insight into the design and operation of a plant.

Report of International Waterways Commission.

On May 7th President Roosevelt sent to Congress the report of the International Waterways Commission on the preservation of Niagara Falls. The report suggests that the amount of water diverted for power purposes be limited, either by treaty or legislation. The limitation is placed at 36,000 cubic feet a second from the Canadian side and 18,500 cubic feet a second from the American side, in addition to 10,000 cubic feet a second authorized for the Chicago Drainage Canal.

The Canadian section, while assenting to these conclusions, did so upon the understanding that in connection therewith should be expressed their view that any treaty or arrangements as to the preservation of Niagara Falls should be limited to the term of 25 years and should also establish the principles applicable to all diversions or uses of waters adjacent to the international boundary and of all streams which flow across the boundary.

The effect of the diversion of water by the Chicago drainage canal will be made the subject of a separate report.

Indiana Telephone Items.

In a meeting [illegible] May 4th the patrons of the [illegible] Company voted [illegible] increase in telephone rates [illegible] almost unanimous against [illegible] Work making any of the changes [illegible] pany has asked in its franchise [illegible] the company, the cost of the plant [illegible] growth and management were thoroughly [illegible] ered. The demand for an increase of rates [illegible] changes in franchise were met by a [illegible] testing against any of the things asked in the petition.

At a meeting of Independent telephone [illegible] Fort Wayne on May 1st plans were agreed [illegible] for the merging of the Independent telephone plants at Peru, South Bend and the De[illegible] and Madison County telephone companies. The terms agreed upon point conclusively to an alliance with the St. Louis Independent interests.

The controlling interest of the Knox County Home Telephone Company of Vincennes, which is owned by William R. Gardner, William Morrison and A. H. Yonter of Toledo, Ohio, has been pooled with the Central Home Telephone Company of Louisville, Ky. The operation of the company will continue as before, but under the supervision of men from the big corporations.

A similar alliance has been effected by the Washington, Bloomington, Seymour and Bedford exchanges, with the Kinloch Long-distance Company of St. Louis, which is allied with the Louisville company. The above exchanges have heretofore operated independently. It is said other Indiana city exchanges are contemplating entering the pool, and it is stated on good authority that a franchise will be secured for an Independent exchange in Evansville and that the latter will enter the pool and by so doing be enabled to give at once a much greater long-distance service than the Cumberland is now giving.

The Central Union Telephone Company has just completed two additional copper metallic-circuit toll lines between Indianapolis and Columbus, which is said to be preliminary to the construction of new exchanges in both cities.

The regular quarterly meeting of the Fourth District members of the Indiana Independent Telephone Association was held in Veedersburg on April 28th, at which time matters of importance to the district were discussed. J. L. Osborn of the Veedersburg Telephone Company was elected delegate to the national convention in Chicago in June. The following representing 8,000 telephones in the Fourth District were elected to attend the annual state convention in Indianapolis, May 17th and 18th: F. O. Cuppy, Lafayette; Jacob Shackelton, Pine Village; J. L. Osburn, Veedersburg; W. H. Wright, Hillsboro; B. S. Orr, Attica; Elmer Switcher, Otterbein; Thomas Shultz, Newton, and F. J. Goodwine, West Lebanon.

The New Home Telephone Company of Bloomfield has just completed the installation of a complete common-battery private-branch exchange for the Vandalia Coal Company at Linton, Ind. The switchboard, which has an ultimate capacity of 50 lines, has 23 installed. The system connects the main office at Linton with all of the company's mines in this territory, one of the branch lines being 10 miles long. There is also a direct copper toll line from Linton to Indianapolis, where the company also has a branch exchange of the Indianapolis Telephone Company. Other coal companies contemplate equipping their mines and offices in a similar manner.

The Citizens' Telephone Company of Kokomo has decided to put in a complete new line of underground cables. The estimated cost is $15,000.

S.

Ohio Telephone Notes.

The City Council of Cincinnati has refused to admit any Independent telephone company to operate in the city. The vote stood 20 to 9 in favor of rejecting all applications for franchises, including that of the Queen City Home Telephone Company, which has made a long and persistent fight for admission. No applications can be made for a franchise for two years. In exchange for this tribute to the Bell people, the Cincinnati and Suburban Bell Telephone Company has consented to make a reduction in residence rates. Hereafter single-line yearly service will be $48 instead of $60, and two-party line service will be $30. The rates for extensions will be reduced from $12 to $9 and double sets from $17 to $12. The company says that this change will cost about $75,000, as additions will have to be made in the switchboards of all the plants to do away with the four-party line service which has heretofore been maintained. The number of operators will have to be increased 10 per cent also. So far as known no change is to be made in the business rates. No change will be made from the present limits of territory covered, which includes Hamilton, Kenton and Campbell counties and a portion of Boone and Clermont counties. It is said that the territory comprises about 340 square miles. The history of the struggle of the Independents to gain a foothold in Cin-

[illegible]

and the li[illegible]

An in[illegible] the Adams[illegible] Company [illegible] to $20,000.

Bids are about to be [illegible] ing of the People's Telephone Company [illegible]

Telephone News from the Northwest.

The Northwestern [illegible] will remove its poles from Front Street, [illegible] Minn., the [illegible] and [illegible] cost of $15,000.

H. Fant, proprietor of the [illegible] Thief River Falls, Minn., has [illegible] between Badger and Roseau, Minn.

The Zenith Telephone Company of [illegible] has installed 1,740 new telephones in the [illegible] months.

The New Ulm (Minn.) Rural Telephone Company will declare a dividend of [illegible] its first year's business.

The Western Electric Telephone Company of Mason City, Iowa, is planning improvements [illegible] system amounting to an aggregate of $[illegible]. [illegible] lines will be rebuilt and a number [illegible] constructed.

The Gary (Minn.) Telephone Company has filed articles of incorporation with a capital of $[illegible]. O. H. Sersland is president and H. L[illegible] secretary.

Articles of incorporation have been filed for the Alpena (S. D.) Farmers' Telephone Company by J. E. Shull and others. The company is capitalized at $4,500.

R.

New Telephone Exchange in Council Bluffs, Iowa.

The Independent Telephone Company of Council Bluffs, Iowa, opened its new exchange building on April 23d with a public reception. Over 3,000 people visited the fine building and inspected the plant. President F. J. Day, Manager C. A. Laubach and Engineer C. H. Judson were in charge of the reception, assisted by members of the board of directors and the young lady employes. It is proposed to keep open house at the exchange every Tuesday afternoon from two to six.

The sum of $125,000 has already been expended by the new company in building its plant and the probabilities are that $50,000 more will be necessary to insure completion. The new building itself cost $12,000. Over $20,000 was spent in laying underground conduits. Most of the remainder went for poles, wires, cables and central-office equipment, or to pay wages of laborers. A large order has been placed for copper wire to be used on long-distance lines of the company.

Local service was not begun on the day the exchange was opened, although 700 houses and business places had been wired, and the company had contracts for 1,600 telephones, with orders coming in daily. Besides the local service the company has 500 instruments in service at Mineola, McClellan and in Boomer Township, where it owns the exchanges. The Council Bluffs switchboard can be increased up to 14,000 telephones.

Between 15,000 and 20,000 Independent telephones in Western Iowa will be brought into communication with Council Bluffs with the opening of the new exchange. Council Bluffs gets connection over Independent wires with Des Moines, Sioux City, St. Joseph, Kansas City, St. Louis, Chicago and other large cities. Towers will shortly be erected on opposite banks of the Missouri River and wires will be strung across to connect Council Bluffs with South Omaha and nearly all the cities and towns of Nebraska.

The Independent Telephone Company was organized in September, 1904, by 20 leading business and professional men of Council Bluffs. Construction work started about August 1, 1905. The result is a plant up to the standard of the most modern telephone requirements.

Among the recently incorporated telephone companies are the following: Ottway Telephone Company, Ottway, Tenn.; Murphysboro Telephone Company, Murphysboro, Ill.; Missouri Exchange Telephone Company, Lamar, Mo.; Farmers' Telephone Company, Noble, Okla.; Bohemian Mutual Telephone Company, Dodge, Neb.

Texas Independent Telephone Association.

The Texas Independent Telephone Association held its annual convention at Waco on April 26th and 27th. There was a good attendance, the representatives of about 30 of the Independent telephone companies of the state being present. A number of people from outside of the state who are interested in Independent telephone matters were also on hand and took an interest in the proceedings. The opening session was presided over by President E. W. Dunaway of Dallas. The address of welcome, on behalf of the people of Waco, was delivered by W. H. Hoffman, president of the Business Men's Club of the city. He said that the fact that Waco was the headquarters of the largest Independent telephone system in Texas made the holding of the annual convention in that city especially appropriate. The minutes of the last meeting were read by Secretary J. B. Earle of Waco, and adopted.

A letter was read from J. B. Hoge, president of the National-Interstate Telephone Association, sending greetings and tendering an invitation to the state association to send representatives to the national convention.

The remainder of the first day's session was devoted to the reading of papers on various subjects relating to telephone matters and to a general discussion of topics of interest to the association.

At the second day's session of the convention it was voted to hold the next annual convention at Fort Worth.

The following-named officers for the ensuing year were elected:

President, J. C. Casler, Fort Worth; vice-presidents, C. W. Roberts of Abilene, C. A. Wilson of Granger and Thomas O'Rourke of Shreveport; secretary and treasurer, C. A. Shock, Sherman; delegate to the national convention, J. B. Earle of Waco; alternates, A. M. Donaway, A. E. Shaeffer, Thomas O'Rourke, C. A. Wilson, J. A. Murray and W. P. Johnson.

Committees were appointed as follows by the newly elected president:

Executive committee—J. B. Earle, chairman; E. W. Dunaway, C. W. Roberts, C. A. Wilson and T. O'Rourke.

Programme—Aaron Smith, J. A. Murray and C. L. Simpson.

Membership—Charles F. Speed, chairman; Aaron Smith, G. D. Woodson, M. E. Martin and A. A. Marrs.

A feature of the meeting was the organization of the Telephone Clearing-house Association. It is composed of the South Texas Telephone Company, Brazos Valley Telephone Company, Texas Telephone Company, North Texas Telephone Company, Ellis County Independent Telephone Company, Texas Consolidated Long-distance Telephone Company, Fort Worth Long-distance Telephone Company, and the Granger Telephone Company. J. B. Earle was elected auditor of the new clearing-house association, and arrangements were made to place the organization in immediate operation.

Meeting of Indiana Telephone Men.

The Sixth District of the Indiana Independent Telephone Association, which embraces the counties of Clay, Greene, Owen, Parke, Putnam and Sullivan, held its second regular meeting in the general office of the Citizens' Telephone Company at Brazil on May 2d, Vice-president J. F. Slinkard presiding. The attendance was good and there were several very interesting talks, especially by new members, which gave evidence of the value and appreciation of the association. Mr. Slinkard of the New Home Telephone Company of Linton spoke of the benefits of the association. J. G. H. Klinger, general manager of the Citizens' Telephone Company of Brazil, was elected delegate to the national convention in Chicago. The following delegates, representing all counties in the Sixth District and 7,500 Independent telephones, were elected to attend the annual convention of the state association, to be held at Indianapolis on the 17th and 18th: Earl Talbot of Linton, E. G. Bush of Clay City, Joseph Moss of Linton, O. V. Gerrard of Spencer, F. M. Boyd of Rosedale, F. G. Gilmore of Greencastle, T. W. Atchinson of Terre Haute and W. W. Harball of Sullivan. The next regular meeting of the district will be held at Linton the second Wednesday in August.

The annual meeting of the Indiana Independent Telephone Association will be held May 17th and 18th in the Assembly Room of the Claypool Hotel at Indianapolis. Charles A. Bookwalter, mayor of Indianapolis, will deliver the address of welcome at 1:30 p. m. on the 17th. The session on the 18th will begin at 9:30 a. m. and continue through the day. Col. J. D. Powers of Louisville, Ky., will deliver the main address of the day, dealing especially with Independent telephone securities as an investment. The two main subjects for discussion will be the "Independency of the Independents" and "Independent Telephone Property as a Safe Investment."

CORRESPONDENCE.

Great Britain.

London, April 25.—Petrol motor cars and 'buses have held such undisputed sway in England for so long that they are almost regarded as the final form of locomotion of this type. In an unostentatious way, however, and especially in the physical sense, a number of private carriages have come into being in which the motive power is electricity. But admittedly their upkeep is high and no serious competition is to be imputed. Without any previous warning, however, a notice appeared in the daily press to the effect that there was to be a trial in London of a new electrically propelled 'bus, called the "electrobus," and this public function duly took place. As a vehicle all the advantages which are known to exist in an electric vehicle, such as ease of starting and stopping, absence of vibration and smell, were apparent, and really none of the technical press invited were surprised as far as this was concerned. Their thoughts naturally turned to more practical details, and especially the cost of maintenance and so on. The battery consisted of 44 cells slung in two cases, placed underneath the car in the center. One charge is said to be sufficient for 30 to 40 miles, and each vehicle will have four batteries in order that it may cover 120 miles per day. A single motor is provided and the weight of the whole vehicle fully loaded is 7½ tons, while the weight without load or batteries is three tons and four hundredweight. The drive and controller are similar to that on small vehicles. In appearance the 'bus is very similar to the ordinary petrol vehicle, but without the big bonnet in front, and the seating capacity is the same. The estimated total running expenses are about 18 cents per car-mile, which, however, many people doubt as possible. Six cents per car-mile is stated for charging and upkeep of batteries.

Generally speaking, there seems some skepticism on the part of electrical men as to the possibility of running such a service of motor 'buses upon the estimates given, and, unfortunately, the company proposing to run them is meeting with considerable adverse criticism from the financial papers on questions appertaining to finance. An appeal is being made for a public subscription of $1,500,000 in ordinary shares, the object being to place 300 vehicles on the streets, and the prospectus shows that after paying a 10-per cent. dividend there should be a balance of $500,000, with 240 'buses, each running 120 miles a day on a total working expense of about $23 a day. Certain arrangements with other companies, however, as to the underwriting of shares and the construction of cars have led to warnings being issued to the public in several of the "money" articles of the daily papers, which are bound to have effect, and it would not seem that the prospects of the promoters are too bright. With the recollection of the failure of the London Electric Cab Company some years ago the public is bound to be "shy," even without warning, and, of course, great efforts are being made by the existing motor 'bus companies to throw as much cold water on the project as possible. It will be interesting to see to what extent the public responds in the circumstances.

The London, Brighton and South Coast Railway Company, which is equipping some of its London suburban railway lines on the single-phase overhead system, does not, for the present, intend to erect a generating station of its own. The directors of this company are strong advocates of Parliament allowing an electric power company to be created for the purpose of the supply to railways, and so hastening the conversion of many of the London local lines. However, present circumstances do not point to this possibility, and as a temporary expedient a contract has been entered into with the neighboring electric supply company for seven years for the supply of the necessary current to the lines now being converted to electric traction.

The question of electric power supply keeps itself to the front in various ways and the dilatory tactics in London will in all probability prove to her disadvantage. While there is all this wrangling going on other people are acting upon practical suggestions which will have the effect of tempting many of the larger manufacturers—already wavering—from London as their manufacturing center. The North Eastern Railway Company in conjunction with the Newcastle-on-Tyne Electric Supply Company, Mr. Merz's company, has organized a special department for collecting information and advertising vacant land along the line of its routes where cheap power and convenient railway accommodation can be had for the asking. Incidentally, I may mention that the parliamentary consideration of the London County Council electric power bill commences tomorrow.

There has just been opened in London a small sub-station which will take electrical energy at high pressure from the mains of a power company. In the very highly municipal London it is worthy of note that this sub-station has been built by one of the borough councils, which intends to supply light and power throughout its area from this sub-station. Lacour motor converters have been installed, but otherwise there is nothing special about the equipment. One feels inclined to congratulate both the council and the rate payers on their having pursued a course which will at all events secure them against a speculative risk.

A somewhat peculiar custom prevails in London of holding an inquest to determine the cause of fires, quite apart from the question of any lives having been lost. In most cases an "inquest" is held when there is a suspicion that the fire has been caused by electricity. Such an inquest was held a few days ago, and it was somewhat amusing to note the profound ignorance of the jurymen with regard to electricity. In the end the testimony of the experts was accepted, but as two directly opposite views were expressed no cause was returned. It certainly did seem useless to waste the time of 16 jurymen who knew nothing about electricity. The experts' views might have been taken without needing their attendance at all.

G.

Dominion of Canada.

Ottawa, Ont., May 5.—The rate payers of Owen Sound, Ont., have approved of a by-law to issue debentures to the amount of $102,000 for the purpose of extending the gas and electric-light plants of that town.

When the Montreal, Light, Heat and Power Company absorbed the Standard Light and Power Company it acquired among other assets a charter right to conduct a gas business in the city of Quebec. It has never exercised this right, and a few days ago it was disposed of to Mr. Emerson McMillan of New York, representing the American Light and Traction Company which controls the Jacques Cartier Electric Company, Quebec.

About two years ago the city of Kingston, Ont., took over the plant of the Light, Heat and Power Company of that city at the cost of $182,000. Since that time the sum of $50,000 has been expended upon it out of the earnings, while the cost to consumers of lighting gas has been reduced from $2 to $1.50 per thousand, and electric lighting from 14 cents to 12 cents per kilowatt-hour, and for power from 12 cents to eight cents, with the prospect of still further decrease. A by-law to raise $85,000 to be expended in extending the plant is to be voted on.

The management of the Montreal Light, Heat and Power Company has completed arrangements for the construction of a large and modern power house to be situated on the Soulanges Canal, about two and one-half miles from the town of Vaudreuil, Quebec. The estimated cost of the new building and plant is $1,000,000. This will make the outlay for improvements the most extensive, at any one time, for many years. The work of construction will be continued at once, as the officials wish to have the building ready for the distribution of power into the city of Montreal by the first of November next.

Clarence H. Fraser, who has been a resident of Bombay, India, and who is at present visiting in this vicinity, speaking of the progress being made in the Indian Empire, states that there is a great field there for the electrical industry and that the country offers a great future for electrical engineering. At the present time a scheme is on foot for the organization of a company with a capital of $10,000,000 to construct a hydro-electric power plant in the city of Kashmir by harnessing the Jahlam River. The power will be utilized for an electric railway, some 200 miles long, to connect Abbotabad with Springar. In Kashmir are many factories engaged in manufacturing industries, principally silk, and the electric plant to be established will supply the motive power for these factories. There are also many local tramway lines and short and light railways, and to these power will also be supplied. As to the price of the electrical power, those interested figure that it will be about half the cost of steam power. This electric plant will probably be one of the biggest of its kind in the world at present.

W.

New England.

Boston, May 5.—The Southern New England Telephone Company has laid a cable in the Thames River between Winthrop's Point in East New London and Groton. It has 200 wires and is 1,450 feet long. It is the fourth and largest cable the company has laid across the Thames River at this point.

The Boston Transit Commission has advertised for bids for the construction of section 9 of the Washington Street tunnel, which will extend from Hanover Street to Haymarket Square, a distance of 460 feet. This section will include a station with two platforms.

The Massachusetts Institute of Technology students very successfully presented "The Freshman," a musical comedy, at the Colonial Theater, Boston, on the afternoons of April 26th and 27th; also at the Auditorium in Malden, Mass., on the evening of April 27th, and at Providence, R. I., on the evening of April 28th. The book was written and the music composed by juniors, and they produced a very creditable entertainment, treating of the trials of a freshman.

The Maine and New Hampshire Railroad Company has filed its articles of incorporation with the Maine secretary of state. It was organized at Port-

land, Maine, under a special statute. The company's capital is given as $1,000. It proposes to build an electric railway between Standish and Hollis, Maine. George B. James of Boston is president.

The New York, New Haven and Hartford Railroad Company is building a large power house at Cos Cob, Conn., which will supply electric power for its cars running between Stamford, Conn., and New York city.

The Massachusetts Legislature has granted leave to withdraw on George C. Thurston's petition for legislation making 10 cents per kilowatt hour the maximum rate charged for electricity for lighting purposes in Boston; on Edward H. O'Brien's petition that every corporation, firm or person furnishing gas or electricity for light, heat or power should be compelled to charge a uniform rate to all customers; and on George J. Raymond's petition that every company furnishing electricity for light and power in the state should be required to furnish it at a price that will produce a profit not exceeding 10 per cent. of the capital invested.

The Massachusetts Legislature has passed a bill making it unlawful for a street-railway company which has operated a street-railway line in any city or town to discontinue the operation of any part thereof without first obtaining the consent of the aldermen. Street-railway companies which have ceased to operate within the last two years are compelled to resume operation within three months after a written request to that effect has been delivered to the company by the aldermen.

The Windsor Locks Electric Light Company has obtained control of the Thompsonville Electric Light Company. The former operates a plant in Windsor Locks, Conn., under a charter granted to the Enfield Gas Company. As soon as the necessary changes can be made at the Windsor Locks plant, the Thompsonville (Conn.) plant will be used as a sub-station.

Norman Marshall, president of the Marshall Electric Manufacturing Company of Boston and a graduate of the Worcester Polytechnic Institute, has offered to give the institute all supplies made by his company that may be needed for the electrical equipment of the new electrical engineering building. The institute has received a large electric blue-printing machine from the Buckeye Engine Company and a portable electric drill from the Prentiss Tool and Supply Company. A company of students has been making electric tests of running cars on the Worcester Consolidated, the Boston and Worcester and the Boston Elevated companies' tracks, using apparatus devised by graduates of the institute.

The Boston Elevated Railway Company placed the first steel column on the Forest Hills extension of its elevated structure last Wednesday night. The columns and girders will be set at night. B.

New York.

New York city, May 5.—The general machinery trade in this city continues excellent and all lines are doing a large business. The same is true of power equipment. To illustrate, one well-known firm has received through its New York office during the last few months inquiries for more than $200,000 worth of cranes of various descriptions. The New York branches of two important German machinery houses that make a business of importing machinery equipment of American manufacture into Germany and other European countries have been watching the progress of American machinery men in Japan with apparent interest, as within the last few weeks both firms have opened offices in Japan and prepared to go into active competition for business. The Germans have attached their Japanese branches to their New York houses in a way, and they will probably prove a factor in the keen competition for Japanese business that is now going on among the machinery men represented there.

The telephone system of this city has grown wonderfully in the last four months. Since January 14,807 new telephones have been installed, making the total number in service and under contract 256,962. This is 2½ times as many telephones as London has, more than five times the number of telephones in Paris, and nearly four times as many telephones as Berlin has.

Plans are now being prepared by R. P. Bolton, 527 Fifth Avenue, for a terminal station and power house, to be constructed for the New York Central and Hudson River Railroad at Forty-second Street and Park Avenue. None of the equipment for the power plant has been purchased as yet, and beyond the fact that there will be a large plant no details have been made public. It is thought that the plans will be completed about May 15th, and bids will then be asked. The equipment will include coal and ash handling machinery, as well as the usual apparatus required in a power house.

The Long Island Railroad Company is laying an extra track across the Flushing Meadows, so that its Port Washington branch will be double tracked from Long Island City to Main Street, Flushing. The company has plans for electrifying that part of its system, and has been widening its right-of-way. The new track will greatly facilitate the operation of express trains.

The manufacture of automobile cars for railroad use is to be undertaken by the Railway Auto Car Company, which has been organized, with a capital of $700,000, for the purpose of carrying on the enterprise. The new concern has acquired the American right to build the Gatz type of car [illegible] in use on some European railroads. [illegible] are primarily interested in the company. H. [illegible] is president, F. Q. Brown of Redmond & Co. is first vice president, and William F. [illegible] Jr., second vice president. Charles [illegible] of the company, says automobile cars can be operated for less than 25 per cent of the cost of [illegible] trains, making possible a frequency of service [illegible] four times that given under existing conditions without increasing expenditure. [illegible] at high rates of speed, can be stopped [illegible] and handled similarly in every respect to a trolley car.

Martin W. Littleton, W. E. Cooke and Joseph B. Ware explained to Controller Metz and Borough Presidents Ahern and Coler a few days ago the methods of the Atlantic Telephone Company, which is seeking a franchise to install an automatic telephone system in the city. Mr Littleton is the company's counsel, Mr. Cooke its chief electrician, and Mr Ware represents the Citizens' Telephone Company of Grand Rapids. Controller Metz said after the hearing that he had not been influenced by the proposal of the company to pay the city $3,000,000 in installments for a 25-year franchise, and to give the city its own telephone service free. "If you can show me," he said, as the hearing concluded, "that two telephone systems are going to benefit the people of New York, I would vote for the new franchise, even if the city were not to get a cent, but I have grave doubt as to the good a second telephone system would do."

Alexander Smith, while cleaning snow from the Manhattan Elevated Road in December, 1902, formed a short circuit with his shovel between the third rail and an iron bolt which projected from the track. He alleges that his right eye was injured by the accident. Smith, through his attorney, Abraham Oberstein, brought suit against the Manhattan Railway Company on the grounds that it was the duty of the company to provide him with a wooden shovel or some other nonconductive tool, for use near the third rail. Judge McCarthy of the City Court tried the case, and a jury returned a verdict in favor of the plaintiff for $1,900. C. I. C.

Southeastern States.

Charlotte, N. C., May 5.—The Public Service Corporation of Hampton, Va., is chartered to produce and distribute light, heat, power and compressed air. J. W. Rowe is president and S. C. Rees treasurer.

A proposition by Isadore Newman & Sons to take over the street-railway companies in Birmingham, Memphis, Little Rock and Houston is creating much interest in financial circles in the South. The proposition as made to the stockholders in the Birmingham Railway, Light and Power Company is that they shall receive 105 shares of preferred stock in the new merger for every 100 shares now held, and 150 shares of common stock and 10 of preferred for every 100 shares of common now in their possession. The stockholders of the companies which it is proposed to merge will likely take some action at a meeting called for that purpose. Propositions for the other cities vary somewhat, being on a slightly different basis.

The organization of the Norfolk and Portsmouth Traction Company has been perfected at Portsmouth, Va., to carry out the merger of the electric railways, light and ferry companies recently announced by Middendorf, Williams & Sons of Baltimore and John L. Williams & Sons of Richmond.

Foster W. Brown, Frank Spurlock, R. W. King, D. J. Duncan and Thomas G. Newman have asked for a charter for the Lookout Mountain Railway Company, in which Chattanooga Railway stockholders are interested to rebuild the electric line to the famous resort on Lookout Mountain, near Chattanooga. The company seeking the charter has $100,000 capital stock.

In returns made to the comptroller-general of the state of Georgia the Georgia Railway and Electric Company's report shows that since the last returns the company has experienced an increase of $150,242 in net earnings, and the total returns, including franchise and properties, are $3,204,486. L.

Ohio.

Cleveland, May 5.—Steps have been taken to build an electric railway from Norwalk to Bluffton, Ind., thus forming a connecting link for a direct route between Cleveland and Indianapolis. The following men are interested: Colonel L. R. Tudor of Van Wert, N. E. Mathews of Ottawa, Harry R. Moltz of Decatur, Ind., L. E. Gleason of Van Wert, Dr. C. F. Douglas of Kalida, John B. Holthouse of Decatur, and F. L. Websterm, treasurer, of Van Wert.

Reports were in circulation in Cleveland this week that the attempt to merge the illuminating companies of that city had revealed a plan of the Standard Oil Company to merge all the traction and light interests that stand in the way. It is further surmised that the Widener-Elkins syndicate is doing the work, and that the whole plan contemplates the connection of the Atlantic Coast and the [illegible]

[illegible]

[illegible] in opposition to the W[illegible]

[illegible] formed to build a line from [illegible] delphia, with [illegible] from [illegible] from Minerva to [illegible] capital stock is [illegible] right of way over the 70 miles of the line has been secured.

The Wadsworth and Western Traction Company, incorporated a few days ago, [illegible] the Northern Ohio Traction and Light Company will extend its line across the state, connecting with the Mandelbaum property at Mansfield and the Cleveland and Southwestern at Wooster. A. J. Rowley is one of the incorporators, with office at Akron.

A report comes from Dayton that the Schoepf syndicate has concluded negotiations for the purchase of the Dayton and Northern and the Dayton and Muncie Traction Company, and the extension of the former from Greenville to Muncie, Ind. This will give the syndicate a through line between Columbus and Indianapolis in connection with the Union traction properties in Indiana.

The Cleveland Electric Railway Company will increase its mileage about 10 per cent. this summer. Fifty new cars have been ordered and some of the old box cars built over, so that the addition will amount to 60 cars over and above the 600 now in operation.

Owing to the breaking of a huge flywheel in the power house of the Mansfield Railway and Light Company last Wednesday the local lines were put out of business and the town was in darkness for two days. The Shelby line was also shut down, and two or three other interurban lines which secured a portion of their power from that plant were crippled.

The Galion, Mt. Gilead and Delaware Electric Railway Company has been incorporated with a capital stock of $10,000. The line is to pass through Crawford, Morrow and Delaware counties and connect with the Columbus, Delaware and Marion road at Delaware. O. M. C.

Michigan.

Grand Rapids, May 5.—The Thornapple Electric Company, with principal office in Hastings, has changed its name to the Thornapple Gas and Electric Company. The company furnishes electricity to Lake Odessa, Nashville and Middleville and gas and electricity to Hastings. The company is putting in another wheel at its dam at LaBarge.

The Pere Marquette Light and Power Company has gone before the village councils of Montague and Whiteall with a proposition to furnish electric current to those villages exclusively for 10 years. The contract submitted provides for furnishing arc lights for $4 each per month and 16-candlepower incandescents for 25 cents each per month. It is the plan of the company to transmit current from its dams on the south branch of the Pere Marquette River, a distance of 40 miles.

The council of Paw Paw has been considering the building of a dam about 1½ miles north on the Paw Paw River in order to secure greater power for the electric plant. Engineers declare the plan feasible and estimate the cost at $40,000.

The Bay City Traction and Electric Company of Bay City sprung a surprise on the council by submitting a proposition to do the lighting of the city's streets. The company declares it can furnish a better and more economical service than the city itself. It proposes to use the present pole and wire lines of the city, replace the old-style open arc lamps now in use and charge $50 per lamp a year on the moonlight schedule, or $60 on an every-night all-night schedule. The company will give the city an option to purchase the lamps and wire extensions at the expiration of the 10-year franchise asked for. The municipal plant is badly run down and the city is considering the offer.

The Village Council at Memphis has granted a franchise to S. R. Lester of Sandusky for the erection and operation of an electric-lighting plant and a system of waterworks. He is given exclusive rights for a period of 30 years.

A new feature of the work at the Chandler-Dunbar excavations at the Soo this year will be a trolley system for handling rock and earth instead of the old cable-hoisting system, which was in use last year. Trolley wires are being strung and two motor cars of 30 horsepower each will draw the cars of rock.

The Edison Illuminating Company of Detroit and the Detroit City Gas Company are in keen competition for the extension of illuminating and power

business. Last week the Edison, or, rather its subsidiary company, the Peninsular Electric Lighting Company, for the first time turned on a street-lighting circuit for the village of Royal Oak. Twenty arc lights were lighted, and everybody in the village was in the streets or on the porches to take in the illumination. The Edison people are now arranging to do commercial lighting in Royal Oak and between there and Highland Park, and it is said to be now a hope that villages and townships will gradually make contracts for lighting all the main thoroughfares out of Detroit.

The United States Gypsum Company is the first Grand Rapids concern to use the power of the Grand Rapids-Muskegon Power Company. It will use 250 horsepower daily. The power company has placed orders with the Westinghouse company for two 5,000-horsepower waterwheel-type three-phase generators and five transformers. At some of the dams along the Muskegon River the company intends, it is said, to generate a current of 100,000 volts. The company is building five miles of railroad, connecting its dam site at Croton with the Pere Marquette Railroad. Five more dams are to be erected along the Muskegon River, making seven in all.

The Citizens' Telephone Company of Grand Rapids has bought the Reed City telephone exchange owned by C. F. Marshall of that city. The exchange operates 300 telephones. L. W. B.

Indiana.

Indianapolis, May 5.—The Cincinnati, Hamilton and Dayton Railroad has placed on sale, between Indianapolis and Rushville, tickets at 80 cents one way, as against $1.20, the former rate, in order to meet interurban competition.

Work was begun this week on the Indianapolis, Crawfordsville and Western electric railway, between Crawfordsville and Indianapolis. The contract for the construction of the roadbed and the laying of the ties and steel has been awarded to Mansfield, Moore & Co. of Indianapolis.

It is rumored that the majority of the stock of the Kokomo, Marion and Western Traction Company has been acquired by the Union Traction Company.

In order to finance the Evansville and Eastern Electric Railway, from Evansville to Rockport, a mortgage for $750,000 was executed and filed in Vanderburg County in favor of the Pittsburg Trust Company.

The initial steps have been taken to build an electric road from Bluffton, Ind., to Norwalk, Ohio, the route being practically an air line, that will pass through a number of good Indiana and Ohio towns. The Riggs and Shorman Company of Toledo, Ohio, will have charge of the survey and construction.

The Indianapolis and Eastern Traction Company has ordered six new cars for service between Indianapolis and Richmond. The cars will be 60 feet long, with three compartments and all the latest mechanical appliances.

Kenelworth, the first of the handsome new cars for the limited service between Indianapolis and Fort Wayne on the lines of the Indiana Union Traction Company and the Fort Wayne and Wabash Valley Traction Company, was exhibited at the terminal station on May 2d. The six cars of this type for this service are said to be the best equipped electric cars in the world. Each car is 62 feet nine inches long and is divided into four compartments. The cars were built by the Cincinnati Car Company. They are lighted by clusters of incandescent lamps.

Russiaville has decided to construct an electric-light plant and install it with the latest type equipment. Alvin Middleton has the matter in charge.

Professor Matthews, head of the electrical engineering department of Purdue University, has been employed to make a critical examination of the building, engines, generators, etc., of the Richmond municipal electric-light plant, with a view of ascertaining the extent of depreciation, now that the plant is about to be sold. S. S.

Illinois.

Peoria, May 5.—The Springfield and Northwestern Traction Company has been incorporated, with principal office at Champaign, and capital stock of $1,500,000. This is a part of the McKinley syndicate. The company will at once build an electric railway from Springfield to Bloomington.

The Illinois Traction Company will at once build an interurban between Peoria and Lincoln, and thence to Springfield. General Manager Fischer has received orders from Montreal to begin the construction of an electric interurban from Champaign westward toward Monticello. This is taken to mean that Decatur will not be on the line, or possibly that it will be entirely cut out from the original plans of the company. It was at first intended to construct the line from Champaign to Springfield via Decatur. Now the intention is to build from Monticello to Clinton, then follow the Illinois Central into Lincoln, then along the right-of-way of the old Springfield and Northwestern from Lincoln to Springfield, and then northward to Peoria. The company is not well pleased with the limited privileges which has been granted to it in Decatur. Decatur will have connection with the new line by the intersection of the Decatur-Bloomington line at Clinton. The village of Danvers has granted the company the franchise asked for.

Congressman W. B. McKinley, president of the Illinois Traction Company, last week issued an order that all employes on lines controlled by the syndicate should receive a donation equivalent to five per cent. of the total wages they have earned during the last year. He has also just given $50,000 for the erection of the Christian Association Building at the University of Illinois.

Guy W. Talbot, formerly general manager of the Peoria and Pekin Terminal Railway, has been placed in charge of the Astoria and Columbia River and the Corvallis and Eastern Railways, with headquarters at Portland, Ore.

The Chicago and Joliet electric line will provide a fine gymnasium for its employes at Joliet.

Hardin McCollough, a lineman for the Galesburg Gas and Electric Company, was instantly killed while connecting a live wire.

A bill has been introduced in Congress granting the Rock River Navigation and Improvement Company incorporation papers for the purpose of constructing dams and building reservoirs for the storage of water to generate power.

The old grist mill at London Mills has been demolished and it is now proposed to convert the grounds into a park and repair the dam and build a municipal lighting plant and pumping station. V. N.

Northwestern States.

Minneapolis, May 5.—Electricians of Minnesota, North and South Dakota and Wisconsin employed by the telephone and electrical companies threaten a general strike unless a raise in wages is given them. Such a strike would affect about 700 men.

The Fort Dodge (Iowa), Des Moines and Southern Electric Railway Company has let the contract for grading 21 miles, from Lanyon to Fort Dodge, to Murray Bros. of Cedar Rapids. The General Electric Company will begin the electrification of the line at once.

The project of an interurban railway between Fairfield and Keosauqua, Iowa, has been revived. Henry Buser of Indiana and associates are pushing the matter and propose to organize a company with a capital of $1,000,000, building a dam across the Des Moines River, and begin the construction of the line very shortly.

The Stillwater Gas and Electric Light Company proposes to build another dam across the Apple River near Stillwater, Minn., to furnish 1,000 additional horsepower.

T. Mahaney and others propose to establish an electric-light plant at Minnewaukon, N. D.

The new electric-light company at Hastings, Minn., proposes to erect a new power plant on the Vermilion River.

The Eastern Wisconsin Railway and Light Company has announced that it will extend the Fond du Lac street railway to the fair grounds and cemetery. R.

Pacific Slope.

Oakland, Cal., May 2.—The Mount Hood Electric Company has submitted a proposition to the city of Portland, Ore., to construct and sell to the city for $1,250,000 a waterpower plant having an initial capacity for 10,000 horsepower. An additional 15,000 horsepower for future development of plant would be installed for $400,000. The company will contract to purchase surplus current from the city.

The Interstate Electric Power Company, composed of Idaho capitalists, will build a 20,000-horsepower electric plant at Eagle Rock, between Weiser and Huntington, Ore. A dam will be constructed and work will begin as soon as preliminaries can be completed. The dam and plant will cost from $60,000 to $75,000, and Engineer Wiley will have charge. Power will also be utilized for irrigation of the Dead Ox Flat region.

The Newberg Electric Light Company and the Spaulding Logging Company of Newberg, Ore., have been merged in the Yamhill Electric Company, incorporated with a capital stock of $25,000. The company will erect a new and larger plant, with 300 horsepower, on the Willamette. The plant will be in operation by fall and will furnish power and light.

The Willamette Valley Electric Company of Cottage Grove, Ore., has petitioned the City Council for a 30-year extension of franchise. The old power station is being remodeled and the system overhauled. New boilers and an engine of 150 horsepower will be installed. About $10,000 is to be spent for alterations and improvements. A.

PERSONAL

John Collins, superintendent of transportation for the Edison Electric Illuminating Company of Boston, died suddenly at his home in the Brighton District on the afternoon of April 29th.

H. E. Davisson of Decatur, Ill., superintendent of the car service on the Decatur-Springfield branch of the Illinois Traction system, has been transferred to Bloomington to become superintendent of the Bloomington and Normal Street Railway Company. Mr. Davisson, before going to the Illinois Traction system, was located at Galesburg, in the employ of the McKinley syndicate.

James A. Bendure, general manager of the Schoepf electric railways at Lima and in the northwestern part of Ohio, has resigned and S. F. T. Hepburn of Cincinnati has been appointed to take his place.

L. W. Tyler, superintendent of construction for the Sioux City (Iowa) Telephone Company, has resigned to accept a position in the engineering department of the Western Electric Company in Chicago.

John H. Ainsworth, manager of the Central Union Telephone Company at Columbus, Ohio, has returned home from the South, where he went to regain his health after completing the work of rebuilding the exchange following the fire last summer.

M. J. Mandelbaum, one of the prominent traction men of Cleveland, Ohio, has returned home after an absence of seven months in Europe. Shortly after their marriage in October Mr. and Mrs. Mandelbaum sailed for Europe and spent the winter in Switzerland.

From his interest in science, and the further fact that he is chief signal officer of the army, Gen. A. W. Greely, commanding the United States regular troops in San Francisco, is especially well known to electrical men. He has a fine record for brave and efficient service in the army, to which he is adding by his excellent work at San Francisco.

Robert Knight of Roxbury, Mass., in the employment of the General Electric Company, and Miss Susie Tod of Pollokshields, Glasgow, Scotland, were married in Roxbury on April 25th. Mr. Knight was with the British Thomson-Houston Electric Company at Rugby, England, and Glasgow, Scotland, for a number of years.

Robert W. Waite, vice-president of the Louisville and Southern Indiana Traction Company, with offices at New Albany, Ind., has been elected a member of the executive board of the Central Electric Railway Association. He takes the place made vacant by the resignation of Gardner F. Wells, formerly general manager of the Terre Haute Traction and Light Company, who recently went to Boston to take a position in the home offices of Stone & Webster.

William S. Logue, general sales agent of the Edison Manufacturing Company of New York, died suddenly in Chicago on April 25th. He had never been of robust strength. On April 16th he came to the Chicago office on business, apparently in his usual health. He became sick on the 22d and died three days later. Earlier in life he had been a telegrapher. In 1886 he entered the employment of Thomas A. Edison and had since been with those interests. The body was taken to Baltimore for burial.

James B. Hoge, president of the National-Interstate Telephone Association, has the sympathy of a large circle of business and personal friends in the death of his father, Byron M. Hoge of Flushing, Ohio, who committed suicide during a temporary fit of despondency. Mr. Hoge was a veteran of the late war and prominent in the community where he lived as his sons are in the telephone world. One of them is connected with a Boston telephone company, while James B. Hoge is a leader in the Independent movement and is known all over the United States.

Montefiore Levi died suddenly on April 24th from heart disease at his residence in Brussels, at the age of 74. Born in England, Mr. Levi, who belonged to a well-known family, went to Belgium, became naturalized in 1882, and represented Liège in the Senate till 1900. He was a man of great wealth, and gave largely to science and philanthropy. To his munificence is due the foundation and endowment of the Electrical Institute at Liège, one of the most notable of its kind in Europe. He contributed largely to the building of the monument to Zénobe Gramme, which was unveiled in Liège last October.

Graham Smith, formerly in charge of Westinghouse exposition and convention publicity as the New York Westinghouse press representative, and recently engaged in advertising work under his own name, is about to undertake a journalistic tour of several months abroad. On his return he will assume the direction of the eastern advertising interests of several prominent corporations of the Middle West and West, with an office in the Flatiron Building, New York, and will make a specialty of the preparation of industrial books of the higher class.

Mr. Charles H. Vaughen, who was for five years at the Lynn factory of the General Electric Company, and for the last two years has been motor expert in the engineering department of the same company at Schenectady, has become general manager for the Niagara Tachometer and Instrument Company of Niagara Falls. Mr. Vaughen will have his headquarters at the Falls. On the eve of his departure to take up his new duties his fellow engineers of the General Electric Company presented him a handsome gold watch, engraved with his monogram and a suitable inscription. The Ni-

agara Tachometer and Instrument Company has been developing and perfecting its instruments for about a year, and Mr. Vaughen takes hold energetically to push both the commercial and scientific departments of the business. With his already well demonstrated ability, the institution will undoubtedly prosper.

Mr. William Clegg, Jr., who has been special agent of the Westinghouse Electric and Manufacturing Company in its St. Louis territory, has just received the appointment of acting manager of the St. Louis office. Mr. D. E. Webster, formerly manager of the office, has been transferred to a position in the Chicago sales office of the company. Mr. J. S. Tritle has been appointed acting manager of the new district office opened by the Westinghouse Electric and Manufacturing Company in Rooms 512 and 513, New England Building, Kansas City, Mo. Mr. Tritle was formerly connected with the St. Louis office of the Westinghouse Electric and Manufacturing Company.

A. L. Drum, general manager of the Chicago and Milwaukee Electric Railroad Company, has resigned his position with the company, effective May 1st. He is succeeded by Robert Stearns, formerly with the Northwestern Elevated Railway of Chicago. Mr. Drum came to the Chicago and Milwaukee company something over a year ago from Anderson, Ind., where for two years he had been general manager of the Indiana Union Traction Company. He still remains with the Chicago and Milwaukee electric-railway interests, but in a different capacity. A company is being formed to be known as the Chicago and Milwaukee Power Company. This company is preparing to build a large power house at Waukegan, Ill., to serve the extensive railway system. The plant is to be one of the finest in the West and will cost between two and three million dollars. Mr. Drum will superintend its construction. The company has acquired a large tract of land in Waukegan, which has all advantages for a convenient plant. Work on the new plant is to be begun soon.

Three well-known Chicago Edison men have just left for a trip through Europe. The party, which sailed on the Baltic on May 9th, is composed of Mr. L. A. Ferguson, second vice-president; Mr. R. C. P. Holmes, purchasing agent, and Mr. Peter Junkersfeld, electrical engineer, all of the Chicago Edison Company. While the trip is of a business nature, the gentlemen expect to find time to visit some of the more important electrical plants and institutions in London, Berlin, Paris and other large cities before returning to the United States, about July 1st. After arrangements for the trip had been completed, and just before his departure from Chicago, Mr. Junkersfeld received an official appointment to represent the Western Society of Engineers at ceremonies in commemoration of the fiftieth anniversary of the Society of German Engineers at Berlin in June. The Society of German Engineers is the largest technical society in Germany. It invited the Western society to send a representative to the anniversary celebration, and Mr. Junkersfeld, in recognition of the honor of having received the appointment, will endeavor to change his plans so as to be able to present at the celebration.

ELECTRIC LIGHTING.

Frank Wright will install an electric-light plant in Cottonwood Falls, Idaho.

The council of Kaukauna, Wis., is arranging to establish a municipal lighting plant.

E. E. Moore and others are preparing to install an electric plant in Black River Falls, Wis.

The Consumers' Light Company of Ballinger, Texas, has been incorporated with a capital of $20,000.

The cities of Moorehead and Staples, Minn., are each inviting bids for the installing of electric-light plants.

The Hastings (Neb.) Electric Light and Water Power Company has been incorporated with a capital of $50,000.

The Paducah Light and Power Company of Paducah, Ky., is a recent purchaser of a 500-kilowatt Allis-Chalmers generator.

The Noblesville (Ind.) Heat, Light and Power Company recently purchased a 150-kilowatt Allis-Chalmers bolted generator, 2,300 volts, two-phase, 60 cycles, with direct-connected exciter.

The contract for building the waterworks and electric-light systems for Altus, Okla., has been let to the McQuatter Plumbing and Machine Company of Hillsboro, Tex., for $28,000.

The Eminence (Ky.) Electric Light Company has been placed in the hands of a receiver, with directions to open up the plant and run it. Various claims have been asserted against the plant.

Charters have been issued at Harrisburg, Pa., to an Allegheny County syndicate, with headquarters at Pittsburg, to operate a chain of electric-light and power companies in that county. C. T. Marsh of Swissvale is treasurer and director of the companies. The companies are the O'Hara Light and Power Company, the H[illegible] Light [illegible] Company, the Harm[illegible] Light and Power Company, the Tarentum Light and Power Company, the Springdale Light and Power Company, the Deer Light and Power Company [illegible] [illegible]cutridge Light and Power Company.

The Missouri Pacific Railroad [illegible] struct an electric-light plant [illegible] machine shop in Webster [illegible] light needed in the railroad [illegible].

The Fairbury (Ill.) Electric Light Heat and Power Company has consolidated with the [illegible]worth Electric Light Company. The [illegible] will be remodeled and new machinery [illegible].

The Milwaukee Electric Railway and Light Company recently added to its equipment three [illegible] watt exciters for direct mounting on the [illegible] of the three 1,500-kilowatt turbine generator units ordered some time ago from the Allis-Chalmers Company.

Damages of $4,000 in favor of the Reed City (Mich.) Electric Company have been ordered against Richmond Township for placing a dam bridge across the Hersey millpond, thereby interfering with the waterpower privileges of the electric light plant.

A corporation headed by George W. Hunt of Globe, Ariz., has been formed for the establishment of a second electric light plant, as well as for the building of an electric railway system to connect the main part of the city with the smelting and mining districts to the north.

ELECTRIC RAILWAYS

Passenger traffic on the Chicago and Oak Park Elevated Railroad for April was reported as 47,348, daily average. This is an increase of 1,258 over April last year. With transfers, the daily average was 49,021.

The Kansas City, St. Joseph and Excelsior Springs Railroad Company has been authorized by Congress to build a bridge across the Missouri River at Kansas City, in connection with the project to build an electric railway to St. Joseph and to Excelsior Springs.

The Elgin and Bloomingdale Railroad Company has decided to change its name to the Chicago and Elgin Electric Railway Company and to increase its capital stock to $800,000. The line has a direct route between Elgin and Chicago surveyed and the right-of-way is secured. The road will connect with the Lake Street Elevated in Chicago.

Extensive tests are about to be made on the Swedish state railways to determine upon what principles the lines shall be electrified. It is proposed to start trials with the Oerlikon overhead contact system, and for this purpose a stretch of three kilometers between the Central railway station of Stockholm and Tonteboda has been fitted up.

Motormen who have been in the employment of the Aurora, Elgin and Chicago Railway Company for three years have been given a voluntary increase in wages of 2½ cents an hour. This will give them 27½ cents an hour. Conductors of required experience in the company's service are receiving 25 cents an hour. New men are taken into the company's employ at 22½ cents an hour. The first raise is to 23½ and then to 25 cents.

The Colorado and Southern Railway is preparing plans to electrify its line to Boulder, according to a report from Denver. If the Denver Terminal Railway Company is given permission to operate cars into Denver the Colorado and Southern will, it is said, in all probability immediately build an electric line to compete with the company in the northern part of the state.

Among the recent single-phase railway equipments furnished by the Canadian Westinghouse Company is one for approximately 35 miles of track for the Windsor, Essex and Lake Shore Rapid Railway Company. For the present five cars equipped with two 100-horsepower motors each will be operated, in addition to which a 500-kilowatt, single-phase, 25-cycle generator is to be installed in the main power house near Essex, together with switchboards, exciters and transformers, for operating the system. A trolley voltage of 6,600 will be used and the most improved type of catenary line construction will be installed throughout the system.

A new tunnel through the Bernese Alps, between the canton of Berne and the canton of Valais, from which the Simplon line passes to Italy, is under active and practical consideration. The board of directors of the committee having the enterprise in charge held a general meeting recently and unanimously approved the project submitted by Chief Engineer Zollinger for a line to pierce the Bernese Alps under the Lotschberg. Electrical traction will be used, and the new tunnel will be 8 2-5 miles long. The total cost is estimated at $16,984,000. A Franco-Swiss syndicate of bankers and engineers, at the head of which is the [illegible]

[illegible]

Portland [illegible] [illegible]cluded.

POWER TRANSMISSION.

The central power house of the [illegible] Power and Traction Company [illegible] has been destroyed by fire, entailing [illegible] $350,000. The company [illegible] lighting and street railway system [illegible] Franklin and suburbs.

Surveys are being made and rights of way secured for the extension of the new high-tension electric line from Greenwood, B. C., to the Mother Lode mine of the British Columbia Copper Company and the Boundary Falls smelter of the Dominion Copper Company, each being a distance of four miles from Greenwood. The work is being done by a subsidiary of the West Kootenay Power and Light Company. At Greenwood and Grand Forks work is under way on sub-stations for the company, where the power, which will be brought over the mountains from Bonnington Falls on Kootenay River at 60,000 volts, will be transformed to about 2,000 volts for commercial purposes.

Prominent manufacturers and capitalists from Cleveland, Indianapolis, Terre Haute, Toronto, Hamilton and a number of New England cities recently inspected the power-generating plants at Niagara Falls. They had been invited and were entertained by the boards of trade of Niagara Falls, N. Y., and Niagara Falls, Ont. The object was to show what the two cities have to offer in the way of cheap electric power, manufacturing sites and shipping facilities. The visit was concluded with a banquet at which there were speeches by Harold Buck of the Niagara Falls Power Company; Calvin W. Rice, representing the General Electric Company; Paul M. Lincoln, representing the Westinghouse Electric and Manufacturing Company, and Edward Gurney of Toronto, Canada, a former president of the Manufacturers' Association.

PUBLICATIONS.

A revised price list of phosphor-bronze products has been issued by the Phosphor-bronze Smelting Company of Philadelphia.

Frank W. Morse of Boston is sending out to the trade two small circulars describing the Never-break electric-light guard and Morse and Webster adjusters and Morse adjustable fixtures.

The Trumbull Electric Manufacturing Company of Plainville, Conn., has just completed a 100-page catalogue of electric wiring material. Copies may be had by those interested by writing to the company.

Instructions for setting and operating the Gates ball mill is the subject of instruction book No. 5006, sent out by the Allis-Chalmers Company. The Gates ball mill comes under the head of cement machinery in the company's long list of products.

The latest piece of advertising from the Holophane Glass Company, New York, is a small blotter, on which is shown something new in the shape of a Pagoda reflecting arc. The cluster is artistically hung from the ceiling by an eight-link chain.

A bulletin devoted to the subject of belt conveyors for handling excavated earth and rock and concrete materials has been issued by the Robins Conveying Belt Company of New York city and is a comprehensive illustrated description of the apparatus built by this company.

Several new "flyers" sent out by the General Electric Company are descriptive of the following apparatus: Type T, form D and form D-2 fuse holders; type MS8 hood switch for railway service; type MA 13A copper ribbon fuse box; receptacles for outdoor wiring; porcelain sockets; all-porcelain wireless clusters; key and keyless receptacles; type SC sped-controlling rheostats; also catalogue No. 7584 on marine supplies. A supply catalogue on Sprague-General Electric type M controller apparatus has also been issued, together with a catalogue describing General Electric lightning arrest-

ers. The latter is prepared in a tasteful manner and describes the apparatus in detail. Supplementary to the lightning-arrester catalogue (No. 1052) is a pamphlet on dimension, connection and instructions for installing this class of apparatus.

The Nernst series street-lighting system is described in the April issue of The Nernst Glower, published monthly by the Nernst Lamp Company, Pittsburg, Pa. There are some good illustrations and many valuable hints to central-station men and others who have to do with lighting.

Spon & Chamberlain of New York have just published a new book by J. H. Kinealy entitled "Mechanical Draft." The book contains valuable data, and the tables are arranged in such sequence as to make them most easy of application in making calculations for mechanical-draft installations.

The Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass., is sending out a booklet—circular No. 775—treating on inner globes for all arc lamps. Long experience enables the Stanley-G. I. company to make a selection of glassware which will insure satisfactory operation. The company's inner globes are manufactured for any standard make of arc lamp.

Volume I, No. 1, of "The Insulator," a small publication issued by the Standard Varnish Works of New York city, is a guide to the correct uses, selection and application of electrical varnishes. "How Varnish Cuts the Cost of 'Expenses,'" "A New Kind of Electrical Varnish" and "How to Buy Electrical Varnish" are the subjects taken up in this issue. Contributions from readers are desired if they are practical ideas from practical men.

The Wellman-Seaver-Morgan Company of Cleveland, Ohio, has published a very interesting book of 32 pages, dealing with locomotive cranes, buckets and tubs. Some excellent half-tones illustrate the various applications of the cranes and show excavating buckets and dumping tubs in operation. The information in the book will be of value to a variety of industries. The company is prepared to build both standard and special locomotive cranes and a large variety of buckets and tubs. Inquiries on the subject are welcome.

Real pleasure will be derived from looking through the interesting little booklet prepared by the New Orleans Railway and Light Company on the electrical illumination features of the Mardi Gras celebration of February, 1906. The booklet contains 19 fine half-tone illustrations portraying the magnificent scale on which the illumination of the various streets and buildings was carried out during the celebration. These brilliant displays serve to illustrate strikingly the beautiful effects that may be obtained by the use of artistically designed electrical decorations.

A revised price list of telephone and telegraph wire, together with other literature on the subject, is being sent out by the Indiana Steel and Wire Company of Muncie, Ind. As many of its customers have expressed a desire to purchase wire through their jobbers where cross-arms, insulators and other supplies are to be had, the company has arranged with the leading jobbers throughout the country to carry its wire in stock and to supply the same at a uniform price. The company guarantees its wire in every respect and is anxious to hear from those not familiar with its product. Particulars concerning the company's method of manufacturing wire and the result of tests of the finished product will be sent to anyone interested.

The second edition of the third annual report of the Reclamation Service, now published by the United States Geological Survey, is out. It is accompanied by a collection of 59 maps, separately bound, which were prepared after the close of the field season as illustrations to the text. These maps may give to many a clearer idea of the reclamation work projected and now in progress than does the written record. This report shows that examinations and surveys, as required by law, have been carried on throughout the arid regions, and that construction has been begun and has progressed rapidly wherever the surveys have demonstrated the practicability of a project. This report is published for general distribution and may be obtained on request to the director of the Geological Survey.

SOCIETIES AND SCHOOLS.

Unless there was some change in the programme at the last moment, the cornerstone of the United Engineering Building in New York was laid on May 8th by Andrew Carnegie.

Very little space is left in the main exhibit hall at the Atlantic City convention of the National Electric Light Association, owing to the demand, so that an overflow into the pier wings is probable. The uniform plan of exhibit and booth decoration is found to lend itself admirably to the space provided and the lighting and color scheme will prove very effective. While the convention is going on there will be in full swing on the pier without any interference, concerts by an excellent band, a vaudeville theater, a skating rink and deep-sea net fishing, so that the variety of instruction, entertainment and amusement will be something never enjoyed before or under such favorable conditions for comfort. Reservations at the 37 hotels on the association list already run into the hundreds.

The Hotel Pfister will be headquarters for the American Institute of Electrical Engineers during the annual convention in Milwaukee from May 28th to June 1st inclusive. Manager A. L. Severance has had wide experience with electrical conventions and is acquainted with many electrical men. He will not fail to take good care of the visitors.

The executive committee of the Central Electric Railway Association has announced that the bi-monthly meeting of the association set for Columbus, Ohio, May 23d, will be held at Dayton, Ohio, instead of Columbus. The assembly room of the Algonquin, one of the largest hotels of Dayton, has been engaged for the session, which will last one day.

Under the auspices of the Chicago Association of Stationary Engineers, Charles W. Naylor, chief engineer for Marshall Field & Co., will deliver a lecture at Washington Hall, 70 East Adams Street, Chicago, on May 16th at 8:30 p. m. The subject will be "A Comparison of the Electric and Hydraulic Passenger Elevator, from the Standpoint of the Operating Engineer." The lecture will be illustrated. Mechanics and engineers are invited to be present.

TRADE NEWS.

The Chicago office of the Cutter Company, maker of I-T-E circuit-breakers, has been removed to 636 Marquette Building. H. B. Otis is district manager.

R. B. Corey has removed his New York city office to the ninth floor of the Taylor Building, 39-41 Cortlandt Street. Telephone, 3224-5 and 7429 Cortlandt.

The Electric Storage Battery Company of Philadelphia announces the opening of a branch office in Pittsburg, Pa. This office will be located in the Frick Building Annex.

Sealed proposals are being invited until June 1st for furnishing and installing electric fixtures in certain buildings, and for extending the lighting system so as to make proper connections therewith at Fort Omaha, Neb. Blanks and specifications will be furnished upon application to Major M. G. Zalinski, constructing quartermaster, Fort Omaha.

Bids will be received until May 18th by J. F. Lewis, assistant engineer, Michigan State Naval Brigade, 45 Congress Street west, Detroit, Mich., for one 7½-kilowatt direct-current dynamo direct connected to a vertical double-acting engine for use on U. S. S. Yantic. Specifications and detailed information may be obtained of Assistant Engineer Lewis at 45 Congress Street west.

The William Mueller Company has closed its Chicago office, headquarters having been established at Blaney, Mich., which point is now headquarters for its woods operations. Blaney is situated on the Blaney and Southern Railway (this railway has just been completed and is owned and operated by the company in connection with its cedar and logging operations), which connects with the Soo Line at Blaney Junction, 16 miles east of Manistique, Mich. All correspondence should be addressed to William Mueller Company, Blaney, Mich.

The Indiana Steel and Wire Company of Muncie, Ind., reports brisk trade in its telephone and telegraph wire. The mill has run day and night since September 1st, and the prospects are for steady operation throughout the year. Some of the leading jobbers are handling the company's wire with satisfactory results, and the company points with pride to some of the leading telephone companies of the country who are users and endorsers of its wire. The company has had its wire tested at several leading institutions in order to give customers assurance that the quality is right.

The Bureau of Supplies and Accounts of the Navy Department is inviting sealed proposals until May 22d for furnishing certain eastern navy yards with the following: Schedule 532, incandescent lamps, Gonda cells, wire, miscellaneous electrical supplies. On May 29th the bureau will also open bids for furnishing certain other yards with the following: Schedule 538, arc and incandescent lamps, bells and miscellaneous electrical supplies; schedule 541, electrical equipment for launches, electric drill; schedule 542, electrical supplies. Specifications and proposal blanks can be obtained at the Navy Pay Office in New York or upon application to the bureau at Washington.

Owing to his large and constantly increasing business, W. H. Schott, the well-known engineer and contractor of Chicago, has found it necessary to move from the Marquette Building to larger and more commodious quarters. Mr. Schott's offices are now located in rooms 1100 to 1128 American Trust Building. The new offices were especially laid out for the needs of Mr. Schott's corps of engineers and draftsmen, and are admirably suited for an engineering office. The suite of offices fronts on both Monroe and Clark streets, and occupies more than half of the eleventh floor of the building. Mr. Schott makes a specialty of installing central-station heating plants, waterworks, steam plants, electric-light, gas and street-railway plants. Mr. Schott is known as one of the most energetic engineers in the West, and has been most successful in the special line of work which he has been following.

The John A. Roebling's Sons Company of Trenton, N. J., wiremaker, is building what some of the newspapers call a "model city," at Kinkora, on the east bank of the Delaware, 10 miles below Trenton. Many features, including comfortable homes, are planned to make the life of the workmen more attractive, but the new town is founded on business and not on ideals. The explanation of the president of the company is that it had to expand. "We found a site available for our new mills, but there were no accommodations for the men we would have to employ there. Consequently we had to build houses for them to live in, and in doing so built for permanence and incidentally for the comfort of our men."

J. W. Duntley, president of the Chicago Pneumatic Tool Company, sailed for Europe on May 3d in the interest of the company's business. Conditions in Europe and on the continent are improving rapidly, and many large contracts which have been pending are ready to be closed, hence the desire of foreign connections, as well as the company's direct representatives, for Mr. Duntley's presence at this time. Several contracts will be awarded the Consolidated Pneumatic Tool Company of London, foreign branch of the Chicago company, for extensive installations as well as future requirements extending over periods from one to three years. Before sailing Mr. Duntley said that domestic business was considerably heavier than at this date last year.

The new company which takes over the plant and assets of the National Electric Company of Milwaukee will be known as the National Brake and Electric Company, a corporation of Wisconsin, with a paid-up capital of $1,000,000. The new company, which for a short time was known as the Wisconsin Brake and Electric Company, is also successor of the Christensen Engineering Company. It will continue to manufacture air brakes and electrical machinery, with extended facilities and abundant working capital. In the manufacture of motor-driven air compressors and in the adaption of air brakes for electric-traction service it proposes to continue the development of improved devices to meet the new conditions due to the more exacting demands of the present-day trade. To facilitate prompt attention to all inquiries referring to prices and sales of its product, the general sales office of the National Brake and Electric Company has been located at 519 First National Bank Building, Chicago, where all correspondence should be addressed.

BUSINESS.

George A. McKinlock, president of the Central Electric Company, Chicago, has just returned from a business trip to the East.

The new Chicago address of the Buckeye Electric Company and the Jandus Electric Company is 23 Lake Street. The telephone is Central 5937.

The G. E. Watts Electrical Construction Company of Baltimore, Md., has been incorporated. Those interested in the new company are Samuel M. Sachs, J. J. McNulty, D. G. Elderkin, W. N. Hechheimer and Harry Hechheimer.

On account of the continued expansion of its business the Aiton Machine Company of New York has found it necessary to install a number of new machine tools in its factory at Harrison, N. J. These new tools are all especially adapted to the Aiton Machine Company's work, which is the manufacture of wire, cabling, stranding, insulating and rubber machinery.

The National volt and amperemeter is now being supplied by the National Stamping and Electric Works, 54-62 South Clinton Street, Chicago. These meters are designed for work where a low-priced instrument that can be relied upon is required. They are neat in appearance and are of the magnetic-vane type, made for either alternating or direct current circuits. Descriptive matter and prices are supplied on application.

The American Can Company of New York, N. Y., recently purchased, through the New York office of the Allis-Chalmers Company, a 20 and 40 by 42-inch heavy-duty cross-compound engine, direct connected to a 500-kilowatt direct-current generator; also a switchboard and other equipment. The electrical apparatus for the new outfit will be built at the Allis-Chalmers Company's electrical works, Cincinnati, while the engines will be built at the West Allis, Milwaukee, shops.

Secretary Benedict of the Jos. P. Devine Company, Buffalo, N. Y., reports a gratifying condition of affairs relative to the company's business in vacuum drying and impregnating apparatus. The Devine company, during the last several years, has been exploiting the advantage of the Passburg vacuum drying and impregnating process among the electrical factories of the United States. Mr. Jos. P. Devine imported this process from abroad several years ago, and many of the big electrical factories and stations of the United States have

awakened to the fact that there is wonderful merit in vacuum drying and impregnation of insulating compound, especially in the line of cable manufacture, high-tension dynamos, and in transformer and other coil work where are present high tension dangers. The Jos. P. Devine Company has recently reorganized on a much larger scale, to take care of the steady and large increase in business.

The General Storage Battery Company of 42 Broadway, New York city, will make an extensive exhibit of its product at Young's Pier, Atlantic City, N. J., during the convention of the National Electric Light Association, June 5th to 8th, and also at the Master Car Builders' and Master Mechanics' convention, following on June 13th to 20th. The exhibit will be [illegible] company made at the Chicago [illegible] January, and which [illegible] The operation of [illegible] elevator, electric hoist, etc. [illegible] a miniature [illegible] that a Bijur booster [illegible] ing how it keeps down the [illegible] By closing a large [illegible] the board, instantaneous load [illegible] be drawn from a cell [illegible] ampere. [illegible] interesting feature of the exhibit [illegible] will be shown the regular Bijur [illegible] cell, a charging booster [illegible] speed motor driving a separately excited generator [illegible] a Bijur cell largely used in railway and [illegible]

[illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 1, 1906.

819,049. Electric Bell. John Erickson, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed October 31, 1904.

Embodied in the bell mechanism is an electromagnet, a flexible spring, an armature pivotally mounted upon the spring, and means for flexing the spring and thereby moving the armature toward and away from the electromagnet, the armature being disposed between the spring and magnet.

819,050. Indicating Device for Automatic Telephone Switches. John Erickson, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed December 30, 1904.

Automatic telephone-switching apparatus comprises a switch shaft adapted to be moved to a number of positions for establishing different connections, a lamp-signal individual to one of the positions and means operated by the shaft for controlling the lamp signal.

819,059. Mouthpiece for Telephone Transmitters. Harry J. Guttman, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed October 21, 1904.

The telephone mouthpiece is made of drawn steel with internally arranged lugs to hold the diaphragm.

819,060. Terminal Strip. Harry J. Guttman, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed November 9, 1901.

Details of a terminal strip for the attachment of telephone conductors are described.

819,068. Light Fixture. Hubert R. Ives, Montreal, Canada. Application filed November 25, 1904.

A metal bedstead having a hollow post with an opening in its side, has an electric lamp with connections inclosed within the post opposite the opening, a part of the post being movable to control the light from the lamp.

819,071. Electrical Measuring Instrument. Fredrick A. La Roche and Maurice C. Rypinski, New York, N. Y. Application filed November 8, 1904.

In an electrical measuring instrument is provided a permanent magnet and a core therefor outlining an intense field of force. A movable coil is located in the field of force with means for supporting the coil consisting of two oppositely disposed filaments and a support for each filament, each of the supports being provided with means for adjusting its filament longitudinally without moving it axially.

819,073. Means for Charging Storage Batteries of Telephone Systems. Talbot G. Martin, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed December 12, 1904.

A telephone system comprising a manual exchange and an automatic exchange has a trunk line extending between the two exchanges, a storage battery at the manual exchange, a source of current at the automatic exchange for charging the storage battery, together with a charging circuit including one side of the trunk line.

819,082. Electric Relay. Michael Setter, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed October 31, 1904.

A relay comprises a magnet shell made from a sheet metal blank or stamping, and circuit-controlling contacts, together with an L-shaped armature having lateral bearing portions at its elbow.

819,083. Electric Bell. Michael Setter, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed October 31, 1904.

Details are described.

819,084. Telephone Transmitter. Michael Setter, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed October 31, 1904.

A telephone transmitter comprises a diaphragm, a sheet-metal binding, a concave cover plate having its perimeter secured to the marginal portions of the diaphragm, a casing providing a chamber from which the diaphragm and cover plate are removable as a unit and a resistance-bearing device within the fully inclosed space provided between the diaphragm and cover plate.

819,085. Strip of Lamp Jacks. Michael Setter, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed January 13, 1905.

A sheet-metal body is provided with an integral front plate having openings, and provided with integral partitions. Several spring jacks are mounted upon the body, the openings being arranged opposite the spring jacks, and the partitions alternating with the jacks.

819,095. Communicating Electric System. Alexander M. Stark, Toronto, Canada, assignor to the Stark Electrical System, Limited, Toronto, Canada. Application filed August 9, 1902.

A sub-station circuit, a line signal closing circuit tapped on the sub-station circuit, an auxiliary circuit, a line signal through which the auxiliary circuit is closed by the circuit of the current through the line signal closing circuit, and a line signal opening circuit formed by the closing of two sub-station circuits, are the main features of the system.

819,146. Trolley-wheel Guard. James H. Lane and Uriah Gulnick, Newark, N. J. Application filed May 3, 1905.

Two L-shaped arms pivoted at the trolley wheel axle normally project over the face of the wheel and hold the wire in place. On pulling down on the cord the arms are turned to release the wheel from the wire.

819,159. Storage-battery Jar. Roger M. Newbold, Louisville, Ky., assignor to the Adams & Westlake Company. Application filed April 24, 1905.

A battery jar closure comprises a rigid plate and a soft flange projecting from the margin of the plate and inclined upwardly, the flange presenting a flat face to the walls of the jar.

819,160. Pole Changer. Roger M. Newbold, Louisville, Ky., assignor to the Adams & Westlake Company. Application filed July 8, 1905.

Features of originality are an oscillatable switch, a rotatable member, a spring-closed friction band operatively connected with the switch and frictionally engaging the rotatable member and means for spreading the band as the switch reaches the end of its travel.

819,190. Electric Signaling System. Jean F. Webb and Clayton E. Frederickson, Denver, Colo. Application filed April 25, 1905.

The signaling system embodies a pawl and ratchet step-by-step mechanism which controls the circuits.

819,195. Electric Elevator. Parvin Wright, Los Angeles, Cal. Application filed January 19, 1905.

Combined with an electric elevator motor are a brake, a controlling circuit for the motor, means operated by the controlling circuit to control the brake, a circuit for the motor independent of the controlling circuit and means operated by the independent circuit to control the brake.

819,206. Combined Fuse and Switch. Frederick H. Cheyne, Indianapolis, Ind., assignor of one-half to Gordon E. Varney, Indianapolis, Ind. Application filed January 12, 1905.

In a combined fuse and switch are suitable contacts, suitable fuse plugs, a holder handle in which the plugs are mounted, a support for the holder handle and movement-limiting devices whereby the movement of the holder handle relative to its support is limited.

819,223. Lining for Electric or Other Furnaces and Method of Preparing the Same. Herman L. Hartenstein, Chicago, Ill., assignor to the Electrochemical and Development Company, Pierre, S. D. Application filed July 23, 1902. Renewed September 30, 1905.

The method of preparing linings for electric or other furnaces consists in mixing together asbestos, a hydrocarbon adherent, cream of lime and coke, and then forming the mixture into bricks, blocks or slabs.

819,224. Electric Furnace. Herman L. Hartenstein, Chicago, Ill., assignor to the Electrochemical and Development Company, Pierre, S. D. Application filed July 26, 1902. Renewed September 30, 1905.

Embodied in the furnace are a furnace chamber, electrodes arranged to project into the chamber, means for adjusting the relative inclination of the electrodes, means for adjusting the proximity of the electrodes and means for adjusting the extent of projection of the electrodes into the chamber, all of the adjusting means being independent of each other. (See cut on next page.)

819,231. Alarm System and Apparatus. John M. Latimer, Flushing, N. Y., assignor to the Consolidated Fire Alarm Company, New York, N. Y. Application filed September 13, 1905.

An alarm system and apparatus comprises a local circuit having two branches, a battery, an alarm-signal magnet normally connected in the circuit at one end, a trouble-signal magnet normally connected in the circuit at the other end, signal-transmitting mechanism, means for releasing the mechanism controlled by the trouble-signal magnet, a grounded connection from the battery, and means for automatically opening the ground before the completion of a trouble alarm.

819,242. Alternating-current Meter on Ferraris Principle. Emanuel Morck, Frankfort-on-the-Main, Germany. Application filed May 10, 1904.

In an alternating-current meter on Ferraris principle are means providing an additional torque or turning mo- [illegible] meter.

819,267. Telephone Transmitter. [illegible], Chicago, Ill., assignor to the [illegible] board and Supply Company, Chicago, Ill. Application filed October 27, 1902.

Associated with [illegible] single chamber [illegible] the material [illegible] electrodes.

819,293. Electric Railway. Mathias A. [illegible], New York, N. Y. Application filed May 19, 1905.

The housing for the third rail of an electric railway is made the basis of the patent. [illegible] slide rods successively [illegible] in and out of contact.

819,322. Electric Signaling. Jacob B. Struble, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed November 16, 1901.

Signaling mechanism comprises a closed track circuit, an alternating-current supply for the track circuit, a relay in circuit with the closed track circuit, a polarized and a neutral armature controlled by the relay and a signal circuit controlled by the armature.

819,326. Control of Apparatus Governing the Passage of Cars or Vehicles Along a Railway. Mathias Van Asch Van Wyck, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed October 26, 1905.

Combined with a block section of a railway are a train-stop, the trip of which is usually in its operative position, an open circuit for the relay and means affected by a train approaching the block section to close the circuit to have the train-stop move its trip to its inoperative position, and again affected by the same train after it has passed the train-stop to again open the circuit.

819,327. Control of Apparatus Governing the Passage of Cars or Vehicles Along a Railway. Mathias M. Van Asch Van Wyck, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed November 10, 1905.

In combination with railway signals are semaphores which are usually in their danger position, a train-stop adjacent such railway signal, the trip of which is usually in its operative position, and an open circuit for each train-stop, the circuit being arranged to be closed when a semaphore of a railway signal gives a clear indication.

819,355. Potentiometer. Morris E. Leeds and Edwin F. Northrup, Philadelphia, Pa., assignors to the Leeds & Northrup Company, Philadelphia, Pa. Application filed August 2, 1905.

In a potentiometer are an extended wire, a cylinder upon which the wire is wound in the form of a helix, a contact maker arranged to bear upon the wire, a movable support for the contact mounted to cause the contact to follow the convolutions of the helix and a protecting hood mounted for movement with the contact support and arranged to extend over the extended wire.

819,360. Electrical Switch. Walter S. Mayer, Philadelphia, Pa., assignor to A. Edward Newton, Daylesford, Pa., and William M. Scott, Philadelphia, Pa. Application filed March 22, 1905.

A movable contact member, a toggle for operating the contact member, an actuator and locking connections between the toggle and the actuator whereby the toggle may overtravel when operated by the actuator and is underset when unlocked from the actuator are the parts of the switch.

819,389. Electric Wire Terminal. Joseph D. Warren, Providence, R. I. Application filed May 2, 1905.

Mechanical features of a terminal for holding electrical conductors are described.

819,397. Railway Signal. Rollin A. Baldwin, South Norwalk, Conn., assignor to the Baldwin & Rowland Switch and Signal Company. Application filed February 16, 1904.

A local circuit has a contact in position to engage the traveling contact of an electric-railway car, a solenoid being included in the circuit. Means are provided for effecting relative adjustment of the solenoid and its core, and means operable by a movement of one of the solenoid and core elements directs or controls the movement of the car.

819,418. Electrical Receptacle. Philip H. Fielding, New York, N. Y. Application filed November 17, 1904.

A support for electric lamps is described.

819,436. Magnetic Metal Collector for Gear Casings. George H. Jones, Philadelphia, Pa. Application filed July 14, 1905.

Combined with a gear casing are magnetic means to form for attracting metal particles.

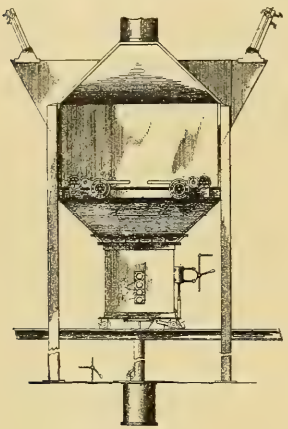
819,437. Means for Packing Joints. James H. Jones, Chicago, Ill. Application filed December 5, 1904.

A packing ring in an incandescent lamp receptacle is adapted to grasp and hold the bulb with a wedging action.

819,505. Electric Release for Target Traps. Joseph R. Birch, St. Louis, Mo. Application filed August 28, 1905.

Electromagnetic means release the catch which holds the trap arm.

819,522. Telephone Transmitter. Elmer R. Corwin, West Lafayette, and Frederick R. Parker, Lafayette, Ind.; said Corwin assignor to said Parker, Chicago, Ill. Application filed May 6, 1903.



NO. 819,224.—ELECTRIC FURNACE.

In a telephone transmitter are a diaphragm, a rigid portion extending over the diaphragm, a dampener button for the diaphragm and a coil spring supported by the rigid portion and capable of adjustment to adjust the dampener button.

819,524. Oil-break Device for Electric Switches and Circuit-breakers. James H. Delany, Wilkinsburg, Pa. Application filed August 12, 1904.

In a fluid-break electric switch are a fluid-containing chamber, in which are fixed and movable contacts or electrodes, a piston head carrying the movable electrodes and by-pass passages around the piston head and having discharge-openings adjacent to the meeting-points of the contacts.

819,525. Rain Alarm. Vincent A. Dever, Philadelphia, Pa. Application filed May 9, 1905.

Contact in an electric-alarm circuit is closed by an arm in one side of the circuit, the arm being depressed by the weight of the moisture collected by absorbent material carried by the arm.

819,531. Mouthpiece for Telephones. Frank C. Fisher, Cheltenham, Pa., and Walter C. Culin, Camden, N. J. Application filed October 30, 1905.

Details are described.

819,559. Circuit-breaker. Joseph La Cos, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 25, 1904.

Combined with the movable contact carrier are an arm thereon, a roller pivoted in the arm, a latch to hold the circuit-breaker closed, provided with a tooth bearing against the periphery of the roller, and a horn on the latch to rest on the roller.

819,560. Method of Producing a Constant Magnetization by Means of Alternating Currents. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed September 10, 1904.

The method of producing a substantially constant unidirectional flux in a magnetic circuit provided with an exciting-winding consists in impressing polyphase voltages on the winding and varying the number of effective turns connected to each phase of the voltages at the same rate as that at which the voltage of that phase varies. (See cut).

819,563. Electric Motor Controller. John B. Linn, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 1, 1902.

Fixed contacts, each contact comprising several spring members, are associated with movable contacts for engaging the spring members of each of the several fixed contacts. Other movable contacts connect the adjacent spring members of different contacts.

819,571. Alternating-current Motor Control. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 15, 1904.

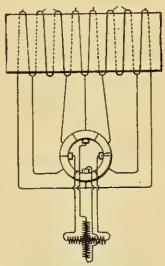
In a repulsion motor having two sets of commutator brushes, the sets being displaced from each other by approximately 90 electrical degrees, and both sets being displaced from the line of magnetization of the primary member, are means for short-circuiting one set, a switch adapted to close a circuit between the brushes of the second set and a magnet winding controlling the switch and connected in circuit with the brushes of the second set.

819,572. Alternating-current Motor and Starting Switch. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 9, 1904.

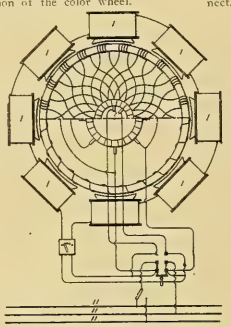
In an alternating-current motor are a rotor winding provided with a commutator, commutator brushes and connections short-circuiting the rotor on a definite line, a starting switch for the motor having a movable switch member adapted to close the circuit of the rotor winding on a second line at an angle to the first and means for arresting the movement of the switch member until the potential of the rotor winding on the second line falls to a predetermined value. (See cut.)

819,611. Light-projecting Apparatus. Edmond W. Sohlberg, Kansas City, Mo., assignor of two-thirds to Martin Lehman and Joseph L. Stiebel, Kansas City, Mo. Application filed December 30, 1904.

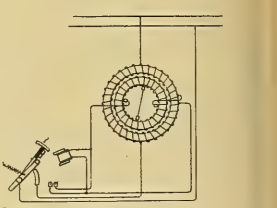
Light-projecting apparatus comprises a casing for inclosing an electric light, means for effecting oscillation of the casing in two planes disposed at angles to each other, a light-focusing device carried by the casing and adjustable toward and from the light-producing device, a color wheel rotatively mounted on the casing and adjustable with the focusing device and adapted to intercept the focused rays of light, means for effecting rotation of the color wheel and electromagnetic means for controlling step-by-step rotation of the color wheel.



NO. 819,550.—ALTERNATING-CURRENT METHOD OF PRODUCING CONSTANT MAGNETIZATION.



NO. 819,613.—MOTOR CONTROL.



NO. 819,572.—ALTERNATING-CURRENT MOTOR AND STARTING SWITCH.

819,613. Controlling the Speed of Motors. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 26, 1902.

Combined with a multipolar electric motor are means whereby the active armature circuit may be of the parallel-wound or series-wound type, at will, the number of poles of the motor remaining unchanged. (See cut.)

819,620. Method of Operating Constant-current Transformers. Matthew O. Troy, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 12, 1903.

The method of operating a constant-current transformer at a maximum load less than that corresponding to the full load for which the transformer is designed consist in utilizing less than the full number of secondary turns and adding to the number of primary turns normally employed.

819,624. Incandescent Electric Lamp. Howard I. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 31, 1904.

In the construction of this lamp a vitreous envelope has a thin metal band shrunk about a portion of it while the parts are hot, so as to make intimate contact therewith. A metal conductor or wire passes through the envelope from the inside and makes contact with the band or ring on the outside.

819,625. Electric Muffle. Erland Zell, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 28, 1902.

An electrical furnace consists of an iron tube and a tubular casing surrounding the tube having end pieces centrally apertured to receive the tube, the tube being secured against longitudinal movement with respect to one of the end pieces and free to move in either direction through the other end piece.

819,626. Motor Starting and Regulating Rheostat. Paul H. Zimmer, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 28, 1905.

In a rheostat are the combination with armature and field resistances of a controlling arm therefor having a bias to the starting position of the armature resistance, a switch adapted to be closed to short-circuit the arm by the movement of the latter to running position and means in connection with the arm for varying the field resistance.

819,627. Protective Means for Alternating-current Systems. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 16, 1903.

An alternating-current system comprises a switch or circuit-breaker, a reverse-current device for tripping the switch provided with a series coil governed by current in the system, and a potential coil energized by an energy-storing device.

819,630. Oscillating Motor Fan. Ralph E. Barker, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 10, 1903.

An electric fan is mounted so as to oscillate, being provided also with a counterbalancing weight.

819,645. Snap Switch. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 10, 1902.

Details are described.

819,650. Electric Heater. Johannes Härden, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 27, 1905.

An electric heater comprises a receptacle and a resistance for heating the latter, one portion of which has a positive and the other a negative resistance temperature coefficient, both portions being in heat-conductive relation with the receptacle.

819,677. Electric Block-signal System. Paul J. Simmen, Chico, Cal. Application filed July 31, 1905.

In an electrical block-signal system for railways are the combination of an electrically continuous rail, electrically insulated sections of the other rail of the track, a group of rails for each section at each side of the track and transversely opposite to the corresponding section, an electrical connection between one member of the group on each side with the section in advance, an electrical connection between another member of the group and the next section but one in advance, and so on for each member of the group, the direction of such electrical connection being symmetrical in regard to the corresponding groups and sections with which they connect.

819,702. Locking Socket for Electric Lights. Jeremiah Murphy, Chicago, Ill. Application filed June 11, 1904.

Details are described.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on May 7, 1906:

402,562. Electric-signalling Apparatus. J. P. Coleman, Swissvale, Pa.
402,563. Method of Treating Underground Electrical Conduit With Chemical Substances. A. E. Colgate, New York, N. Y.
402,565. Conduit for Electric Wires. G. W. Cook, Detroit, Mich.
402,566. Underground Conduit for Electrical Conductors. G. W. Cook, Detroit, Mich.
402,586. Distribution of Electricity by Secondary Batteries. W. W. Griscom, Haverford, College, Pa.
402,592. Electric-wire Insulator. A. W. Heaviside, Newcastle-upon-Tyne, England.
402,613. Electric Bell. W. K. Rainey, New Orleans, La.
402,626. Electrical Annunciator. B. Smead, Chicago, Ill.
402,657. System of Electrical Distribution and Conversion. T. H. Hicks, Detroit, Mich.
402,717. Telegraph Instrument. C. G. Burke, Richmond Hill, N. Y.
402,752. Insulator. F. M. Locke, Victor, and J. Lapp, Honeoye Falls, N. Y.
402,753. Cutout. O. P. Loomis. Somerville, Mass.
402,754. Automatic Circuit-controller for Electric Lights. O. P. Loomis, Somerville, Mass.
402,779. Electrically Controlled Apparatus for Treating Emphysema. A. Steinhoff, Briesnitz, Saxony, Germany.
402,810. Supporting and Cross Connecting Electric Wires. W. I. Denyer, Boston, Mass.
402,823. Electric Clock. E. G. Hammer, Brooklyn, N. Y.
402,828. Circuit-closer for Railway Car Telegraphs. G. L. Hopkins, Manchester, N. H.
402,829. Coupler for Electric Conductors. G. L. Hopkins, Manchester, N. H.
402,832. Electric Railway. R. M. Hunter, Philadelphia, Pa.
402,836. Insulator and Holder for Electric Railways. B. Jennings, San Jose, Cal.
402,890. Electric or Cable Railway Car, S. A. Bamis, Springfield, and L. Pfingst, Boston, Mass.
402,912. Rheostat. J. B. Entrikin, Des Moines, Iowa.
402,915. Portable Galvanic Battery. A. Friedlander, Berlin, Germany.
402,928. Telephone System. F. A. Holcomb, Grand Rapids, Mich.
402,929. Telephone System. F. A. Holcomb, Grand Rapids, Mich.
402,960. Electric Bell. R. R. Moffatt, New York, N. Y.
402,963. Cable Railway. A. R. Parkeson, Monongahela City, Pa.
402,986. Electric System of Communication. E. B. Shafer, New York, N. Y.
403,005. Process of Electric Soldering, Brazing and Welding. E. Thomson, Lynn, Mass.
403,006. Method of Electric Welding and Brazing. E. Thomson, Lynn.
403,009. Slotted Conduit for Electric Conductors. C. J. VanDepoele, Chicago, ill.
403,010. Electric Connection for Railway Rails. C. J. VanDepoele, Chicago, Ill.
403,011 Electric Locomotive. C. J. VanDepoele, Chicago, Ill.
403,017. Automatic Governor for Electric Motors or Dynamo Electric Machines. S. S. Wheeler, New York, N. Y.

// WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVIII. CHICAGO, [illegible]

Flywheel Accident in Plant of Mansfield (Ohio) Railway, Light and Power Company.

Seldom does a flywheel accident cause more damage to property than did the one which occurred in the plant of the Mansfield Railway, Light and Power Company of Mansfield, Ohio, on May 9th. (Mansfield is about 70 miles southwest of Cleveland and has a population of about 20,000.) A rough estimate on the damage to the plant alone is $60,000 to $100,000, to say nothing of that which resulted from loss on the street-lighting contract and other contracts for light and power, and the stoppage of the street-railway service. Fortunately, however, no one was fatally injured; only one man was within reach, and he received injuries which will not be fatal.

It seems that the accident, which occurred about 4:45 p. m., was unavoidable. The flywheel which let go was about 20 feet in diameter. It went to pieces with an explosive noise which could be distinctly heard at the baseball park, over a mile away. When the wheel went to pieces it tore out the inside framework of the building as cleanly as if it had been cut away with a saw. A large hole was cut in the roof of the structure, and a large portion of the flywheel, broken into small pieces, was distributed around the neighborhood for several blocks.

The cause of the accident is unknown, but it is believed that either the cylinder head blew out, causing the breaking of the wheel, or else the wheel broke under the influence of abnormal centrifugal force, resulting from failure of the governor. The engine is a total wreck, and although there are two other engines in the plant, one of these was partially disabled. As the latter were both small engines, there was only a small portion of the original generating capacity left to do business after the accident.

Of the accompanying illustrations, one shows the damaged interior of the station, the effects of the accident being very evident. The other is an exterior view of the station after the occurrence of the accident.

Charles Harbaugh, a fireman who was injured, was the only man present in the engine room at the time of the accident. After regaining consciousness at the hospital he said that just before the accident he noticed something wrong with the governor, and he immediately seized the [illegible] engine, calling at the same time [illegible] on duty. While he was turning [illegible] belt went to pieces, he said, [illegible] everything went wild.

Whatever the true cause of the accident may have been, it is certain that the results were [illegible] enough. Some of the walls were left standing without apparent support. Pieces of the wheel which went through the roof cut off one of the tall steel stacks a few feet above the boiler house roof. Other pieces struck the tall brick stack which [illegible]

[illegible] Had [illegible] would have resulted.

[illegible] along Main Street [illegible] flying fragments.

The moment the [illegible] rendered powerless [illegible] was stopped [illegible] necessity. Incandescent lamps everywhere were shut off and the people had the novel experience of returning once more to the kerosene lamp, and the stores did a rushing business in selling lamps and oil. Had the accident occurred two hours later the people would not have had time to prepare, and much more inconvenience would have resulted. There was a little moonlight on that night, just enough to show the "dead" street cars at all points along the tracks, standing anywhere that the power left them.

It is a hardship to be thrown back on the methods and appliances of former years, and Mansfield certainly had a taste of this. Practically everyone was affected. Stairs were used instead of elevators where electricity had been used for power; the oil lamp, which had taken a back seat in the march of progress, was eagerly sought; electric coffee grinders and all sorts of labor-saving appliances gave way to the hand-operated devices; dentists were compelled to dig up their abandoned foot-power engines; in the postoffice the canceling machines gave way to the old hand stamps.

The president of the Mansfield Railway, Light and Power Company is H. M. Byllesby of Chicago and the general manager is W. F. Raber of Mansfield. The capacity of the plant was 1,500 to 2,000 horsepower.

Interior of Damaged Station, Showing Effects of Accident.

Exterior of Power House after Bursting of Flywheel.

THE RECENT FLYWHEEL ACCIDENT IN CENTRAL STATION IN MANSFIELD, OHIO.

Control of the Direction of Electric Waves.[1]

By William Marconi, LL.D., D.Sc

This note relates to results observed when for the usual vertical antenna employed as radiator or absorber in wireless-telegraph stations there is substituted a straight horizontal conductor placed at a comparatively small distance above the surface of the ground or water.

When an insulated horizontal wire (AB), such as is shown in Fig. 1, is connected at one end to a sphere of a spark gap, the other sphere of which is earthed, and sparks are caused to pass between the spheres, it will be noticed on investigating the space around such an oscillator that the radiations emitted reach a maximum in the vertical plane of the horizontal wire (AB) and proceed principally from the end (A), which is connected to the spark gap, whilst the radiation is nil, or reaches a mini-

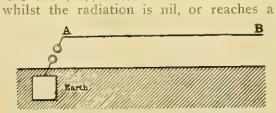


FIG. 1.

mum, in directions which are approximately 100 degrees from the direction in which the maximum effect occurs.

I have also noticed that any horizontal conductor of sufficient length placed upon or at a short distance above the surface of the ground, and connected at one end through a suitable detector to earth, will receive with maximum efficiency only when the transmitter is situated in the vertical plane of the horizontal receiving conductor, and in such a direction that the end connected to the detector and to the ground is pointing toward the transmitting agency.

If, therefore, such a horizontal conductor be swivelled about its earthed end in a horizontal plane, the bearing or direction of any transmitting station within range of the receiver can be ascertained.

I have carried out a number of tests with transmitters and receivers having radiating or receiving antennæ or conductors arranged as follows:

(1) Transmitting conductors consisting of horizontal wires, the radiations being received at a distance by means of the usual vertical wires suitably attuned.

(2) Both transmitting and receiving conductors consisting of horizontal wires.

(3) Transmitting conductors consisting of one or more vertical wires, with or without capacity areas

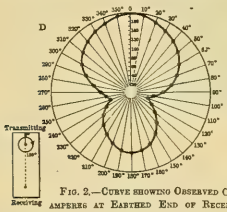


FIG. 2.—CURVE SHOWING OBSERVED CURRENT IN MICRO-AMPERES AT EARTHED END OF RECEIVING CONDUCTOR UNDER THE CONDITIONS OF DIRECTION SHOWN BELOW.

Transmitting Conductor: Horizontal, rotating from 0 deg. to 360 deg., 1.5 metres above ground. Receiving Conductor: Vertical, fixed; height, 18 metres. Length of Transmitting Conductor, 60 metres. Receiving Conductor, 18 metres. Distance of Transmission, 300 metres.

at the top, such as have been generally employed in wireless telegraphy, the radiations being received by means of horizontal conductors.

At long distances I almost invariably used as a detector my magnetic receiver.[2] At shorter distances I utilized a Duddell thermo-galvanometer[3] by means of which it was possible to measure the root-mean-square values of the currents induced by the oscillations in receiving wires disposed in various positions relative to the transmitting conductors.

With arrangements such as are referred to in (1) the following tests have been carried out:

1. Transmitter.—Horizontal wire 100 meters in length, direct excitation, spark length two centimeters, wave length approximately 500 meters.

Receiver.—A vertical wire eight meters in length tuned to the period of the transmitter by means of a syntonizing coil, and connected to a magnetic detector and to earth in the usual manner.

Results.—Signals quite distinct at 16 kilometers in the vertical plane of the horizontal transmitting wire and in the direction of its earthed end; weak at 10 kilometers in the same vertical plane, but in the reverse direction; inaudible at six kilometers at right angles to the directions above mentioned.

2. Transmitter.—(At Mullion, Cornwall); consisting of horizontal conductor 150 meters in length, composed of four parallel wires about three millimeters in diameter, placed 1.50 meters apart, supported at a height of 20 meters, and all connected to earth through the spark gap of an induction coil placed in a building on the ground; spark length about two centimeters.

Receiver.—At the Haven, Poole (distance 240 kilometers); consisting of vertical wire 50 meters long, connected through a syntonizing coil to a magnetic detector and to earth.

Results.—A movement of 15 degrees of the plane of the transmitting conductor out of the right direction was sufficient to cause signals to become indetectable at Poole.

Polar diagram (D) (Fig. 2) gives the values of the received current in micro-amperes, with conditions as marked under the diagram. The values of current in micro-amperes shown in each diagram are the mean of a considerable number of readings, the transmitted energy being kept as nearly as possible constant by means of a suitable interrupter applied to the sending induction coil.

With the arrangement mentioned at (2)—i. e., both transmitting and receiving conductors horizontal, the following results, among others, were obtained:

1. Transmitter.—Conductor 200 meters in length, supported at a height of 15 meters above ground; spark length about two centimeters.

Receiver.—Similar conductor supported one meter above ground connected at one end to a detector and to earth as usual.

Results.—In the direction for maximum effect (as already explained) readable signals at 25 kilometers. At about 90 degrees from said direction at 12 kilo-

FIG. 3.—CURVE SHOWING OBSERVED CURRENT IN MICRO-AMPERES AT EARTHED END OF RECEIVING CONDUCTOR UNDER THE CONDITIONS OF DIRECTION SHOWN BELOW.

Transmitting Conductor: Horizontal, revolving from 0 deg. to 360 deg., 1.50 metres above ground. Receiving Conductor: Horizontal, fixed, 1.50 metres above ground. Length of Transmitting Conductor, 60 metres. Receiving Conductor, 60 metres. Distance of Transmission, 500 metres.

meters, nothing; in the same direction at five kilometers, weak signals.

2. Transmitter.—Consisting of four wires, each 330 meters in length, separated from one another by a distance of 1.4 meters, supported at a height of 20 meters above ground and connected by means of a nearly vertical conductor to a spark producer; spark length, three centimeters.

Receiver.—Consisting of one wire 220 meters in length, covered with insulating material, placed on the ground and connected to the end nearest the sending station through a syntonizing coil to a magnetic receiver and to earth.

Results.—When in the vertical plane of the transmitting antennæ, and in the best direction, weak but distinct signals were received at a distance of 160 kilometers; at 45 degrees from said direction and at 150 kilometers distance, nothing was received; at 25 degrees from the best direction, and at 160 kilometers distance, very weak signals were received.

The results over shorter distances are given by the readings obtained on the thermo-galvanometer, and are shown in the polar diagrams E and B (Figs. 3 and 4).

With arrangements such as are mentioned at (3)—i. e., the transmitting conductor consisting of

FIG. 4.—CURVE SHOWING OBSERVED CURRENT IN MICRO-AMPERES AT EARTHED END OF RECEIVING CONDUCTOR UNDER THE CONDITIONS OF DIRECTION SHOWN BELOW.

Transmitting Conductor: Horizontal, fixed, 1.50 metres from ground. Receiving Conductor: Horizontal, rotating from 0 deg. to 360 deg., 1.50 metres from ground. Length of Transmitting Conductor, 30 metres. Receiving Conductor, 30 metres. Distance of Transmission, 225 metres.

the usual vertical type and the receiving conductor horizontal, the following results among others merit attention:

At Clifden, Connemara, Ireland, by means of a horizontal conductor 230 meters in length, laid on the ground and connected at one end to a magnetic receiver and to earth, it is possible to receive with clearness and distinctness all the signals transmitted from the Poldhu station (situated 500 kilometers distant) provided that the free end of the conductor points directly away from the direction of Poldhu. No signals can be received if the horizontal wire at Clifden makes an angle of more than 35 degrees with the line of direction of Poldhu.

The signals from the Admiralty station at Scilly can be received at Mullion, Cornwall (distance about 85 kilometers), by means of a horizontal wire 50 meters in length, two meters above ground, provided the wire is placed in a radial position with respect to the sending station and with its free end pointing away from it. But it is unreceptive if placed so as to make an angle of more than 20

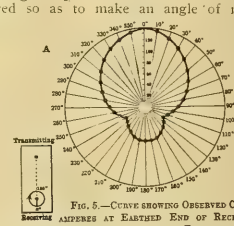


FIG. 5.—CURVE SHOWING OBSERVED CURRENT IN MICRO-AMPERES AT EARTHED END OF RECEIVING CONDUCTOR UNDER THE CONDITIONS OF DIRECTION SHOWN BELOW.

Transmitting Conductor: Vertical, fixed; height, 44 metres. Receiving Conductor: Horizontal, rotating from 0 deg. to 360 deg., 1.50 metres above ground. Length of Transmitting Conductor, 45 metres. Receiving Conductor, 30 metres. Distance of Transmission, 680 metres.

degrees with the line of direction of the station at Scilly.

Some tests have also been carried out for the Admiralty in the vicinity of Poldhu, in conjunction with H. M. S. Furious. For this purpose eight horizontal wires 60 meters in length, supported at a height of about two meters, were arranged radially and made to converge in a small building, situated in a field near Poldhu. These radial wires were so arranged as to divide the circle into eight equal sectors. By means of a suitable switch any one of the ends of these wires at the position where they converge together could be connected to earth through a magnetic receiver.

The wireless telegraph station on the Furious consisted of an ordinary vertical-wire aerial about 50 meters in length, connected to a suitable spark-gap. The station on the ship transmitted at intervals, and the ship followed a course describing an arc of about 180 degrees round Poldhu, keeping at distances varying up to 16 miles. By means of the horizontal wire arrangement the bearing of the ship from Poldhu could be determined at any time by noting on which particular wire or wires the reception of signals was strongest, and also by observing which wires were non-receptive.

It was also found possible to receive simultaneously and without mutual interference different signals sent by means of oscillations of the same wave-

FIG. 6.—CURVE SHOWING OBSERVED CURRENT IN MICRO-AMPERES AT EARTHED END OF RECEIVING CONDUCTOR UNDER THE CONDITIONS OF DIRECTION SHOWN BELOW.

Transmitting Conductor: Vertical, fixed; height, 44 metres. Receiving Conductor: Horizontal, rotating from 0 deg. to 360 deg. on ground. Length of Transmitting Conductor, 45 metres. Receiving Conductor, 30 metres. Distance of transmission, 680 metres.

length coming from the ship and from the Lizard wireless station (10 kilometers away) whenever the ship was in such a position that its bearing from Poldhu made an angle of at least 50 degrees with the bearing of the Lizard station.

For further values and curves of received current in receivers I refer to diagrams A, A' C, C'. (Figs. 5, 6, 7 and 8.)

Referring generally to the results mentioned in this note, I have observed that, in order that the effects should be well marked, it is necessary that the length of the horizontal conductors should be great in proportion to their height above the ground, and that the wave-lengths employed should be considerable—a condition which renders it difficult to carry out such experiments within the walls of a laboratory.

I have found the results to be well marked for wave-lengths of 150 meters and over, but have not been able to obtain as well-defined results when employing much shorter waves—the effects following some law which I have not yet had time to investigate. There also appears to be a decided advantage, in so far as effects at long distances are concerned, in utilizing a directly excited radiating conductor—that is, an insulated conductor in which the high-frequency oscillations are started by means of a suitable spark discharging it to earth or to another body, as was usual in my early forms of Hertzian-wave wireless-telegraph transmitters.

If inductive excitation is employed, that is, if the oscillations are induced in the radiating conductor from another oscillating circuit, the comparative results in various directions appear to be in the same proportions as those noticed when using the

1. A paper read before the Royal Society, March 22d. Communicated by Dr. J. A. Fleming. From the London Electrician. The full title of this paper is: "On Methods Whereby the Radiation of Electric Waves May be Mainly Confined to Certain Directions, and Whereby the Receptivity of a Receiver May Be Restricted to Electric Waves Emanating from Certain Directions."

2. See Proceedings of Royal Society, London, 1902, Vol. LXX., p. 341.

3. Philosophical Magazine, 1904, Vol. VIII., p. 91.

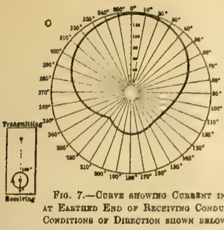


FIG. 7.—CURVE SHOWING CURRENT IN MICRO-AMPERES AT EARTHED END OF RECEIVING CONDUCTOR UNDER THE CONDITIONS OF DIRECTION SHOWN BELOW.

Transmitting Conductor: Poldhu Station Aerial, consisting of multiple vertical Conductors with large capacity at the top. Receiving Conductor: Horizontal, rotating from 0 deg. to 360 deg., 1·50 metres above ground. Length of Receiving Conductor, 80 metres. Distance of Transmission, 650 metres.

method of simple excitation, but the distances over which the effects can be detected are much smaller at parity of the power employed at the transmitter.

I have noticed that the most advantageous length of the receiving horizontal wires, in order to obtain results at maximum distances, is about one-fifth of the length of the transmitted waves if the wires are placed at a distance above the ground; but the receiving wires should be shorter if placed on the ground. It would be instructive to investigate more thoroughly the difference of the results and curves obtained by means of horizontal wires placed at different heights above ground and also the effect of varying the length of the wires.

When using horizontal receiving wires aranged as described in this note I have often noticed that the natural electrical perturbations of the atmosphere or stray electric waves, which are generally prevalent during the summer, appear to proceed from certain definite directions, which vary from time to time. Thus, on certain days the receiving instruments, when connected to wires which are oriented in such a way as to possess a maximum receptivity for electric waves coming from the south, will give strong indications of the presence of these natural electric waves, whilst on differently oriented wires the effects are at the same time weaker or imperceptible. On other days these natural electric waves may apparently come from other directions.

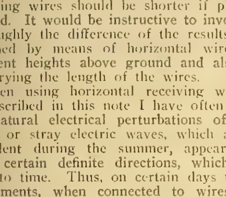


FIG. 8.—CURVE SHOWING OBSERVED CURRENT IN MICRO-AMPERES AT EARTHED END OF RECEIVING CONDUCTOR UNDER THE CONDITIONS OF DIRECTION SHOWN BELOW.

Transmitting Conductor: Poldhu Station Aerial, consisting of multiple vertical Conductors, with large capacity at the top. Receiving Conductor: Horizontal, rotating from 0 deg. to 360 deg. on ground. Length of Receiving Conductor, 80 metres. Distance of Transmission, 650 metres.

It would be exceedingly interesting to investigate whether there exists any relation between the direction of origin of these waves and the known bearing or direction of distant terrestrial or celestial storms, from whence these stray electric waves most probably originate. A considerable number of observations would be necessary to determine whether there exists any relation between the bearing of storm centers and the direction of origin of these natural electric waves. I propose to carry out some further investigations on the subject.

I ought to explain that the experiments described in this note were carried out during a period of many months, and that as other results achieved over great distances coincide generally with those here described, I have not thought it necessary to make special reference to them.

I should also mention that the tests over short distances were carried out over practically flat country, while over considerable distances they took place over hilly country, such as the West of England, and in some cases partly across sea and partly across land.

New "Wrinkles" in Drafting Rooms.

Much time is taken in lettering the titles on drawings, but in up-to-date drafting rooms this work is now done with the aid of a printing press. With a small job press especially made for this work and a few fonts of type the titles are quickly and neatly printed on the tracings or other drawings, saving time and making a better job. The economy of time is especially marked where there is a series of drawings, each bearing, in the title panel, one or more lines common to all. Ordinary printer's ink is not used, but an ink especially prepared for the purpose.

The vertical filing system, heretofore largely used for cards, photographs, catalogues and such small deer, is now adapted for large drawings, say four by five feet. Special receptacles and cases are made, and it is found that the method has marked advantages over the old system of filing flat in drawers in cabinets.

Alternating-current Signal Circuits in the New York Subway.[1]

By J. M. [illegible]

Up to a few [illegible] automatic signals had [illegible] almost uniform arrangement of [illegible] in which one installation [illegible] other only in detail of construction [illegible] character of battery. As a [illegible] then elapsed since the first [illegible] block signals had been installed [illegible] of design seemed to indicate that [illegible] time it would only be necessary for a railroad company to purchase standard parts [illegible] the number of signals required, decide whether they would use storage, gravity, or [illegible] for their track circuits, and proceed with the installation.

Every signalman knew that such batteries had their limitations for track-circuit work, as they often had signals act mysteriously on account of stray currents from electric railroads becoming mixed up with the track circuits. While these conditions caused many detentions to traffic, yet, as there was nothing better on the market, the railroad companies took the many detentions as necessary evils which had to be tolerated.

With the advent of the high-speed electric roads it was realized that they would have to be signaled, but as the rails were used for returns for the power current, it was manifestly impossible to use batteries for track circuits. It was therefore necessary to employ for such circuits a fluid of such character to operate track relays as would not be hindered by the power current, and the relays themselves would not respond to the return current from the motors. Alternating current was found to fulfill these requirements, not alone when direct current is used for motive purposes, but as well when alternating current is used. In designing the instruments to be used in connection with the alternating track circuit, it was necessary to keep in mind that these instruments must respond quickly to the action of alternating current; but when the train shunts the track circuit the return power circuit, whether direct or alternating, must not cause the track relay to remain in the clear position.

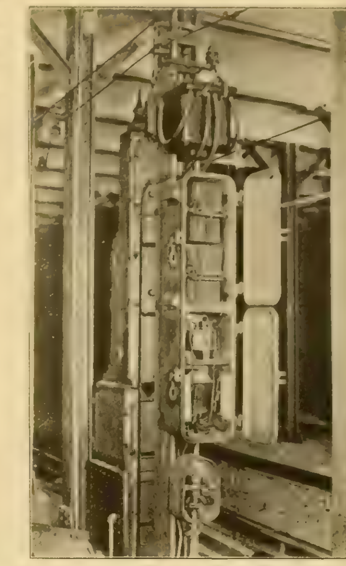
In the New York subway, single-phase 60-cycle current is used for the track circuits and for lighting the signals. This is supplied by turbo-generators in the main power house, and delivered to the sub-stations at a potential of 11,000 volts. The generators carry a constant load, and are entirely independent of the motive-power circuit, thus the electromotive force is constant. In the sub-station the alternating current is stepped down by oil-cooled transformers, with a ratio of 20 to 1, to 550 volts, and delivered at this potential to the signal cables, which extend through the subway from sub-station to sub-station. In normal operation of the system the transformers in all sub-stations are on the signal mains in multiple, and each station is provided with switchboards, on which are mounted the necessary switches, circuit-breakers, ammeters, synchroscopes, all of which are so connected that any sub-station can be cut off the line at any time, without interfering with the connection between adjacent sub-stations.

In case the 11,000-volt 60-cycle cables leading from the main power house to the several sub-stations should break down, there is provided, for reserve power in each sub-station, a 25-kilowatt transformer, which is connected by an oil switch to the 25-cycle 11,000-volt power circuit. This, at a potential of 550 volts, can be thrown on to the signal mains by reversing a double-throw switch. The reversing of this switch cuts the 60-cycle transformer off, and the 25-cycle on the signal mains. The 25-cycle current is not intended for constant operation, as results from its use are not so satisfactory as from the 60-cycle current. This is on account of the considerable voltage fluctuations of the power current. The frequency being lower, the energy consumed when operating the signal system by it is increased about 66 per cent. In the course of a year this would be no small item in dollars and cents.

A transformer with two secondary coils is placed at the exit end of each block, the primary coil being connected across the alternating-current mains. Cut-outs and fuses are placed in each of the primary connections. One of the secondary coils supplies current to the rails for track circuits at a potential of about 10 volts. The other is for lighting the signals at 50 volts potential. In the circuit between the transformer and the block rail is a grid resistance of one ohm and a 50-ampere 500-volt fuse.

The purpose of the resistance is to prevent a dead short-circuit in the secondary coil of the transformer, when a train is in the block. At the signal end of the block the alternating current passes from the rail through a 50-ampere fuse to a grid of one-ohm resistance, then through a relay and impedance coil, which are in multiple to the return rail; then through this rail back to the transformer [illegible] will pick up at [illegible]

[illegible]



SIGNAL APPARATUS IN THE NEW YORK SUBWAY.

a difference of about six volts maintained between rails at the relay end of the block.

As the relay picks up at three volts, this gives a working margin of 100 per cent. The block lengths average about 820 feet. Their lengths are equal to braking distance, plus 50 per cent., when a train is making the greatest speed possible for it to make at that point. Grades are taken into consideration in making these calculations.

As all automatic signals must depend upon the track circuit for their operation, the efficiency of this determines the degree of success of the signaling system; therefore, it is of prime importance that the track circuit should be the best obtainable.

A large portion of the subway signaling has now been in operation for 18 months, which is equivalent to nine years' operation on a road having 304 trains per day.

The number of failures have been small, averaging about 17 per month. The number of alternating-current relay failures have been one to about 75,000,000 movements. About 40 per cent. of the total number of failures have been due to slivers from brakeshoes bridging rail insulation joints in the vicinity of stations.

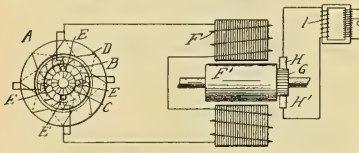
It is hard to realize what this record means, until one goes to a station in the subway, during the busy time of day, and counts the passing trains; at the end of 60 minutes it will be found that 122 trains, or 786 cars, probably carrying 80,000 people, have passed by. If you make a journey over the road, you will find hundreds of signals and automatic stops, all depending for their operation upon the track circuit, and all responding promptly to the action of the passing trains, and all performing their duty toward humanity, by protecting the train in advance from being run into by your train. On this record the signals are to be considered the guardian angels of the subway. You will probably be interested in this precision and almost infallible operation, for the many hundred signals and hundreds of automatic stops you have passed make 200,000 complete operations each 24 hours, and have for a whole month performed their duty with but 13 failures, all on the side of safety, or one detention to nearly one-half million movements.

1. Paper read at the New York meeting of the Railway Signal Association, May 8, 1906. Mr. Waldron is signal engineer for the Interborough Rapid Transit Company.

Stanley's System of Transmitting and Utilizing Low-frequency Currents.

American engineers are still firm in the belief that alternating current is best suited for economical transmission over considerable distances. But the utilization of power so transmitted requires the use of expensive transforming apparatus. William Stanley, the well-known inventor of Great Barrington, Mass., has invented "Means and Method of Transmitting Power" in which alternating currents are supplied to alternating-current motors of the direct-current type. The object is to provide a system (particularly useful for electric railways) in which the principal advantages of alternating-current distribution and direct-current motors are present. Mr. Stanley was granted a patent for his invention on April 17, 1906, the application having been filed March 10, 1905. What follows is condensed from the specifications of his United States patent No. 817,998.

If motors of the induction or transformed type are employed it is difficult to cause the time of flow of the field flux and the secondary current to coincide—that is to say, the flux made by the field coils of the motor is not usefully employed at all times or during every part of each wave interval, and a counter-torque effect is set up by reason of



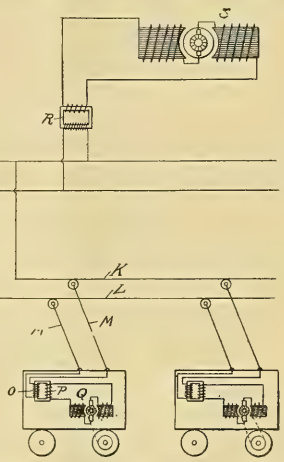
this failure to coincide, with the result that the effective torque or effect of the motor, especially at starting, is much reduced below the value that would be obtained if the currents impressed upon the motor were continuous in direction and of steady value.

If, on the other hand, a motor of the commutator type with laminated or divided iron path for its flux is employed with the alternating currents, other difficulties arise, so that only a portion of the electromotive force impressed upon the motor terminals is usefully employed, a considerable proportion being employed in overcoming the self-induction electromotive force of the motor circuit produced by the rapidly alternating current. Moreover, in such commutator motors the conductors of the armature connected to the commutator are subject to induced currents, and these currents not only do not add to the effective torque of the motor, but cause heating of the armature and flashing and burning of the commutator and brushes to such an extent as to render the operation of the motor uncommercial and unsatisfactory.

Again, where such commutator motors are used with the alternating currents it is necessary, in order that the self-induction of the motor may not consume a very great portion of the electromotive force impressed upon it, that the fields or fluxes of the motor shall be relatively weak in comparison with the fields employed with the motor energized by continuous currents, and the design necessitated by the use of such weak fields increases the size and cost of motors and reduces their output.

Mr. Stanley has discovered that by the use of very low-frequency currents—such, for example, between three cycles and 15 cycles per second—motors of the commutator type may be designed of very low self-induction, and therefore free from the trouble arising when motors of the commutator type are used with generators of high frequency, and that the induced currents generated in them will not be sufficient to cause serious heating of the conductors or burning or flashing of the commutators. He has further discovered that these very low frequency currents have the same advantage of distribution as the alternating currents of the frequency heretofore used—that is, the energy can be transmitted by alternating currents of high potential and at the points of consumption transformed by induction into currents of a low potential of the original frequency. In carrying out the invention, he employs alternating currents of a frequency, say, between three cycles and 15 cycles per second, transmitting the energy at high potential and transforming it at the points of consumption into currents of low potential, and there using it to operate motors of the commutator type having laminated or divided iron paths for the flux. This system may be availed of for traction purposes or for transmission in which stationary motors are employed.

In case it is used for traction purposes, Mr. Stanley prefers to locate the step-down transformer on the car whose motor is to be supplied. In this way the advantages of high-potential transmission are preserved without regard to the point on the system at which the car may be. Thus a car remote from the power house will be supplied with energy without the use of any low-potential mains, such as would be necessary in case stationary step-down transformers were used to supply sections of the overhead conductor. The energy would always be transmitted to the car at high potential wherever the car might be. The high-potential transmission system in which the trolley wires themselves constitute the transmission mains enables the transmission to be effected with a great saving in



STANLEY'S SYSTEM OF TRANSMITTING AND UTILIZING LOW-FREQUENCY CURRENTS.

energy when the same amount of copper is employed as would have to be employed in a low-potential transmission system, and if the same loss is to be permitted as would be present with low-power transmission, permits the use of a much smaller amount of copper, and thus saves in the cost of the original installation. It does away with the rotary converters and relies only on the static transformers, which by reason of their simple inductive action do not require attention by an attendant.

Any frequency between three cycles and 15 cycles per minute produces sufficient change of value to enable a current of one potential—as, for example, 10,000 volts—to be transformed to another of a lower potential—as, for example, 500 volts—when applied to closed-circuited transformers, a type of apparatus developing a maximum inductance from a minimum value of current-flow. At the same time the transformed currents may, because of their low frequency, be used to energize and operate motors of the continuous-current type of laminated magnetic circuit, a type of apparatus which does not possess as great inductance as do the transformers above mentioned, and do not, therefore, with such low frequencies develop induced electromotive forces of sufficient value to materially change the characteristics and output of such motors from that found when they are operated on continuous-current circuits.

The frequency chosen depends upon the local conditions of the undertaking, but must be so low as not to generate the objectionable electromotive forces and induced currents above referred to.

If currents of a frequency of 25 periods were employed to operate motors of the commutator type, some 20 per cent. of the effective electromotive force would be consumed in overcoming the self-induction of the field, while if a current having a frequency of five periods were used only a negligible per cent. of the effective electromotive force would be thus consumed. Thus a motor operated by a five-period current and having the same electromotive force of self-induction as another motor operated at 25 periods could have a field strength of total flux $\sqrt{5}$ times as great and a torque $\sqrt{5}$ times as great as the 25-period motor.

In the same manner the electromotive force of self-induction and the induced currents in the armature winding may be reduced to one-fifth their value when five-period currents are substituted for 25-period currents, a condition that reduces the waste energy in such coils to one-twenty-fifth of the amount found at the higher (twenty-five-period) frequency. In fact, the low frequency permits of obtaining substantially the same torque output and operation as may be obtained by motors operated at zero frequency—that is to say, by continuous currents—and yet possesses the advantages of generation, transmission and transformation obtained by employing transformers of the usual type.

A frequency of five periods per second results in currents which are well adapted to the service of electric locomotion where trolley wires are to be supplied with low-potential currents which are to be directly supplied to motors, or to the application of power where it is desirable to use large values of energy in one spot and where, consequently, transformers would be of large capacity. When, however, the power is to be distributed in smaller units of high potential—as, for instance, in the operation of individual motors by individual transformers on a number of cars connected together or singly, in which case the size of the motors and their transformers is reduced—the frequency employed may be advantageously increased from five periods to 10 periods or even 15 periods per second without involving corresponding disadvantages. The general rule is that the frequency employed shall be inversely proportional to the unit of work of the service, a car equipment with its step-down transformer and motor being considered a unit of work.

The increase in frequency permits the use of smaller transformers and a corresponding decrease in the expense of the installation. It must, however, be kept so low as not to develop an objectionable electromotive force of self-induction or to produce large secondary currents in the induced members before mentioned.

Referring to the accompanying diagram, (A) represents a low-frequency exciter consisting of an armature having a winding (B), whose coils are connected to segments of the commutator (C). (D) is the field-magnet winding of the closed-circuited type, tapped at four equidistant points and connected to brushes (E), bearing upon the commutator (C).

An energizing winding (F) of a low-frequency generator is connected to two of the brushes. The magnetic circuit of this generator is laminated. (F') is the armature of the generator having a commutator (G), on which the brushes (H H') rest. Since the field of the generator is excited by low-frequency currents, low-frequency electromotive forces are impressed upon the brushes (H H'), the frequency being independent of the speed of rotation of the generator armature.

The primary of a step-up transformer (I), of which (J) is the secondary, is connected to the distributing mains. To the distributing mains are connected conductors (K L), supported in any well-known manner, for supplying electrical energy to electrically propelled vehicles. (M M') are trolleys mounted on top of the car and forming the terminals of the primary (O) of a step-down transformer. (P) is the secondary of the step-down transformer connected to the terminals of a series-wound motor (Q), having low self-induction and provided with a laminated magnetic path for its flux. The motor is mechanically connected to the wheels of the vehicle so as to propel it.

The system being a constant-potential system, the motors on other cars are connected to the mains by similar devices, the motors on the several cars being in parallel with one another.

It is obvious that other circuits may be connected to the transmission mains so as to supply stationary motors or motor-generators for power, lighting, or other purposes. Thus, for instance, (R) is a transformer and (S) is a motor supplied thereby, the two being similar to the equipment shown and described on one of the electrically propelled vehicles, but connected directly to the mains instead of to other conductors, with which to engage moving contacts.

Lighting Company Gets New Contract in Buffalo.

The agitation for a municipal lighting plant as a means of getting lower rates in Buffalo, N. Y., seems to have failed. The council has directed the commissioner of public work to enter into a new five-year contract with the Buffalo General Electric Company.

The San Francisco Situation.

[From the Regular Correspondent of the Western Electrician.]

Oakland, Cal., May 10.—The electrical situation in San Francisco has improved considerably since the great fire. The Mutual Electric Light Company's generating plant at the corner of Spear and Folsom streets has been running for some days, supplying the Union Ferry Depot and the wharves under the control of the State Board of Harbor Commissioners.

Telephone service has been restored to a certain

Ruins under the cross are those of Western Union Telegraph Company's main office. Across the street, to the right, are the ruins of the Stock Exchange.

CORNER OF PINE AND MONTGOMERY STREETS, SAN FRANCISCO, AFTER THE FIRE.

extent along the eastern water front, but other parts of the city are still laboring under great difficulties for want of reliable telephone communication, which is badly needed to facilitate the resumption of commercial business. The Pacific States Telephone Company is installing a small temporary switchboard in its new eight-story main exchange building on Bush street between Kearny and Grant avenues. This building can be restored, but the loss of the new switchboard, which was said to be the largest of its kind in the world, was a severe blow to the company. A duplicate of the board is now being constructed with all possible haste. Damage to the telephone conduits, owing to the construction of the

Pacific States Telephone Company's new West Exchange in the distance. Here operating headquarters were opened after the fire, other exchanges being destroyed. St. Dominic's Church in middle ground.

CORNER OF PINE AND STEINER STREETS, SAN FRANCISCO, AFTER THE FIRE.

underground ducts, was probably not so great on the whole as was sustained by some of the lighting conduits by the earthquake and fire. The clerical force has been installed in the East office on Hyde Street, near Sutter, and the building will be repaired. The building had been in use as a telephone exchange only a few months when the fire put it out of business.

San Francisco junk dealers who can get their recent accumulations shipped out of the city are thriving. Many have boys and men out with sacks working for them. Copper is the chief source of profit, bringing 15 cents a pound. An enterprising junk man had two loaded box cars at the Santa Fe freight sheds ready for shipment south when the police confiscated the goods. The greater portion of this loot consisted of copper telephone and electric-light wire.

Frank J. McC[illegible] ... chief of San F[illegible] ... able attention ... narrow ... escaped ... while driving ... across ... pected to recover. The ... phone Company had ... ing Bacon Block, Oakland ... curred.

The Standard Underground ... Company, R. Sammman, San Francisco ... burned out in the Rialto Building ... offices at 9495 Bacon Block ... of the ... equipment in Oakland ... the stock of lamps and miscellaneous ... goods.

The Stanley G. J. Electric ... Company, Northern Electrical Manufacturing Company, Fort Wayne Electric Works, and the Sprague Electric Company are getting down ... new Pacific Coast office at 6765 E. 12th St., Oakland, Cal.

The Electrical Supply Company, (A. Sedman, manager) has opened a temporary office at 842 Diamond Street, San Francisco.

The Electric Storage Battery Company, which was burned out with the Rialto Building, has opened temporary headquarters at 2943 Hillegass Avenue, Berkeley, Cal.

The General Electric Company is receiving freight at its new warehouses on Folsom Street at Lincoln ville, where it has competitive railroad facilities.

The United Railroads of San Francisco, under the supervision of Thornwell Mollady, the local executive head, and Manager George F. Chapman have been rapidly increased in efficiency ever since the week of the great fire, and within a few days cars will be in operation on all of that company's electric lines. Two hundred cars are already in operation and 2,200 men are at work in various capacities. This is about 800 men short of the number employed before the fire. Weekly pay days have been established, owing to the limited amount of cash in circulation and the banks remaining closed.

In the accompanying pictures are shown glimpses of the Pacific States Telephone Company's New West Exchange, where operating headquarters were opened after the fire which destroyed the company's other buildings, and the ruins of the main office of the Western Union Telegraph Company.

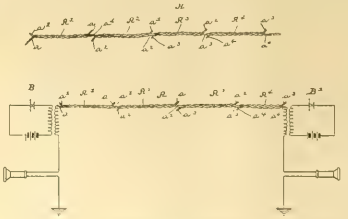
A.

Sectionalized Inductive Conductor for Telephone Lines.

An improvement in electric transmission which has more special reference to telephonic circuits has been brought out by Isidor Kitsee of Philadelphia in a recent patent granted to him for such a method. Its object is to increase the efficiency of the telephonic line of transmission. The line of transmission as employed by Mr. Kitsee consists of a series of sections, each section consisting of a pair of insulated conductors twisted together, one conductor of the preceding section being intertwined with one conductor of the section following.

Referring to the diagram, (A) is the line of transmission as an entirety, of which (A') (A²) (A³) (A⁴) are separate sections. The section (A'), designed to form one terminal of the line, comprises the short wire (a) and the long wire (a'). The section (A²) comprises part of the wire (A') and part of the wire (a²). The section (A³) comprises part of the wire (a²) and part of the wire (a³), and the section (A⁴) comprises part of the wire (a³) and the short wire (a⁴), which forms the other terminal of the line. (B) and (B') are the two telephonic stations.

The operation in this line is apparent. Impulses generated in the secondary of the inductorium at



SECTIONALIZED INDUCTIVE CONDUCTOR FOR TELEPHONE LINES.

the station (B) will flow through the wire (a), will induce impulses in (a'), whereby impulses will be induced in (a²), and thereby in (a³) and (a⁴), and from (a⁴) the impulses will flow to the receiving device and ground at station (B'). So, also, will the impulses generated at the station (B'), through the inductive influence of one section of the twist of wire upon the other section, be received in the proper manner through the receiving device at station (B).

Students of Polytechnic Institute of Brooklyn Make Train Test.

[illegible] ... York, back ... and back to ...

The instrument ... the ...

INTERIOR OF BROOKLYN ELEVATED AP[illegible] TEST.

class instructor, Mr. Ashe, who has had so much trouble in obtaining satisfactory results with the testing sets hitherto made that he decided to build an instrument which would meet the conditions. An interesting feature of the device was a Westinghouse magneto tachometer, which was mounted on the end sill of the car truck on rubber cushions. This instrument was belted to the five-inch car axle of the trailer truck. Wires were then led up from the instrument to the recording device, which followed variations of the voltmeter needle. The maximum reading of the voltmeter was 1.22 volts at maximum car speed. Prior to the test the car was moved over a small stretch of track, making a given number of wheel revolutions. This distance was taped and the circumference of the car wheel accurately determined.

One important result of the test was the proof of the great superiority of the Westinghouse unit switch control over the older forms of Westinghouse upright control and various forms of hand control. The acceleration was extremely smooth.

Owing to the excellent co-operation of the various departments of the Brooklyn Rapid Transit Company, through J. F. Calderwood, C. E. Roehl, W. G. Gove, D. S. Smith and their assistants, Mr. Brown and Mr. Dempsey, the test was a great success.

Other similar tests are planned to be made on the Brooklyn Rapid Transit, using instruction car No. 999, which is equipped with upright controls, also a complete test on a four-motor trolley of the latest type. Owing to a press of business, Dr. Sheldon of the Polytechnic was unable to be present at the test. The picture shows the train-testing set in operation.

A novel scheme has been instituted in England for hiring out accumulators for ignition sets to automobile and motor-cycle owners. By the payment of a small sum, subscribers are provided with an official pass which allows them at any time to exchange their run-down ignition accumulators for fresh ones at any station along the route. Three distinct classes of motorists are catered to—motor cyclists, small-car owners and four-cylinder-car owners. The first-named are, perhaps, the most benefited by the innovation as the ignition accumulator is one of the motor cycle's weak points.

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CONTENTS OF THIS NUMBER.

Flywheel Accident in Plant of Mansfield (Ohio) Railway, Light and Power Company. Illustrated 393
Control of the Direction of Electric Waves. By William Marconi. Illustrated 394, 395
New "Wrinkles" in Drafting Rooms 395
Alternating-current Signal Circuits in the New York Subway. By J. M. Waldron. Illustrated 395
Stanley's System of Transmitting and Utilizing Low-frequency Currents. Illustrated 396
Lighting Company Gets New Contract in Buffalo 396
The San Francisco Situation. Illustrated 397
Sectionalized Inductive Conductor for Telephone Lines. Illustrated 397
Students of Polytechnic Institute of Brooklyn Make Train Test. Illustrated 397
Editorial 398
Electric Power Stations and Plant Life in London 399
Reverse-relay Construction 399
Glass Flooring for Switchboard Structures 399
Dr. Sheldon Elected President of the Institute 399
Electrical Opportunities in South America—Brazil, Chile and Peru 400, 401
Ontario Power Development Investigation 101
New Form of Wireless Torpedo Explodes 402
Arc Lighting. By R. H. Henderson. Illustrated 402, 403
New Line of Single-phase Alternating-current Motors. Illustrated 403
New Type of High-potential Fuse Holder. Illustrated 404
Electrical Properties Company 404
Space-telegraph Plans of the Wellman Polar Expedition 404
Milan Exposition 404
Power Center for Small Users in Indianapolis 404
Commercial Telegraphers' Union 404
Chicago Street-railway Situation 404
Indiana Telephone Items 404, 405
Ohio Telephone Notes 405
Canadian Telephone Items 405
The Telephone in Washington and Oregon 405
Southeastern Telephone Developments 405
Telephone News from the Northwest 405
Illinois Telephone Men Discuss Clearing-house Project 405
New England Telephone Company's Report 405
Annual Meeting of Bell Contract Agents 405
General Telephone News 405

DEPARTMENTS.

Correspondence 406, 407, 408
Great Britain 406
Dominion of Canada 406
New England 406
New York 406, 407
Southeastern States 407
Ohio 407
Michigan 407
Indiana 407
Illinois 407, 408
Texas 408
Northwestern States 408
Rocky Mountain States 408
Pacific Slope 408
Personal 408, 409
Electric Lighting 409
Electric Railways 409
Power Transmission 409
Publications 409
Societies and Schools 410
Automobiles 410
Telegraph 410
Space Telegraphy 410
Miscellaneous 410
Trade News 410
Business 411
Illustrated Electrical Patent Record 411, 412

DATES AHEAD.

Central Electric Railway Association (bi-monthly meeting), Algonquin Hotel, Dayton, Ohio, May 23d.

American Institute of Electrical Engineers (annual convention), Hotel Pfister, Milwaukee, May 28th to June 1st.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

Canadian Electrical Association (annual convention), Clifton House, Niagara Falls, Ont., June 19th, 20th and 21st.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Hollenden Hotel, Cleveland, Ohio, July 18th to 20th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

A NEW METHOD of obtaining magnesium is described by E. Haag in a German electrochemical journal and abstracted in Science Abstracts of London. The author describes a method based upon the electrolysis of carnalite (magnesium potassium chloride) in the fused state, with separation and recovery of the chlorine liberated at the anode, and of the impurities and insoluble portions of the raw carnalite, not acted upon by the current. The apparatus comprises an upper part for receiving and melting the raw carnalite, a central electrolyzing part provided with perforated carbon electrodes, in which the actual electrolysis occurs, and a lower portion in which the molten magnesium and insoluble impurities are received and separated. The chlorine gas rises through the perforated electrode and passes away by a funnel-shaped hood which covers the upper part of the apparatus. The carnalite and the magnesium which is separated from it are kept in the molten state by resistance heating, and the various portions of the apparatus are maintained gas-tight by seals formed of these molten materials.

FLYWHEEL accidents, while of infrequent occurrence, when they do happen result most disastrously. An example is the recent unfortunate accident in the power plant of the Mansfield (Ohio) Railway, Light and Power Company, described elsewhere in this issue. Ways and means for preventing such accidents have been frequently discussed, and the causes for their occurrence have been analyzed as far as conditions will permit after the accidents, but in spite of all precautions we hear periodically of some plant which has been partially or totally wrecked by the bursting of a flywheel. In most cases the destruction is so complete as to leave little evidence of the real cause.

Flywheels are designed with an extremely large factor of safety, but if for any reason the load on the engine is suddenly relieved, or the governing apparatus does not perform its function properly, the sudden increase of speed—perhaps many times the normal—results in a centrifugal force so enormons as almost to defy any degree of mechanical strength which may be given the wheel, and the stronger and heavier the wheel is built, the more terrific the results when it does let go. Careful inspection of the wheel during construction, and equal care and watchfulness on the part of the operator in inspecting his machines, particularly the governing devices, seem to be all that can be done to prevent the accidents. These precautions are probably carried out to the leter in most installations, do not occur more frequently, but sooner or later someone is careless, and a wreck occurs. One of the advantages of the steam turbine that might be incidentally pointed out is the freedom from danger from bursting flywheels—an advantage that is seen to be of no small moment when one contemplates an accident such as that at Mansfield.

AN UNUSUAL situation in the relations between an electric-light company and the city which it serves recently came about in Worcester, Mass., in connection with a renewal of the street-lighting contract. Up to the first of May the Worcester Electric Light Company furnished the illumination for the electric street lighting of the city at a rate of 30 cents a 2,000-candlepower arc lamp a night, on the all-night and every-night basis. In response to a prevailing sentiment for lower rates, the company reduced its charge to 25 cents, and asked the mayor to renew the lighting contract on a three or five-year basis. The mayor has flatly refused to make a contract with the company for any definite time whatever, although the service in Worcester is admirable in every way. There are some 760 arc lamps in the streets of the city, so that the company is obliged to suffer a reduction in its gross earnings of some $14,000 a year, without any adequate security for its street-lighting investment other than that afforded by a night-to-night agreement. Doubtless the company will have to expend $30,000 or $40,000 for new equipment—possibly magnetite arcs—in order to come out in any kind of shape from its 16⅔ per cent. reduction in rates.

We hold no brief for the Worcester company, but it certainly seems that treatment of this sort is about as far removed from a "square deal" as one would expect to find, even in a community where the will-of-the-wisp of municipal ownership has been energetically extolled by a sensational press. It is strange that the standards of ordinary business equity are so frequently slipped out of sight in municipal government. We happen to know that the Worcester Electric Light Company has a professional reputation for progressive management and fair dealing all through New England; it has voluntarily expended many thousands of dollars in underground construction and has never been slow to adopt the best equipment in its station and upon its distributing system. Within the last few months it has been subjected to a variety of newspaper vilification and has been attacked without notice at legislative hearings in Boston for the furtherance of cheap political capital. It is to be hoped that the attitude of the Worcester city authorities on the matter of contract renewal will give place, on sober consideration, to a saner and fairer arrangement.

WHAT seems to have been an unlooked-for exigency in the affairs of the Sanitary District, the elective body which governs, controls and operates the Chicago Drainage Canal, has arisen. It has been brought to light by the agitation to prevent the further diminution of water going over Niagara Falls, to preserve the scenic grandeur of the spectacle—an agitation directed primarily against the hydro-electric companies and projects at the Falls. It is now asserted that, by an oversight, the Chicago Drainage Canal has never been recognized by the federal government, and that the War Department has never issued a permit for turning the waters of Lake Michigan into the Chicago River. As originally planned in or about 1890, the channel was to have a maximum capacity of 10,000 cubic feet a second. The flow now is about half that, we believe, but, with experience, it is seen that the growth of the city and the completion of auxiliary channels now under way will make necessary a much larger amount of water than was at first thought necessary—14,000 feet or more. But Congress has been asked, among other recommendations of the International Waterways Commission, which investigated the Niagara question, to restrict the amount absolutely and permanently to 10,000 feet. If, however, this maximum is adopted, Chicago would be in a serious position, for very likely a treaty with Great Britain in relation to the waters of the Great Lakes would be made, including this stipulation. With a treaty once signed it would be very difficult to change its terms so as to allow Chicago sufficient water to take care of its sanitation as the city grows.

At its meeting of May 14th the Chicago City Council protested vigorously against the proposition now before Congress to limit the amount of water which can be drawn from the lakes for uses of the Drainage Canal. It passed two resolutions—one asking the Illinois senators and representatives to oppose the measure, as at present constituted, and the other asking that all reference to the amount of water for the canal be eliminated from it. The latter seems to be the authoritative resolution. It is similar to the one the Sanitary District will itself pass and the one which will be presented to the Legislature. It was drawn at the suggestion of the Illinois delegation in Congress.

Electrical men will be especially interested in the situation, owing to the hydro-electric development of the canal. It is promised that electric power from the generating plant at Lockport, Ill., will be ready for delivery at the western limits of Chicago by January 1st next. The work of building the plant is now actively under way, as readers of the Western Electrician are aware. The city wants the power for street lighting and other purposes, and has been offered it at the rate of $26.40 a horsepower-year. City Electrician Carroll has endeavored to get a lower rate, on the ground that interest on investment is figured on this cost, whereas the city has itself provided 95 per cent. of the money for the canal and should not be required to pay double interest on the money it has borrowed. But it is admitted that the price named is less than the cost to the city of producing the power itself, thus the rate will probably stand.

Electric Power Stations and Plant Life in London.

[From the London correspondent of the Western Electrician.]

London, April 28.—A distinctly new phase of the electric power controversy which is now occupying the attention of engineers in London has been reached, in that a public department has issued a warning regarding the danger to plant life and public buildings in London from the products of combustion which will be emitted from the chimneys of the new generating stations which it is proposed to erect. The commissioners of public works, as the public department in charge of royal parks and gardens, have felt a growing apprehension as to the possible injury, from the cause above mentioned, to the life of the trees, plants and flowers. Further, some doubt exists as to whether the great national treasures in museums and picture galleries are not exposed to this same danger. For this reason the attention of Parliament has been directed to this aspect of the question.

Before proceeding further, it may be well to point out that an unduly alarmist view has been taken for one reason, if for no other. The commissioners of works assume, apparently, that all the generating stations proposed under the 13 electric power bills which have been deposited will be erected. This cannot be so, as many of them are competitive schemes, and probably the greatest addition to the number of works now existing would be two or three. However, the viewpoint expressed by them, although not new, is interesting in its general application and really could be better urged in favor of electric generating stations of the magnitude proposed, inasmuch as the large number of small works with chimneys of their own would tend to disappear quickly with a really cheap supply of electric power available.

But in its special reference to the proposed electric generating stations, the commissioners of works are most concerned in reference to the general suggestion that all such electric power undertakings should be exempt from liability from nuisance in respect of their works. Much is made of the point that hitherto all electric supply companies are liable for nuisance, but certainly no action has ever yet been taken against such a company by any person or body, claiming for damages in respect of ruined vegetation. One can hardly see how liability of this sort could be earmarked to any individual chimney.

In this matter the commissioners of works have been advised by Dr. T. E. Thorpe, principal of the Government Laboratory, who, first of all, says that the ejection of volumes of oily steam from an adjoining electric generating station has occasioned much damage to the shrubs and grass in Brompton Cemetery, which is under the charge of the commissioners. Dr. T. E. Thorpe has also expressed himself in the following terms:

"It would appear that smoke, with its sooty and tarry particles, can be so well consumed by proper apparatus that no danger ought to arise in that respect. Effectual means should be taken to secure that apparatus of the most approved character shall be employed for the consumption of smoke. The use of dust-destructor refuse as fuel should be altogether prohibited. But the principal enemy to be combatted is sulphuric acid, the production of which can be much diminished, if not entirely prevented, by pouring limewater on the coal before it goes into the furnaces; and this condition, the fulfillment of which would involve small expense and little labor, might reasonably be insisted upon."

The following gives a summary of a number of answers given by Dr. Thorpe to questions placed before him by the commissioners of works:

The products of combustion emitted from electric generating stations under ordinary conditions are carbonic acid, water vapor, nitrogen, minute quantities of carbonic oxide, ammonia and more or less sulphurous acid, depending upon the amount of sulphur in the fuel, together with more or less carbonaceous matter (soot) and mineral matter derived from the ash. The most deleterious of these to vegetation, works of art and museum exhibits is the sulphurous acid, which, by oxidation, is converted into sulphuric acid, and so exerts a corrosive action. The formation of sulphurous acid and consequent production of sulphuric acid cannot be prevented by any rearrangement of the furnaces or by the use of exhausts or modern appliances. Its evolution may be minimized by careful choice of coal, or by insuring that the coal is burnt with small quantities of lime (if the amount of lime already in the mineral constituents of the ash of the coal is not sufficient to retain the sulphur [illegible] calcium sulphate.)

The evidence which the [illegible] will no doubt tender to the [illegible] commence consideration of the [illegible] electric power bill on [illegible] and is probably the first [illegible] such circumstances. The [illegible] problem [illegible] such as London is becoming [illegible] each year, and must be taken [illegible] but for the reason stated early in the [illegible] the [illegible] of that difficulty as a result of the passing of one of the electric power bill, promoted the [illegible] is likely to be infinitesimal. G.

Reverse-relay Construction.

Reverse-relay devices are usually made in the form of a relay operating on the wattmeter principle, having devices for closing a local circuit when the abnormal conditions occur, which local circuit operates or controls the operation of a circuit-breaker in the main circuit. Such devices (as explained by Mr. Ralph D. Mershon of New York in a recent patent issued to him on a release relay device) have been found to operate more or less satisfactorily when the abnormal conditions do not depart far from normal; but they have not proved satisfactory in the extreme conditions which may be and not infrequently are met in practice. For example, assume two circuits or sources of current feeding into the same bus-bars, each circuit being provided with a switch and a reverse relay for opening it, operating on the principle of the wattmeter. Upon one of the circuits being short-circuited near the bus-bars the wattmeter relay would, if it operated properly, reverse its reading, and, swinging back of zero, would close its local circuit, which would in turn open the switch.

As a matter of fact, however, the reverse-relay devices now ordinarily used will not operate as just described for either or both of two reasons: First, when a short-circuit occurs the voltage at the bus-bars is lowered to a greater or less degree, and the component of wattmeter torque due to voltage is therefore reduced; second, in case of short-circuit the power factor of the current is very low, which also reduces the wattmeter torque. The result is that in the case of a severe short-circuit the reduction of torque from one or both of these causes is so great that it is not sufficient to carry the reverse relay far enough beyond its zero point in the negative direction.

The object of Mr. Mershon's invention is, therefore, to provide reverse-relay apparatus which will operate successfully under all conditions which may occur in practice, no matter how severe.

In carrying out the invention a relay device may be employed for each piece of apparatus, which will operate under what may be described as slightly abnormal conditions—that is, when the voltage is not greatly reduced. In connection with it there is also one which will not operate under the slightly abnormal conditions, but only under severely abnormal conditions. It is, on the other hand, possible to employ a single device, which will operate under all conditions.

The essence of the invention resides in obtaining in the instrument, under abnormal conditions of low voltage and low power factor in the circuit in which the device is connected, a torque high enough to enable it to perform the desired function. This principle may be carried out in any one or more of a variety of ways—as, for example, first, by having such a fixed phase relation between the current and the electromotive force of the shunt circuit as will produce as great a torque as possible under the abnormal conditions mentioned; second, by causing the voltage effective on the shunt element of the instrument to be increased over what it otherwise would be when the abnormal conditions arise; third, by causing the current in the series coils or the effect in the instrument due to the main current to be increased over what it otherwise would be when the abnormal conditions exist, or, fourth, by changing the phase relation of the current and electromotive force in the shunt circuit. The first will cause the instrument to have a greater torque than an ordinary wattmeter would have under the condition of low power factor, because at that time the ampere turns of the shunt and series fields will have a better phase relation for producing torque than in the case of the ordinary wattmeter. The second will increase the torque, because the shunt field is strengthened. The third will increase the torque, because the series field is strengthened. The fourth will also increase the torque, for the reason that the conditions which [illegible]

which, [illegible] brought [illegible] meter [illegible] current flowing when a short-circuit [illegible] However, for the purpose [illegible] The phase relation [illegible] fields may be changed by [illegible] the shunt element a [illegible] or capacity, as may be needed. In the case of a [illegible] operating on the ordinary [illegible] and in which, therefore, the [illegible] nearly as possible in [illegible] force, it is desirable when the [illegible] to have the current in the [illegible] bringing it more nearly in step with the lagging current taken by the short-circuit. [illegible] may be done by cutting reactance [illegible] circuit. The same result may be [illegible] greater or less extent by cutting resistance out of the shunt circuit, thereby changing the ratio of the reactance and resistance in that circuit. In the case of a wattmeter operating on the electromagnetic inductive principle, in which the shunt current is made as nearly as possible 90 degrees away from the electromotive force, the phase relation of current and electromotive force in the shunt circuit may be changed by cutting resistance or capacity into the shunt circuit.

The above-mentioned methods are given merely as examples of ways for restoring or partially restoring the torque of the wattmeter to a value high enough for successful operation, and the explanation has been confined more specifically to electromagnetic inductive and dynamometer instruments, for the reason that these are the types now most commonly used, but it will be seen that analogous results may also be secured in the case of electrostatic instruments.

Glass Flooring for Switchboard Structures.

Mr. T. Percival Chubb of London, writing to the London Times Engineering Supplement, and referring to a recent fatal accident in a London power station, says: "We notice that Mr. A. P. Trotter (Board of Trade electrical advisor) in his report, while attributing it more to absent-mindedness than to anything else, considers that the bare iron floor contributed, without doubt, to the fatal shock, and he further remarks, in the course of his report, that wooden gratings form treacherous safeguards against electric shocks. May we be allowed to mention that in many of the switchboard galleries recently and now being erected glass flooring is being adopted, the iron framework being completely insulated by the glass lenses, the joints between which are caulked with a specially prepared non-conducting material, thus forming a perfect insulating floor, which has the additional advantage of admitting daylight to the floor below? We may add that this glass flooring, which we have fixed in various parts of the country, has been put to considerable test."

Dr. Sheldon Elected President of the Institute.

[Special Dispatch to the Western Electrician.]

New York, May 16.—The annual election of officers of the American Institute of Electrical Engineers, the result of which was announced at the annual business meeting held last evening, resulted as follows:

President—Dr. Samuel Sheldon, Brooklyn.

Vice-presidents—A. H. Armstrong, Schenectady; H. H. Humphrey, St. Louis; F. G. Baum, San Francisco.

Managers—Paul Spencer, Philadelphia; Paul M. Lincoln, Pittsburg; A. M. Schoen, Atlanta; John J. Carty, New York.

Treasurer—George A. Hamilton, New York.

Secretary—Ralph W. Pope, New York.

The vote for president was: Sheldon, 1,257; Rice, 907. This ends one of the most closely contested elections in the history of the Institute.

M. L. G.

Electrical Opportunities in South America.[1]

Brazil.

As regards the importation of electrical goods into Brazil, it will be found on reference to the trade statistics, which are, by the way, rather belated, that in 1903 there was an increase on the whole, with decreases in certain classes. The importation of cars for railway purposes increased from 571,530 milreis in 1902 to 649,065 milreis in 1903. [The silver milreis of Brazil is valued at 55 cents, but as will be seen a little later in the present article the average value of the paper milreis in 1903 is placed at 12d., or 24 cents.—Ed. W. E.] The imports from Germany and the United Kingdom greatly decreased, while an increase was shown in the imports from the United States. The imports of copper wire, plain or covered with any material, decreased from 814,081 milreis in 1902 to 411,198 milreis in 1903; large decreases were evidenced in the imports from Germany and the United States, while an increase of nearly 20,000 milreis was shown in the imports from the United Kingdom. The imports of insulators decreased from 107,598 milreis in 1902 to 61,382 in 1903, and in this class also the imports from Germany and the United States decreased, while those from the United Kingdom increased; nevertheless the imports from Germany were slightly in excess of those from the United Kingdom. The imports of appliances for electricity, electric lighting, etc., not otherwise specified, increased from 2,240,619 milreis in 1902 to 2,503,924 milreis in 1903; the imports from the United States were 1,616,043 milreis in 1903, as against 394,704 milreis from the United Kingdom, and 327,726 milreis from Germany. Motors, fixed engines and parts thereof were imported to a value of 529,364 milreis as compared with 588,154 milreis in 1902; the imports from the United States increased, while those from the United Kingdom and Germany showed decreases. The imports of machinery and apparatus not separately specified amounted to 9,714,957 milreis as against 8,976,001 milreis in 1902; the imports from the United Kingdom were 4,626,265 milreis, but showed a slight decrease; the imports from the United States and Germany, although in each case only about half the value of the imports from the United Kingdom, showed increases. The above values are in paper milreis. The average exchange for the paper milreis in 1903 was about 12d. The total imports from the United Kingdom to Brazil amounted in value to 60,988,902 milreis; from the United States, 24,283,801 milreis, and from Germany 26,506,366 milreis; there were increases in the cases of Germany and the United States, but a decrease in the case of the United Kingdom. The values for these total imports are in gold milreis (gold milreis = 2s. 3d.).

It will be seen from these figures that to a certain extent the United Kingdom is holding her own on the Brazilian market, but that in one of the largest items, viz, appliances for electricity, etc., the imports from the United States far exceed those from the United Kingdom and Germany together. There is no doubt that the investment of capital in Brazilian undertakings has led to much of the trade, and it is a generally accepted fact that investment of capital, not necessarily in electrical undertakings only, has had and will continue to have a great effect on the trade of the country, with special reference to the countries from which the goods are imported. The special commissioner appointed by the United States government recently to inquire into the trade conditions of Brazil has advised his countrymen to invest in up-to-date enterprises with a view to establishing a greater purchasing power in the country, and hence a market for American goods. Germany and the United States have not been slow in this respect. The German consul at Curityba recently reported that the electrical works in that town and in other towns in the district were entirely of German origin, and that the market for German goods was rapidly extending. Moreover, the Allgemeine Siemens-Schuckert Company has recently established a subsidiary company in Rio de Janeiro to undertake the sale of its goods and to take up concessions, etc.

The British consul-general at Rio states that the advantages of electricity for lighting and power purposes are fully appreciated in the country, and encouraged by a helpful system of natural watercourses, installations have been made in several of the smaller towns. As a competitor of electricity alcohol is engaging much attention for illuminating and industrial purposes. The following list of engineering requirements in Brazil, which is recommended to the consideration of British firms, was formulated by the British consul at Rio, who states that there is a field for enterprise in all the branches specified: (1) Electrical works; (2) hydraulic machinery, turbines, Pelton wheels, etc., especially as applied to electrical transmission—Brazil offers special facilities for this class of work; (3) locomotive engineering; (4) railway carriage building; (5) mining engineering; (6) milling and grinding machinery; (7) cranes and other lifting machines.

The great centers of trade are Rio de Janeiro and Sao Paulo, and it is in these states that the greatest development may be looked for. A great future is also predicted for the Amazon Valley, but it is not anticipated that any very great opportunities will present themselves for some years to come.

The following are the duties leviable on various kinds of electric material imported into Brazil: Insulators, buttons for electric bells and porcelain wares of various kinds, with or without copper, for electric installations, 200 reis per kilogram; glass insulators, 100 reis per kilogram; copper wire, plain, 400 reis per kilogram; copper wire, covered, 900 reis per kilogram; copper wire, with an envelope of lead or iron for submarine or underground cables, power, light or other electrical purposes, 20 per cent. ad valorem; articles of copper not otherwise enumerated, 2,000 reis per kilogram; telegraph and telephone posts of iron, 20 per cent. ad valorem; carriages, etc., for railways, etc., 30 per cent. ad valorem; dynamos and other electric apparatus for the distribution of power and light, locomotives and tenders, traction engines, hydraulic motors, turbines and hydraulic wheels, windmills and other motors, 15 per cent. ad valorem; electric machinery of various kinds for milling, pressing, etc., 15 per cent. ad valorem. On the majority of goods imported it has been decreed that 35 per cent. of the duty shall be payable in gold so long as exchange remains above 15d. The present rate of exchange is 16 9-32d., and the gold milreis is equivalent to 2s. 3d., so that at the present time 35 per cent. is payable at the rate of one milreis = 2s. 3d., and 65 per cent. at the rate of one milreis = 1s. 4 9-32d. In the case of goods imported via Rio de Janeiro and Rio Grande do Sul a surtax of two per cent. gold is levied for the purpose of defraying expenses in connection with port works which are being carried out.

The following are the leading importers of electrical goods in the chief towns:

Rio de Janeiro.—Itmaos Braconnot r. Quitanda, 40; Brazilianische Elektrizitäts Gesellschaft, Praca Tiradentes, 45; Casa Cresta, r. Quitunda, 41; F. G. Braga, r. Goncalves Dias, 46; Companhia Telephonica, Praca Tiradentes, 45; Fred Figner, r. Ouvidor, 105; Guinle & Co., r. Ouvidor, 64 B; H. Smyth, r. Rosario, 115; Haupt, Biehn & Co., r. Alfandega, 42; Compagnie de Travaux et d'enterprises au Brazil, r. Primeiro de Marco, 79.

Fortaleza (Ceara).—Antonio Henrique da Justa, r. do Senador Pompeu, 92.

Sao Paulo.—Guinle & Co., r. Direita, 7; Joao Riva, r. Gen. Osorio, 141; Laur Habasinski, largo do Ouvidor, 3.

Influences operating against trade development, says the Rio consul, are to be found in the heavy taxation and in the commercial laws which make the recovery of debt uncertain, thus facilitating inequitable and secret settlements between unscrupulous traders to the detriment of less-favored creditors, and particularly of such as are not resident, or are not adequately represented in the country. In consideration of these facts it has been considered advisable to warn manufacturers and merchants against opening up direct trade with Brazilian firms except with fully approved guarantee.

Catalogues should be in Portuguese, the language of the country, with the metric system of weights and measures, and should be distributed as widely as possible, not only in the coast towns but also in the interior, where there are many industrial enterprises of considerable importance. The mere sending of catalogues, however, is said to be utterly useless, except in the case of old-established firms whose manufactures are well known on the market. Commercial travelers should be linguists, for with the gradual developments of the last few years the import trade is now more and more in the hands of the Portuguese and German houses. French has taken the place of English with Brazilians proper as an alternative language to Portuguese.

Chile.

The commercial relations of Chile have wonderfully improved in recent years both as regards its trade and industry. Particularly was this improvement shown during the last six months of 1904 and the year 1905. For two years or more the exchange has been maintained at a relatively high and stable rate, and this, combined with the high prices which have prevailed in the copper and saltpeter markets, has been the chief cause of the improved conditions of the country.

It is difficult to arrive at any very satisfactory details as to the imports of particular classes of electrical goods, as these are so often included under other general headings; but the following particulars may probably be of some service in giving a general idea of the nature and extent of the trade. The imports of materials for railways, vessels and telegraphs in 1904 amounted to 2,327,000 pesos, of which 1,370,000 pesos were from the United Kingdom and 497,269 pesos from Germany. [The peso is valued at 36 cents.—Ed. W. E.] The total imports increased by 800,000 pesos, while those from the United Kinkdom increased by 460,000 pesos. The imports of bronze and copper in bars, etc. (includes copper wire), amounted to 361,000 pesos, or double the imports in 1903; imports from Germany increased from 46,625 pesos to 151,000 pesos and exceeded those from the United Kingdom by 20,000 pesos. Lamps and lighting utensils of glass were imported to a value of 254,000 pesos, a slight decrease; of these 181,000 pesos were from the United States. The imports of glass and porcelain (various), including certain insulators, amounted to 33,000 pesos, of which 25,000 pesos were from Germany. The imports of various kinds of apparatus, including insulators, telegraph material, etc., amounted to 147,000 pesos; the imports from the United Kingdom were 38,000 pesos, an increase of 2,000 pesos, and those from Germany 95,000 pesos, an increase of 25,000 pesos. Mining machinery, pumps, etc., were imported to the value of 3,228,603 pesos, or two and a half times the imports in 1903; the imports from the United Kingdom increased from 770,704 pesos to 1,929,832 pesos, and those from Germany from 394,253 pesos to 1,145,139 pesos. The imports of cranes, weighing machines, etc., amounted to 150,629 pesos, of which 106,401 pesos were from the United Kingdom. Machinery, etc., for industries, electric lighting, etc., motors, etc., were imported to the value of 7,436,000 pesos; the imports from the United Kingodm were 3,159,080 pesos, from Germany 798,000 pesos, and from the United States 2,780,000 pesos.

As compared with the figures for 1903, the imports of machinery, instruments, tools and apparatus of all kinds showed a marked advance; the imports in 1904 were valued at 20,890,000 pesos, as compared with 12,895,000 pesos in 1903. The figures of the imports of electrical goods, so far as they go, show that the United Kingdom in nearly all cases holds the greatest share of the trade, but it is noticeable that imports from Germany in this line as well as in the total trade are increasing at a greater ratio than those from the United Kingdom, and that in Chile as well as in the other South American countries German capitalists are interesting themselves to a great extent in the undertakings of the country Allowance must be made, however, in the use of the Chilian statistics, for the fact that in many cases the imports are not attributed in all cases to the real country of origin, but rather to the country from which they are shipped As will naturally be seen, this method is more favorable for German figures than for those of the United Kingdom, so that it is possible that the figures for Germany are somewhat in excess of the real imports from that country But in spite of this, it is evident that German manufacturers are succeeding to a great extent in the introduction of their goods on the Chilian market, and it behooves British makers to put forth strenuous efforts to retain the trade they already hold, and at the same time to gain their share of the increased trade which is sure to arise as the country develops

There are at present in Chile about 25 towns which have taken up electricity for lighting purposes, the current being mostly supplied from steam-driven plants, and only in a few cases from waterpower, which is not so abundant in most parts of the country as in other South American states.

As in Brazil and other South American states, so also in Chile, acetylene is becoming a keen competitor of electricity for lighting purposes, and a decree was recently put in force by the government allowing the free importation of calcium carbide for the production of acetylene gas. Alcohol is also being used to some extent both for lighting and power purposes, and its further use is being encouraged. Gas is used, however, for lighting purposes in most towns, and the companies succeed in paying good dividends, particularly in Valparaiso and Santiago.

Of the electrical companies established in Chile the following may be mentioned: The Cia Luz Electrica de la Serena, with continuous current from two Schuckert turbine sets; the Chilian Electric Tramway, Light and Power Company, with current supplied from five Allgemeine Elektrizitäts Gesellschaft-Tosi turbine sets; and the Cia Gas de Valparaiso, with two Mavor and Coulson and McLellan turbine sets.

It is anticipated that the production of iron by electrical methods in Chile is destined to achieve great importance in coming years, particularly as the government is doing all in its power to foster an iron industry in the country. The districts of the Cordilleras between 43° and 29° S. latitude are richly supplied with waterpower, with strong falls in the immediate neighborhood of iron ore and other metal fields.

The following duties are leviable on electrical goods in Chile: Pushes for electric bells, 25 per cent. ad valorem, valuation 6.50 pesos per kilogram; bronze or copper wire and wire for electrical purposes, free; Morse telegraphic apparatus, free; motors of all kinds, 25 per cent. ad valorem, valuation according to appraisement; special apparatus and accessories for electric lighting, except lamps of all kinds, but including bulbs and candles, free; insulators for telegraphs, telephones or electric lighting, and materials for telegraphs, free; goods not specially enumerated in the Chilian tariff and not being free of duty are liable to duty at the rate of 25 per cent. ad valorem. Valuations are fixed by the customs authorities.

The following are firms interested in electrical undertakings who would be likely to import electric material direct:

Santiago.—Chilian Electrical Company, ltd.; C. Cordero, 1547 calle Moneda; V. Gonzalez, 486 calle Mercedes; Harras & Cie, 3066 calle Huerfanos; A. Hewstone, 3067 calle Catedrale; R. Hewstone, 1102 calle S. Rosas; L. Jaspard; R. Olivares, 1345 calle Compania; R. Oliveira, 1907 calle Catedrale; De Leon Ponce, 322 calle Mercedes; Rivano y. Cia, 2012 calle S. Francisco; Chile Telephone Company, 14 Galeria San Carlos; A. Goubet, 95 calle Cate-

1. Condensed from articles in the Electrical Review of London.

drale; A. G. Hald, 56 calle Bulnes, G. H. Jones, 1317 calle Casilla; Allen Kerr, 490 calle Cadella.

Valparaiso.—Chile Telephone Company; Cia Alemana Transatlantica de Electricidad; Hormann y Cia; Rose Innes y Cia; Pacific and European Telegraph Company; G. S. Lang, 966 calle Casilla; C. F. Heywood, 16 Casilla del Correo.

Tacna.—Cie Telephone et Telegraphe Tacna, Arica, etc.

Curico.—Soc. Anon Electricité.

Iquique.—Central and S. American Telegraph Company; West Coast of America Telegraph Company.

Perena.—Compania Luz Electrica.

The majority of business is done by European houses or merchants in Chile through their buying agents in Europe. Direct business, which is increasing and could be further increased by the employment of the right sort of travelers and care in the selection of customers is usually done c.i.f. in European currency to avoid risk of exchange. The great requirement of the Chilian market is cheapness; but the finish and get up should be made thoroughly attractive in order to create business.

Commercial travelers are not required to obtain permits to exercise their calling in Chile, nor are any licenses necessary.

PERU.

In the case of the United States the imports have increased 300 per cent. since 1900. Moreover, the completion of the Panama Canal will, it is anticipated, give a wonderful impetus to the trade of the United States with Peru, so that British manufacturers will have to pay great attention to the market if they wish to retain the trade they at present hold, and at the same time to gain their share of the increasing demand.

The detailed figures of trade are extremely belated—the last published statistics deal with 1902; the following particulars will, however, give some idea of the trade in electrical goods in that year, although they cannot by any means represent the trade as it is today, for the years since 1902 have shown such a remarkable development that the import figures in this class of goods must have greatly changed. The imports of telegraph and telephone apparatus in 1902 amounted to £2,789, of which £101 were from the United Kingdom, £1,141 from Germany, and £901 from the United States. The imports of pump machines, motors, etc., amounted to £136,214, of which £50,948 were from the United Kingdom, £20,755 from Germany, and £56,263 from the United States. Other machinery was imported to a value of £27,035, the United Kingdom being credited with £5,726, Germany with £5,072, and the United States with £12,909. The imports of copper wire amounted to £5,791; the imports from the United Kingdom were valued at £1,519; those from Germany at £2,147, and those from the United States at £1,778. Railway carriages were imported to a value of £1,014, of which £98 were from Great Britain, £491 from Germany, and £270 from the United States. The total imports of machinery and parts thereof in 1902 amounted to £167,476, and in 1904 these figures had increased to £206,151. The imports of metals and manufactures thereof, which amounted to £414,049 in 1902, increased to £872,601 in 1904.

From the above figures it will be seen that in every item the imports from the United States were greater than those from the United Kingdom, and it may safely be concluded that this position has not been altered in recent years, for it is surprising to find that in the majority of cases where new plant, etc., has been constructed the supplies have been obtained in the United States. British manufacturers are still neglecting the trade in electrical goods, which has had considerable importance in recent years, and bids fair to increase greatly in the future. It is gratifying to find, however, that on the whole the commercial intercourse between the United Kingdom and Peru is satisfactory, but there is no doubt that the trade might be increased if manufacturers and merchants would only study more closely the requirements of the market.

In recent years there has been a great development in the construction of electric railways, and in most of the undertakings it will be found that United States manufacturers have secured orders for the material. The Lima and Callao and the Lima and Chorillo electric railways were opened to traffic in 1904; the lines were constructed and are operated with Peruvian capital, but American material was used. For the Lima and Callao tramway the contract for the line was obtained by Messrs. Bolan & Dillon, and for the power station by Messrs. W. R. Grace & Co. The trolley system is employed with Brill and Stephenson cars. The line between Callao and La Punta—a neighboring sea-bathing resort—has also been opened to traffic as well as the tramways in Callao itself. A contract was signed in the early part of last year between the Provincial Council and the Ferrocarril Urbano de Lima for substituting the electric overhead trolley system for horse traction on the tramways of the company, the work to be finished within two years.

The installation of wireless telegraphic communication is also being carried out in Peru, and a contract was entered into last year by the Peruvian government with a German company for establishing wireless telegraphy between Puerto Bermudez, on the Pichis, and M[illegible] mate [illegible] on the Amazon [illegible] ever, delayed [illegible] tral and South American Telegraph Company [illegible] using the system of [illegible] Peru and the neighboring [illegible]

Among the electrical plants [illegible] may be mentioned that of the [illegible] de Santa Rosa, with alternating [illegible] General Electric single and three [illegible] generator [illegible] of 3,000 [illegible] stated to be the largest electric power [illegible] present existing in South America.

The condition of Lima itself has been [illegible] improved in recent years by the [illegible] electric railway, lighting, telephone and telegraph works, so much so that it [illegible] ing Callao, which it bid fair to [illegible] other coast town in the vicinity. There [illegible] therefore, be still plenty of opportunity for electric traction and other electrical work in the town and district. An electric lighting plant has recently been installed in the town of Iquitos, which is also undergoing great development.

Peru possesses a valuable element in the vast undeveloped hydraulic power which exists on both the eastern and western slopes of the Cordillera. The source of this supply is the ice cap which crowns the summit of the range, and the continual and exceedingly heavy snow and rain storms of the high plateau. All along this vast chain there exist a series of lakes practically astride the summit of the Andes at altitudes varying from 12,000 to 17,000 feet above the sea level, and these, with the stream to which they give rise, form the source of enormous hydraulic energy. The volumes of water which descend on the Pacific side are not necessarily very great, but they are numerous and constant, and their fall is exceedingly rapid.

Electrical apparatus of all kinds pays a general duty of 40 per cent. ad valorem. Valuations are fixed by the customs authorities. The valuations for accessories, switches, contact makers, etc., vary from 60 cents per kilogram to 1.50 sols per kilogram, according to the material of which they are made. [The silver sol is valued at 49 cents.—Ed. W. E.] Insulators are valued at from 7 cents to 30 cents per kilogram; wire and cables from 4 to 85 cents per kilogram; flexible cords from 2.5 to 3.75 sols per kilogram; arc lamps, 15 to 30 sols each; incandescent lamps, 3.5 sols per dozen; electric-light meters, 15 sols each; Morse telegraphic apparatus, 22.5 sols each, without clockwork 11 sols each; electric bells, 1 sol each; carbons for arc lamps, 18 cents per kilogram; insulating pipes from 35 to 50 cents per kilogram. Steam or electrical machinery of all kinds, and hydraulic and other motors are free of duty, as are also agricultural and mining machinery, foundry machines, etc. Customs duties are payable in silver sols. Merchandise imported through Callao is liable to a surtax of one per cent. for the purpose of defraying the expenses of the construction of a national theater.

The currency is composed of gold, silver and copper coinage. Gold is the commonest medium, and that in use is almost entirely in British sovereigns, of which a considerable number are imported annually.

The following are firms interested in electrical undertakings and the importation of electrical goods:

Lima.—Empresa de Timbres y Aparatos Electricos; Empresa Electrica de Santa Rosa; W. R. Grace & Co. (agents for the General Electric Company of New York); Lodowieg & Co., calle de Ucayali; Lima Electric Light Company; P. Burbank, calle Quilca; C. M. Schroeder & Co., calle Mechormalo; C. P. Soldan; Peruvian Telephone Company, Apartado 846; Chorillos Gas Works; Simens & Halske Aktjengesellschaft; E. F. Wagner; Central and South American Telegraph Company; West Coast of America Telegraph Company, Casilla 209; Peruvian Telegraph Company, Casilla 155; Cia del Ferrocarril Electro de Lima y Callao.

Mollendo.—Fabrica y Cia de Electricidad; Bucetich & Co.

Cerro de Pasco.—The Cerro de Pasco Company.

As is the case in other parts of South America, a good deal of the trade is done by large importing houses in Peru, who have their own buying agents in Europe, where payments are made against shipping documents. Direct trade is, however, increasing, and a good deal of business could be done by suitable travelers. It is useless to send out catalogues in English, even although they may be illustrated. Spanish is the language of the country, and weights and measures should be quoted in the metric system. In employing agents and in doing direct trade great care should be taken to prove the reliability of the firms dealt with.

Every facility is given to commercial travelers; they are allowed to enter with their samples on presenting to the custom house, through a responsible agent, an official request to pass so many packages of samples.

Construction work on the extensive new power plant for the Pabst Brewing Company in Milwaukee has been begun. The company has under consideration improvements that will cost $300,000. This will include the equipment of the plant with electric power.

Ontario Power-development Investigation.

[illegible] the full 100,000-horsepower plant [illegible] take over all the [illegible] province and [illegible] Government [illegible] class is popular with Canadian [illegible]

The rates that [illegible] consumers in order [illegible] ment and distribution [illegible] estimated by the commission [illegible]

M[illegible] S[illegible] H[illegible]

C[illegible] P[illegible]

Municipality	H. P.	H. P.	H. P.
Toronto	[illegible]	[illegible]	[illegible]
London	[illegible]	[illegible]	[illegible]
Brantford	[illegible]	[illegible]	[illegible]
Guelph	[illegible]	[illegible]	[illegible]
Stratford	[illegible]	[illegible]	[illegible]
Woodstock	[illegible]	[illegible]	[illegible]
Ingersoll	[illegible]	[illegible]	[illegible]

ARC LIGHTING [illegible]

Municipality	H. P.	H. P.	H. P.
Toronto	[illegible]	[illegible]	[illegible]
London	[illegible]	[illegible]	[illegible]
Brantford	[illegible]	[illegible]	[illegible]
Guelph	[illegible]	[illegible]	[illegible]
Stratford	[illegible]	[illegible]	[illegible]
Woodstock	[illegible]	[illegible]	[illegible]
Ingersoll	[illegible]	[illegible]	[illegible]

INCANDESCENT LIGHTING COST PER K. W. H.

Municipality.	H. P.	H. P.	H. P.
Toronto	[illegible]	[illegible]	[illegible]
London	[illegible]	[illegible]	[illegible]
Brantford	[illegible]	[illegible]	[illegible]
Guelph	[illegible]	[illegible]	[illegible]
Stratford	[illegible]	[illegible]	[illegible]
Woodstock	[illegible]	[illegible]	[illegible]
Ingersoll	[illegible]	[illegible]	[illegible]

COST PER H. P. PER YEAR AT M[illegible] S[illegible]

Hamilton	[illegible]
St. Thomas	[illegible]
Paris	[illegible]
Dundas	[illegible]
Mitchell	[illegible]
St. Mary's	[illegible]
Berlin	[illegible]
Waterloo	[illegible]
Preston	[illegible]
Hespeler	[illegible]
Galt	[illegible]

The total cost per horsepower a year at Niagara is given at $8.30 for a 30,000-horsepower development, $5.80 for 60,000 horsepower and $4.05 if 100,000 horsepower were developed.

New Form of Wireless Torpedo Exploder.

In 1905 Dr. Branly of Paris succeeded in using electric waves through space to fire torpedoes, close incandescent lamp circuits, etc. This new art, called by Dr. Branly "Telemechanics," was explained at some length in the Western Electrician of November 4, 1905. Though he succeeded in applying the waves in many ways his apparatus was at the same time more or less unreliable. Consul Artwell, writing from Roubaix, France, tells of a similar invention recently made by Jean Denissel, which he says, overcomes many of the inherent defects of Dr. Branly's apparatus.

Mr. Denissel has succeeded, it is said, in producing an apparatus for receiving electric waves that is highly sensitive and of great precision—a machine that works underground and in water, at a long distance from the transmitter of electric waves, without mast or post. This machine may be manufactured for about $10, is easy to transport and not capable of being put out of order. It is a cube and weighs about seven pounds. Mr. Denissel's discovery rests upon the application of a connector of his own invention. This connector does away with the relay necessary to posts for the reception of wireless telegraphy and telemechanism now in use. It is described as of capital importance, as a torpedo may be exploded under a vessel or under a column of men from a distance of several miles.

Arc Lighting.[1]

By R. H. Henderson.

Although there are tens of thousands of enclosed arc lamps installed in all parts of the country, very little in proportion to their use has been written concerning their design, operation and maintenance. Being adapted to almost every kind of commercial circuit, their importance in the equipment of a modern central station cannot be overestimated. Broadly speaking, there are certain fundamental elements of arc-lamp design which must be found in all lamps, no matter whether for alternating or direct current, multiple or series.

Details of Arc Enclosure.

Primarily, too much attention cannot be paid to the details of the arc enclosure. The gas check, or bulb cap, as it is sometimes called, must have the surface against which the inner globe rests machined true and smooth, in order to make the joint as nearly air-tight as possible. This is of the greatest importance, and in the case of lamps for high tension this gas check should preferably be made of some heat-resisting material with high insulating qualities, with a surface for the inner-globe seat which will not corrode nor deteriorate. The finer grade of soapstone has been very successfully used for this purpose. Furthermore, in operating lamps the greatest care should be exercised in trimming, to see that the inner globe rests uniformly and evenly on the finished surface of the gas check with a moderate pressure. If this pressure is too great, it will result in the cracking or chipping of the inner globe, generally at the point of contact. Aside from the destruction of the inner globe, the life of the carbons will be shortened directly in proportion to the amount of air admitted to the globe through the fracture. The extreme condition would be in the case of an inner globe being broken entirely so as to form no enclosure for the arc on a lamp which was not fitted with an outer globe. In this case, the life of the carbon, burning freely in the air, would be between six and seven hours, while the same carbon burning in a proper enclosure would last probably from 100 to 150 hours. So it is evident that there is no economy in using chipped or cracked inner globes, owing to the greatly decreased carbon life and the attendant disadvantage and expense of having to trim certain lamps on a circuit before the carbons in the others are burned out. Oftentimes, there is also an outage charge for such lamps, which is deducted by the city or town from the earnings of the central station. Outer globes should be kept up on street systems for the same reason, as their purpose is to protect the intensely heated surface of the inner globes against rain and snow.

Bushings for the Carbons.

Aside from the seat for the inner globe, the most important feature of a gas check is the center, or bushing, through which the carbon passes. This center must be designed with two different and distinct ends in view; one is to provide a smooth, accurately fitted bushing, through which the carbons must pass freely; the clearance, however, must not be greater than a few thousandths of an inch, for if it is more the life of the carbons will be materially reduced. The second requirement, often made of this bushing, is that it should act as a relief valve for the explosion of gases in the inner globe. This explosion is quite severe and takes place generally when a lamp is turned on after being out from seven to 10 minutes, due to an explosive mixture of gases which forms in the inner globe. This mixture is ignited by the arc when the lamp is again switched on. To meet this requirement these bushings are arranged so as to have a slight vertical movement, allowing them to be lifted by the gases in such a manner as to open ports for equalizing the pressure with the atmosphere, thus tending to neutralize the effect of the explosion and the accompanying breakage of inner globes. The best practice in meeting these conditions seems to consist in making the gas check plate of metal with an insulated center bushing for low-tension lamps, and the reverse in high-tension lamps.

The question of open and closed-bottom inner globes has been debated for some time, but the best practice indicates that the closed-bottom inner will soon be the standard. The closed-bottom globe certainly possesses the obvious advantage of having only the one aperture to keep tightly closed in operation, while the open-bottom has two, with twice the chance for air leakage. Perhaps every metal and alloy which is available for ordinary manufacturing purposes has been used for carbon holders in inner bulbs, but practice has demonstrated that iron, both cast and wrought, is the only metal which will successfully withstand the heat of the arc and not be deposited on the inside of the globe either in the form of dust or a brownish scale, which unites with the glass and cannot easily be removed. It is necessary, however, to make the carbon bushing of some metal which will not oxidize as easily as iron. On account of the small clearance between it and the carbon, brass is entirely suitable for this purpose, as the bushing is not really inside of the inner globe.

1. From the Electric Journal. Mr. Henderson is assistant superintendent, Newark works, Westinghouse Electric and Manufacturing Company.

Clutches.

Almost as important as the proper enclosure and combustion conditions in the arc, is the question of the clutch. Probably more different forms of clutches have been made than any other part of the mechanism; yet, viewed by present-day standards, it is the simplest thing in the lamp. A clutch cannot be made of metal unless it is well insulated, which is quite a difficult matter. If it is not insulated, and the upper carbon is not firmly seated in its holder, the clutch will attempt to carry current to the carbon, with the invariable result that the clutch is injured by having its edges fused at the point of contact with the carbon. Again, a clutch with many pieces is all the more liable to get out of order, so the simplest possible clutch has been found to be most effective, that is, a porcelain ring mounted in a sheet-metal basket or punching. It is mechanically strong and will never carry current.

Dashpots.

Dashpots are of like importance and should be designed and manufactured with the utmost care. The cylinders should be as round and of as uniform diameter as it is possible to obtain them; valve seats should be accurately machined and the plungers fitted with the greatest care, so that each dashpot will operate in about the same time as every other one; also they must not be affected by wide variations in temperature. To meet these requirements, practically all dashpots are now being made of graphite and brass, since graphite has a practically negligible temperature coefficient, and works excellently as a plunger in a brass cylinder.

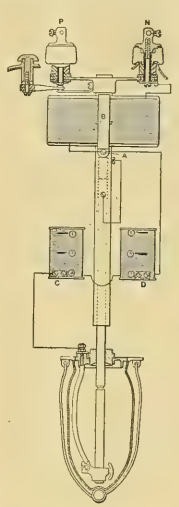


Fig. 1. Direct-current Multiple 110-volt Type.

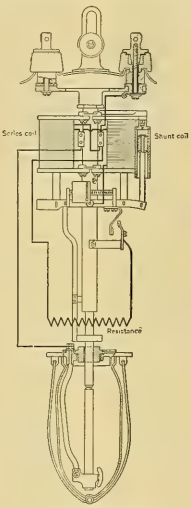


Fig. 2. Direct-current Series and Series-multiple Type.

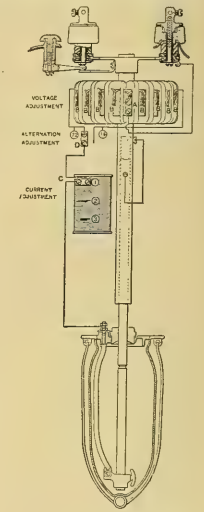


Fig. 3. Alternating-current Multiple 110-volt Type.

CIRCUIT DIAGRAMS OF ARC LAMPS.

Short-circuiting Switches.

The short circuiting switch would seem to be a simple thing, but it may easily be a continual source of trouble, on account of the way it is abused, especially on inside lamps. In commercial service, lamps are generally hung 15 or 20 feet from the floor, and are seldom wired in such a manner as to be controlled by wall switches; so a long pole in the hands of a janitor is generally used to knock the switch back and forth. Such treatment demands a strong and simple switch. If there are no moving wires, it is so much the better, as such wires harden or crystallize in the course of time and break off, making the switch useless until repaired. The best switch, therefore, is one fitted with a substantial handle, working between two positive stops, and having a blade made entirely of insulating material, with a contact button inserted in it, constructed in such a manner as to be forced between two stationary contacts to close the switch circuit and away from them to open. This, obviously, does away with all necessity for moving wires and provides a switch that is practically indestructible.

Binding Posts.

Binding posts also might be considered of small importance to a superficial observer, but they assume new proportions when we stop to think that, in the case of series street lamps, for instance, they are exposed contacts carrying potentials as high as 10,000 volts, and in some cases they have to perform double duty and support the supply lines leading from the pole to the lamp. Practical operation has proven that these binding posts should be compactly built, fitted with two screws, drilled out for wire as large as No. 4 B. & S. gauge and thoroughly protected by heat and moisture-proof insulation, preferably porcelain, arranged in the form of an insulator for outside service.

Alignment of Parts.

Proper alignment should be secured in a lamp by reason of the elements of its structural design. In other words, a lamp should be built so that it will be unnecessary to line it up after assembling. The parts should go together in such a way as to effectually take care of the alignment without further labor. If a lamp movement is not in proper alignment, trouble is to be expected from the upper carbon sticking either in its guides or in the gas-check center. One of the best ways to preserve alignment is to use a rigid center tube construction with a sheath or holder inside of it for the upper carbon. In this method the sheath is connected in the circuit by means of a flexible conductor, which may be inside or outside of the tube. The tube, however, must either be slotted or provided with some other ample means for ventilation. If this is not done the heat from the arc will be retained in the tube and will soon destroy the flexible cable. Various attempts were made in the early days of enclosed arc lighting to supply current to the upper carbon without using a cable, but one by one they proved their inadequacy and were discarded in favor of the cable which is the standard today.

General Considerations.

It is very gratifying to note that many of the features of lamp construction and design which have been outlined in this article are being carried out today in the best modern practice, and that arc-lamp buyers in general are beginning to discriminate against cheap lamps. The time is rapidly approaching when operating men will fully realize the importance of building a lamp of the best possible material, with the highest grade of insulation that can be obtained, combined with workmanship of a good quality, and painstaking shop inspection and testing. The question may be asked as to why all this is necessary, but a consideration of the conditions will make the reasons evident, especially on the high-tension alternating-current series systems. Lamps for this service must operate on circuits of up to 100 lamps, with a potential of over 9,000 volts, and they must continue to operate in rain, sleet or snow, under widely varying temperature conditions and in the most exposed places. Other apparatus for such voltages is protected in every way possible by means of heavy metal cases, large porcelain insulators, and is immersed in oil wherever possible. All of these methods of protection are obviously out of the question in arc-lamp design, yet alternating-current series lamps must not only withstand these voltages but must accurately separate and maintain an arc between a pair of carbons. Moreover, other exposed parts of a high-tension equipment are held rigidly in some such place as on a pole or a building wall, while a lamp is at the mercy of every breeze or gale that blows, being supported in most cases at the end of a light mast arm, or at the center of a slender span wire. These operating difficulties certainly indicate that it is impossible to exercise too much care in the design, manufacture and operation of lamps for outdoor service.

Classification of Lamps.

In taking up the matter more specifically it should be noted that there are three broad classifications

of arc lamps adapted to operate on the different commercial systems such as incandescent, power and street-railway equipments. The first are generally styled multiple lamps and operate on 110 and 220-volt direct current and 110 volt alternating-current constant potential circuits; the second class, series lamps, which operate on both alternating and direct constant-current circuits, and the third class, which is a combination of the first and second, in which lamps operate in multiple series on constant potential circuits. Practically all of the electrical

FIG. 4. CONSTANT-CURRENT REGULATING TRANSFORMER FOR ALTERNATING-CURRENT ARC LAMPS.

and mechanical characteristics noted in the first part of this article are common to all of the commercial types of lamps, and in the brief specific descriptions which follow it should be understood that gas checks, clutches, dashpots, etc., have been described in detail and will only be mentioned in the descriptions as the need arises.

Direct-current Multiple Lamps.

On account of so many isolated plants using 110 volts direct current and on account of many of the larger cities having 220-volt direct-current three-wire systems, a large number of arc lamps suitable for direct-current constant-potential circuits are in operation. Solid carbons are invariably used in these lamps, generally a 12-inch upper and a five or 5½-inch lower. From the circuit diagram (Fig. 1) it will be seen that this lamp consists essentially of a pair of carbons, a resistance and magnets for striking the arc. A dash pot, not shown in the sketch, is used to steady the arc. On the 110-volt multiple lamp the resistance (B) is usually wound with enough wire to enable it to be used on circuits of from 100 to 125 volts, and should be set so as to have an arc voltage of approximately 80. This resistance and the magnet spools should be as nearly fireproof as possible. Much trouble was occasioned with the first enclosed arcs by reason of the resistance, which generally consisted of spring-like coils of wire stretched just enough to separate the turns and prevent them from touching. Such resistances gave very poor results, for, as they heated up, the wire in the coils lengthened sufficiently to short-circuit whole sections, with the inevitable destruction of the resistance and the lamp windings. The resistance spool shown in the circuit diagram does not have this defect, consisting as it does of a large porcelain spool with such deep grooves in its outer surface that it is impossible for the heat to stretch the wire enough to short-circuit between grooves. Such a resistance, combined with magnet spools rendered as fireproof as possible, and proper structural details, make a very satisfactory lamp. The commonest trouble is improper arc voltage. If this voltage is more than 85, the arc is liable to be very unsteady and more of the resistance should be cut in; if lower than 75, the light is poor and the carbon tips oftentimes glaze over with a sort of slag formation which seriously interferes with the proper maintenance of the arc. This condition, being the reverse of the preceding case, requires that some of the resistance be cut out. With the 220-volt direct-current lamp the arc voltage ranges from 140 to 165 at three amperes, according to the voltage of the supply. Both the 110 and 220-volt lamps increase the voltage at the arcs slightly when burning with chipped or broken inner globes, and the glassware should be inspected when long or unsteady arcs are observed.

Direct-current Series Lamps.

Other lamps for the direct-current service are the series lamps for constant-current circuits and the multiple-series for street-railway and power circuits. The latter is practically the same as the series except that it has an arc-compensating resistance which is cut in automatically if, for any reason, the lamp fails to start, thus maintaining the current as constant as possible for the remaining lamps in the series across the 500 or 220-volt mains. The circuit diagram (Fig. 2) shows the main features of this lamp—a series coil adapted to separate the carbons and strike the arc by lifting one end of a pivoted feed lever; a shunt coil working on the opposite end of the feed lever, electrically connected around the arc and arranged to work against the pull of the [illegible] coil, [illegible] the carbon to [illegible]. The dash pot [illegible] ing the [illegible] the arc. [illegible] a threaded rod. [illegible] is provided on the [illegible] lamp. [illegible] used in all [illegible] and the [illegible] mately 80. The chief operating [illegible] by unnecessary friction in the [illegible] breakage of glassware, which [illegible] troubles and are liable to be [illegible] type. It is a good rule to follow [illegible] this class of apparatus to have everything which moves reasonably loose and free [illegible] adherence to this rule will save many dollars in outages in the course of a year.

Alternating-current Multiple Lamps.

The alternating-current multiple lamp is very similar to the direct-current multiple lamp and differs from it only in a few details. A reactance coil is used instead of the resistance and the magnet cores are laminated. This constitutes the chief difference from a structural viewpoint. Fig. 3 shows the major details of the lamp. The voltage adjustment shown on the reactance coil allows for line voltages from 100 to 125 and the alternation adjustment makes it possible to use the lamp on any frequency from 16,000 to 7,200 alternations. In special cases these lamps are operated on circuits as low as 6,000 alternations; below this the alternations become visible to the eye, which is objectionable for general commercial lighting. It is possible to make an alternating-current multiple lamp almost foolproof, which is without question a desirable attribute for any piece of electrical apparatus. This is largely accomplished by treating the coils so as to make it impossible to burn them out in a reasonable time, even though the carbons should slip together. A lamp with this feature is certainly to be recommended as the necessity for repairs to windings is almost entirely if not quite eliminated. The arc voltage on this lamp should be about 72 volts. If set much longer the lamp will rupture the arc and chatter; if much shorter the carbons will glaze and the light will be poor.

Alternating-current Series Lamps.

The alternating-current series lamp is closely allied to the multiple lamp and has many features which are very similar. There never has been a more important advance made in arc lighting than was made by the introduction of the constant alternating-current series system suitable for operation on constant-potential alternating-current bus-bars. This was made possible by the constant-current

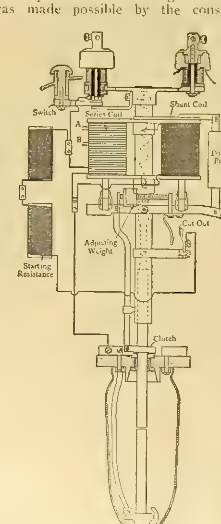


FIG. 5. CIRCUIT DIAGRAM OF ALTERNATING-CURRENT SERIES ARC LAMP.

regulating transformer. It is primarily a transformer, receiving any commercial bus bar voltage and raising or lowering it to meet the demands of the circuit whether it be 50, 75 or 100 lamps; secondarily, it is a regulator delivering a constant current from no load to full load. (See Fig. 4.)

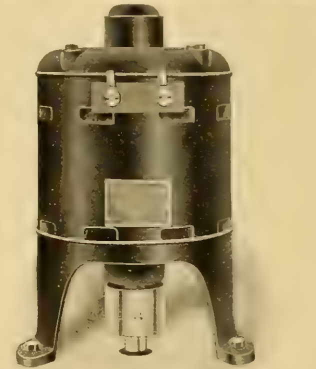
The auxiliary apparatus pertaining to the alternating-current series system consists of a regulating transformer with the primary connected to the source of supply and with the secondary connected to the line. In this line the lamps are connected, together with suitable protective and switching devices, an ammeter and a safety coil. From this coil low-tension leads are brought out, making it possible [illegible] rior illumin[illegible]

[illegible] at 72 [illegible] have been burned [illegible] the case of alternating-current [illegible] bons must be [illegible], however, are [illegible] upper and lower.

In general, careful [illegible] size of carbons, accurate-fitting glassware and the habit of keeping the lamps [illegible] well repaid by more efficient [illegible] outages.

New Line of Single-phase Alternating-current Motors.

To meet the rapidly increasing demand for vertical single-phase self-starting motors, the C[illegible] Electric Company of St. Louis has designed a line of such motors ranging in size from one-half to five horsepower. The standard winding is 104 or 208 volts, interchangeable. The design of the bear-



VERTICAL TYPE OF SINGLE-PHASE ALTERNATING-CURRENT MOTOR.

ings is such that oil cannot get into the motor, and they can be either belted or direct connected to a vertical shaft. The motor as a whole is well protected and at the same time well ventilated. A heavy demand is experienced for these motors for operating centrifugal pumps, for house service and irrigating, as they are entirely automatic in operation and can be started and stopped with an ordinary float switch.

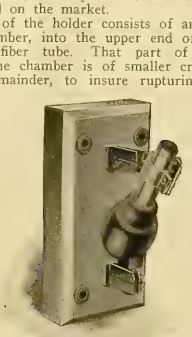
The standard form of construction employed is well protected and at the same time is sufficiently ventilated to permit of the motor carrying heavy loads continuously without an abnormal temperature rise. The bearings are exceptionally large, the best phosphor-bronze being used in their construction, and the oil wells are of ample capacity to hold sufficient oil for several weeks' run, and are of such design as to prevent the possibility of "pumping" oil out of the bearings. The shafts will be found of sufficient size for the most severe service. These motors can be mounted on the side wall or ceiling, by turning the end plates 90 degrees or 180 degrees, so as to keep the oil cups in a vertical position. A substantial iron sub-base is furnished with all except the one-half-horsepower size, which furnishes a good foundation for the motor, and a means for tightening the belt and insuring a constant alignment of pulleys. The one-half-horsepower motor has oblong holes for fastening to the floor.

Vertical motors can be supplied on short notice, with bearings so arranged that positively no oil will drop into the winding of the motor. A view of one of the vertical-type motors is given.

New Type of High-potential Fuse Holder.

The General Electric Company has perfected a new device in the shape of a high-potential fuse holder. These fuse holders are designed to protect 2,300 and 6,600-volt systems, but can be made to suit special requirements for higher voltage. They supersede the "expulsion" type, and will be used in the future on all General Electric switchboards requiring high-potential fuses. The device is of small size, and the company asserts that it is capable of rupturing more energy, under short-circuited conditions, than any other similar device heretofore placed on the market.

The body of the holder consists of an insulated metallic chamber, into the upper end of which is screwed a fiber tube. That part of the fuse located in the chamber is of smaller cross-section than the remainder, to insure rupturing at that



NEW TYPE OF HIGH-POTENTIAL FUSE HOLDER.

point. The expansion of the gases formed by the arc in the chamber expels the fused metal and effectually opens the circuit.

New fuses can be readily inserted in the holder by removing a screw plug located in the bottom of the bulb. The holder is connected in circuit by means of blades fastened to each end, which fit into clips mounted on a base or switchboard panel. The advantages of this method of support will be readily understood. Spare fuse holders can be kept on hand ready for the instant replacement of ruptured fuses.

Compact, substantial and easy to handle, the device may be located in any convenient place. The holder can be supplied in groups of two, three or four, mounted on bases or in single elements without bases for switchboard mounting.

It is recommended that 2,300-volt holder be spaced on 12-inch centers and 6,600-volt holders on 18-inch centers, unless barriers are used between them, in which case these distances can be made five inches and eight inches, respectively.

Ampere rating corresponds to the continuous-current-carrying capacity, and the rupturing point is approximately 60 per cent. greater. Fuses for operating on small overloads can be made to order.

The 2,300 and 6,600-volt fuse holders are made to carry 100-ampere fuses or smaller sizes. Holders of both voltages are furnished back connected for switchboard use without base and either back or front connected on base singly or in groups with barriers.

Electrical Properties Company.

Details of the formation of the Electrical Properties Company, of which John F. Wallace, former chief engineer of the Panama Canal, is president, have been made public. The company has a capital of $6,000,000 preferred stock and $6,000,000 common. Its object is "to acquire, finance and develop properties, either in whole or in part, especially those in which electricity plays the principal part, such as power, electric traction and electric-lighting enterprises, and to invest and deal in and to guarantee the securities of corporations operating such properties. It will also conduct, through Westinghouse, Church, Kerr & Co. (all of whose capital stock is owned by the new company), a general engineering and construction business. It may also issue collateral trust bonds secured by the pledge of securities acquired in the course of business. It is not intended to make any changes in the organization or personnel of Westinghouse, Church, Kerr & Co.

"One of the objects of the new company will be to co-operate with vested interests, such as railways and other public-service companies, in the development of properties for their account, and either temporarily or permanently assist in financing such properties."

The directors, largely representing financial and railroad interests, are Charles H. Allen, Paul D. Cravath, H. D. Giddings, N. W. Halsey, Moses Taylor, F. D. Underwood, R. B. Van Cortlandt and John F. Wallace of New York; George Westinghouse and George C. Smith of Pittsburg; John A. Spoor of Chicago and E. G. Tillotson of Cleveland. The headquarters of the company will be at 111 Broadway, New York city.

Space-telegraph Plans of the Wellman Polar Expedition.

M. J. Smith and C. J. Morley have gone to Europe to join Walter Wellman who is preparing for an attempt to reach the North Pole in the largest airship ever built. Details of the airship and plans of the expedition have been printed in the Western Electrician. Mr. Smith will be in charge of the space-telegraph details by which it is planned to keep in communication with cable stations. He will operate the apparatus in the airship during its flight. Mr. Morley will be in charge of a wireless station to be established on the Arctic steamship Frithjof, which will be anchored at Spitzbergen, while the airship is away. At Hammerfest, in Norway, which is a cable station, another space-telegraph station will be established to communicate with the Spitzbergen station. Mr. G. A. Robinson, who has just completed a series of wireless experiments abroad with Lee De Forest, will be in charge at Hammerfest.

As many messages as possible will be sent to the Frithjof by Mr. Smith as soon as the airship leaves. Each of the messages, according to the plans, will give the exact latitude and longitude, so that the last location will be known should no messages be received after a certain time, when it will be fair to assume that some accident has befallen the ship. A special code will be used, intelligible only to the three operators. This is done to prevent the acceptance of spurious messages that might be sent from other sources and picked up by the stations either at Spitzbergen or Hammerfest.

Although messages will be sent under somewhat different conditions than have ever been attempted before, Mr. Smith expects the apparatus to work satisfactorily. He says: "The reason why the wireless system on the ship is going to be so much of an experiment is due to the fact that we will have to use the steel frame of the airship as an artificial ground. We shall be up in the air and we shall have to work downward. Instead of having a solid mast or anything of that sort, we shall have to drop our wires from the frame of the ship. Four long wires will be suspended, each 250 feet long. I am taking an alternating-current generator along, and this will be connected with the 55-horsepower gasoline motor, the larger of the two motors on the airship. All of these appliances I shall attach to the frame of the ship in Paris, to be forwarded with the big balloon itself to Tromsoe, Norway, where the entire party will meet early in June.

"Mr. Morley will meet Mr. Robinson in London and accompany him to Hammerfest to assist in putting up the appliances there, and he will then join the polar party at Tromsoe. Including mechanics, sailors and other workmen, there will be about 35 men in the party, but only five will go on the airship, the others staying at Spitzbergen, where quarters will be on Dane's Island."

Concerning other details of the trip, the Chicago Record-Herald, which is conducting the expedition with Mr. Wellman, says: "The French aeronaut, Gaston Hervieu, who will be the pilot of the polar airship, will give Mr. Wellman and the other members of the party several lessons in flying through the air in ordinary balloons before they leave Paris, so that they may be accustomed to traveling at a considerable height above the earth. Mr. Wellman said before leaving New York for Europe that he hoped to get away from Spitzbergen on the trip to the Pole early in August. He wishes to try out his airship there, as it will not be tried in flight before reaching Spitzbergen. He believes the ship can be kept in the air from 20 to 25 days. He will carry 5,500 pounds of gasoline, enough for 140 hours' use at an average speed of 12 miles an hour. He hopes to reach the Pole in from two to seven days, according to the winds, and if he succeeds he will have sufficient fuel left to sail back to land and relate his experiences."

Milan Exposition.

The Milan International Exhibition was opened at Milan, Italy, on April 28th by Mr. Pantano, minister of commerce. The king and queen of Italy were present at the opening. The completion of the Simplon Tunnel, one of the principal reasons for giving the exhibition, is given special prominence in the Parco section. Here there is an elaborate reproduction of both ends of the tunnel, and in a separate cinematograph pavilion every phase of the work is exhibited. Various nationalities have representative exhibits at the exhibition. The king of Italy has offered a prize of $972 for the best method of taking high-voltage electric currents without danger to the operator.

Power Center for Small Users in Indianapolis.

Work has been begun on the large power plant of the Laycock Power House Company in Indianapolis. The plant will occupy an entire block and be five stories high, representing an investment of $500,000. The purpose is to furnish space and power to small manufacturing concerns and has the promise of being a veritable manufacturing municipality. The Laycock company is in the market for considerable electrical and power equipment with which to install the new plant.

Commercial Telegraphers' Union.

The annual meeting of the Commercial Telegraphers' Union of America was held in Cincinnati, Ohio, last week. Perhaps the most important action taken was the decision to establish an assessment-insurance feature for the organization. This is to include sick and death benefits, and to provide a fund for those temporarily out of employment. It was also decided to have a ritual and initiatory exercises, the members believing that this will lend interest to the meetings. So far nothing of the kind has ever been attempted. M. J. Reidy of Boston advanced the idea that the government should pension the telegraphers who served during the War of the Rebellion. Milwaukee was chosen for the next place of meeting.

Chicago Street-railway Situation.

The United States Supreme Court has refused a rehearing in the case involving the 99-year claims of the Chicago traction companies to the streets in which they operate. The companies now have absolutely no rights to the streets except those contained in the franchises granted by the City Council. Some of these have expired, others expire in a year or two, and in some streets the companies have the right to operate until the city buys the systems, if it chooses to buy. Thus there is now no danger to Mayor Dunne's municipal-ownership plans if the companies are given permission to discard the cable and adopt the trolley. New plans of procedure in settling the traction situation may be taken up at once.

Indiana Telephone Items.

The A. and G. Telephone Company, capitalized at $5,000, has been incorporated to construct a telephone system in Vanderburg, Posey and Gibson counties. Louis A. Haas, Christ Strupp, Henry P. Goeble and Jacob Holtzopple of Evansville are directors.

The Cyclone Co-operative Telephone Company of Cyclone has filed articles of incorporation, proposing to build in Cyclone and Clinton County. The incorporation papers declare the ultimate object of the company is to obtain the most extensive telephone service possible at the actual cost of operation. The territory occupied by the company will be divided into nine districts, and the board of directors will consist of one member from each district. Every person becoming a member shall pay equally a share of the maintenance and operation of the system. If any stockholder shall become delinquent for seven days his connection with the central office will be severed. All communication over trunk lines of the company will be limited to five minutes each. Albert Strong, W. D. Bolt, W. G. Irons and W. S. Emley are the directors.

It seems assured that the Independents who were crowded out of the Marion field by the recent consolidation of the United Telephone Company and the Central Union Telephone Company will soon be represented in Marion again. The Citizens' Automatic Telephone Company, a new organization, has filed a bond accepting the franchise granted several weeks ago. O. L. Barger of Converse is one of the promoters of the new company. The company proposes to install the automatic telephone system.

The Business Men's Association of Greenwood has decided to dispense with one telephone company. A committee has been appointed, headed by F. O. Hoyt, to confer with the management of the Central Union and Independent Telephone companies to see which will grant the lowest rate and best service. The members have pledged themselves to patronize only the company with which they can make the most favorable terms. This uprising is due to the fact that the local Independent company increased its service rates from a flat rate of $1 a month to $2 for business telephones, $1.50 for residence telephones and $1.25 for farmers' lines.

Superintendent Katterjohn of the Cumberland Telephone Company of Evansville has submitted plans for the underground conduit system to be used by his company to the board of public works. The board and City Engineer Saunders will pass upon the plans within the next few days. Mr. Katterjohn said that as soon as the plans were accepted by the board the Cumberland would proceed with putting their wires underground.

The telephone situation in Indianapolis remains unchanged, the Board of Public Works having taken the matter of an increase of rates and extension of franchise of the Indianapolis Telephone Company under advisement. The Board of Governors of the Board of Trade has adopted a resolution protesting against the authorities granting the request of the company for changes in its franchise which will enable the owners to increase their rates. Mayor Bookwalter has requested the legal department to make a careful examination of the questions relative to the validity of the Central Union franchise. If the contract is found to be assailable or the claim of a perpetual franchise is maintained by the company, action will be taken,

since the courts have decided that [illegible] has no right to grant either a perpetual or an exclusive franchise to any corporation. S.

Ohio Telephone Notes.

At a conference between General Manager Kilgour of the Cincinnati and Suburban Bell Telephone Company and the striking linemen a few days ago the men were given to understand that if they wanted to go to work they must apply individually to the superintendent of construction. They would not be taken back in a body. The men decided to stand together and go back in a body or not at all.

The Boughtonville Telephone Company of Boughtonville has been incorporated by W. G. Blackmore, J. O. Palm and others. The capital stock is $10,000.

Articles of incorporation have been issued to the Minerva Telephone Company of Minerva, Stark County, with a capital stock of $4,000. E. D. Shaw, R. T. Davis and others are interested.

The surplus shown by the Cuyahoga Telephone Company for the first three months of the year is $40,297.71, in comparison with $20,451.06 for the corresponding period last year. The United States Telephone has also been making a much better showing than it ever did before. This is largely because of the additional number of connections and the extensions to the trunk lines.

The new exchange of the Tuscarawas Telephone Company of New Philadelphia has been completed and the lines all cut in.

At Coshocton the Citizens' Telephone Company has moved into its new quarters in the Burns Block, where a new exchange has been installed.

Louis Mischler and others have incorporated the Brown County Independent Telephone Company of Georgetown, with a capital stock of $10,000. Considerable Independent development is taking place in that section of the state. C.

Canadian Telephone Items.

The Independent Long-distance Telephone Company has obtained a franchise from the Ontario Legislature. The sum of $200,000 must be spent within one year by the company or the Bell Company will retain the right to make exclusive contracts, and if this sum is not spent within the two years the franchise will be forfeited.

One of the most important bills at present before the Dominion Parliament is the measure giving the Bell Telephone Company of Canada power to increase its capital stock from time to time to an amount not exceeding $50,000,000. The present capitalization of the company is $10,000,000. The reasons given by the company for this immensely enlarged capital increase sought for were explained to the railways committee by Mr. Lafleur, K. C., the company's representative. He said that $9,000,000 of the present capital stock of the company is paid up, leaving only a margin of $1,000,000. The development plans were extensive. During the present year the expenditure would be: For new exchanges, $2,500,000; underground conduits, $900,000; long-distance connections, $700,000; buildings, $400,000. The expenditure of the next ten years for substations would be $21,000,000; for underground conduits, etc., $23,000,000; for long-distance connections, $11,000,000; a total for ten years of $55,000,000. The present investments of the company in Ontario are $5,500,000; Quebec, $4,500,000; Manitoba, $2,000,000. W.

The Telephone in Washington and Oregon.

The Home Telephone Company of Spokane, Wash., has commenced work on the construction of its city system. Charles S. Zahn, a telephone engineer with the Empire Electric Company, is in the city in charge of the work. A. Andrews is purchasing material and supplies.

The Tumalum Mutual Telephone Company has been organized at Freewater, Ore., and will be built between that place and Walla Walla. F. J. Bodefelt is president.

The Pacific States Telephone Company will expend $50,000 making its building on Wall Street in Spokane fireproof. The framework of the building will be replaced as far as possible with iron and fireproof brick.

Manager J. E. McGillivray of the Pacific States Telephone Company at Walla Walla announces a substantial reduction in rates on the rural lines between that place and Spokane, the service being furnished for $3 a year when the customer furnishes his own instrument. Under this promise many extensions will be added at once.

A telephone company at Medical Lake, Wash., formerly a mutual concern with 27 telephones, has been incorporated and is putting in a modern system. The monthly rental is to be $1.25 for residences and $1.50 for business houses. The long-distance rate to Spokane, 16 miles, is 15 cents. B

Southeastern Telephone Developments.

The Monroe (N. C.) telephone exchange has decided to charge small outside concerns for connections into the town, for special calls, and the outside companies have kicked on the proposition. Another local [illegible] were granted at [illegible] a new system [illegible] started to [illegible].

An ordinance [illegible] Petersburg, Va. [illegible] Company [illegible] manholes [illegible] center of the city.

The Louisville [illegible] the local [illegible] underground [illegible] nance [illegible] before the [illegible] if adopted, require all [illegible] to be placed under the [illegible].

The Meridian Home Telephone [illegible] ridian, Miss., has been [illegible] in Alabama with [illegible].

The Southern Bell Telephone [illegible] for the present year [illegible] increase of $237,510 over last year.

The Reran Telephone Company [illegible] is chartered with $5,000 capital [illegible] are: W. C. Harvey, president [illegible] Smith, secretary and treasurer, Hart, [illegible]

Telephone News from the Northwest.

The Alpena Farmers' Telephone Company of Alpena, S. D., has been incorporated with a capital of $4,500.

John O. Sohe will soon start work on a local exchange in Fountain, Minn.

Frank Trubler has been appointed manager of the Northwestern Telephone Exchange Company's office in Hudson, Wis., replacing H. A. Livermore, who is transferred to another point.

The Hallock (Minn.) Telephone Exchange has been succeeded by the Kittson Telephone Company, which has just been organized. Work will be started at once for the construction of rural lines.

A meeting was held in St. Paul, May 8th, of the Central Telephone Exchange Association, consisting of Independent telephone companies in different parts of Minnesota. Discussion was indulged in of standardizing the apparatus and construction and how best to serve local communities and rural connections from local exchanges. The association adjourned to meet September 5th.

James W. Bowling of Clarinda has succeeded J. P. Mason as manager for the Iowa Telephone Company at Fort Madison, Iowa, the latter entering the general office at Des Moines.

There is considerable agitation at Willmar, Minn., in favor of the city purchasing the local exchange from the Willmar Telephone Exchange Company. The latter is said to be willing to sell. R.

Illinois Telephone Men Discuss Clearing House Project.

Independent telephone owners and managers of the fifth district of Illinois, which includes the counties of Woodford, Peoria, Tazewell, Fulton and Mason, held a convention at the Hotel Fey in Peoria last week. J. S. Daily of Chillicothe opened by reading a paper on toll accounting. Mr. Daily's object is the establishment of a telephone clearing house for Central Illinois in Peoria. The proposition to establish a clearing house received a number of signatures, but no definite action was taken by the convention. Mr. Daily advocates an effective and equitable agreement, whereby each company will receive the proportionate amount of the toll-board earnings.

John H. Sullivan of Havana read an interesting paper on construction. The secretary of the state organization, C. B. Cheadle of Joliet, gave an instructive talk on the value of affiliation with the state organization and urged the members to work together.

Officers were elected as follows: President, J. S. Daily of Chillicothe; vice-president, W. G. Olwin of Peoria; secretary and treasurer, H. W. Bullock of Eureka. The delegates were very much pleased with the report of the Interstate Telephone Company of Peoria that it had installed nearly 3,000 instruments in eight months. The companies all reported great gains over the Bell company.

G. H. Glass of Pekin, as president, opened the afternoon session with an address. He was followed by Prof. J. C. Kelsey of Lafayette, Ind. "Our Duties to the Public." by Hon. C. B. Cheadle of Joliet, and a paper by G. O. Baker of Peoria, on "Maintenance of Central-energy and Magneto Switchboards" finished the programme. The Question Box and reports of committees finished the session, after which the convention adjourned.

New England Telephone Company's Report.

The New England Telephone and Telegraph Company's annual report for the calendar year 1905 shows the following: Operating expenses, $6,447,122, against $5,880,318 the previous year; net earnings, $1,624,121, against $1,443,242 in 1904; dividend, $1,458,648, against $1,320,447 in 1904; surplus, $165,473, against $122,795 in 1904.

In his report President Thomas Sherwin says the exchange stations operated under the management of the company in Maine, New Hampshire, Vermont and Massachusetts numbered 185,448, as [illegible]

Annual Meeting of Bell Contract Agents.

[illegible] gates were remembered hand[illegible] [illegible] headquarters during its sessions, and the dai[illegible] sions were held in that building.

GENERAL TELEPHONE NEWS

The Pan Long Distance Telephone Company of Fort Smith, Ark., has been incorporated with a capital of $1,000,000 by W. A. [illegible] and others.

The Chicago Telephone Company announces a gain of 2,997 instruments for the month of April: 2,315 in the city and 682 in the country. The total now in use is given as 152,177, of which 111,835 are in the city and 41,342 in the country.

Among the recently incorporated telephone companies are the following: Home Telephone Company, Weatherford, Tex.; Sarcoxie Telephone Company, Sarcoxie, Mo.; Smithfield Mutual Telephone Company, Smithfield, Neb.; Heaston and El Reno Telephone Company, Heaston, Okla.

The Newcastle Telephone and Electric Company of Newcastle, Pa., has been organized as a result, it is said, of the Bell people raising their rates. None but telephone users are to be stockholders, and no person can hold more than 15 shares of stock, the value of which has been placed at $5 each.

The annual meeting of the managers of the exchanges of the Citizens' Telephone Company of Grand Rapids, Mich., was held in the company's building in Grand Rapids recently. Technical papers were read and discussed and in the evening a supper and smoker was given by the employes of the company, at which about 180 employes and officials were present. Representatives of other Independent companies in the state were also present.

The net earnings of the Michigan State Telephone Company for the year 1905 are shown in the annual report to be $625,989. The surplus for the year was $250,405. Gross earnings were $2,293,552. Since the reorganization in 1904 the company has shown good earnings. During 1905 $908,718 was expended in exchange and toll line construction. At the close of the year there were 77,047 subscribers' stations connected to the exchanges.

Writing from Oakland, Cal., Mr. John Van Loew, treasurer of the Empire Construction Company of California and president of the California Independent Telephone Association, says concerning San Francisco: "That you may know we have faith in the coming city, five days after the terrible catastrophe a franchise for a telephone system was to be sold and our company paid $100,000 for the same, and construction will be commenced just as soon as material can be assembled."

The Twin City Telephone Company of Minneapolis has transferred all its property to the Tri-state Telephone and Telegraph Company for $4,000,000. This is an amalgamation of the two companies. The Twin City is the Minneapolis urban operating company, and the Tri-State has been its country and long-distance connection. E. H. Moulton of Minneapolis is president of both companies and holds a controlling interest. The company plans to operate more extensively in Minnesota, North and South Dakota and Iowa, and to extend lines into Wisconsin and elsewhere northwest.

CORRESPONDENCE.

Great Britain.

London, May 2.—At last a commencement has been made with the consideration of the electric power bill of the London County Council, although it would appear that it will be many weeks ere the inquiry will conclude. The details of the proposal are interesting, although the methods adopted by the council are in some respects a departure from the usual practice. For instance, it is the custom for the promoters of a bill such as this to state in it the price at which consumers will be supplied. This, of course, implies a binding contract from which the promoter cannot recede, but the County Council has not done this. A price has been given verbally which will work out even cheaper than that suggested by Mr. Merz last year, but there is no guarantee that this will be adhered to, for one clause of the bill states that if, after five years, the receipts do not equal the expenditure, then, to obviate a call upon the rates, the prices must be raised. Another important point of difference is that there is nothing in the bill to enable any consumer to demand a supply, and the argument of the council that the bill is purely a permissive one is hardly so alluring as it might at first sight appear. The estimated capital expenditure is put at $75 a kilowatt against $40 by Mr. Merz last year. The full engineering details are yet to come, and the cross-examination on behalf of Mr. Merz's company should prove distinctly interesting.

The smoke nuisance in London has been getting worse each year and in a few separate notes are set out the terms of a memorandum on the subject which has been issued by one of the government departments in special reference to electric generating stations. The committee considering the London County Council bill has had this memorandum referred to it and special consideration is to be given to this point.

The dissatisfaction which was at first expressed in connection with the flotation of a company to run electric 'buses in London has now developed into open opposition on account of the unsatisfactory nature of the prospectus and the hurry with which applications for shares were dealt with and allotments made. From the financial papers it appears that the warnings to the public came too late to prevent many allotments being made before the withdrawal of the application could be made, and a recommendation has been published by one paper that those persons who have had shares allotted should at once call a meeting and pass a resolution to wind up the company on account of insufficient disclosures in the prospectus. The technical papers are equally objecting to the statements made by the promoters, and it is certainly suggestive when, having made the assertion that certain vital contracts exist as to upkeep of batteries, the name of the firm so contracting should be withheld.

The overcrowding of railways has been a sore point with many people in London ever since the introduction of the electric service upon the Inner Circle railway. It is not surprising, therefore, to find that a bill has been introduced in Parliament by a number of private members endeavoring to fix the responsibility for overcrowding in trains. Whether it will proceed very far is doubtful. But in principle it is good enough. It gives the Board of Trade authority to interfere by referring the matter to the railway and canal commissioners, who have jurisdiction in these matters, and it suggests that if the companies fail to comply with any requirements suggested by the Railway Commission, certain advantages which railway companies now have should be discontinued. The most drastic suggestion is that any employe of a railway company refusing or neglecting to prevent overcrowding should be fined $25. It would absorb a few weeks' wages, I am afraid, in some cases, to pay such a fine.

The negotiations between the postmaster-general and those municipalities owning telephone systems have at last reached a point which has called forth a definite and decisive statement from the postmaster-general on the question of the purchase of these systems. He refuses to offer the whole of the capital expended upon such systems as their purchase price, and any offer he makes must take into account an adequate allowance for depreciation. Neither will the postmaster-general give an undertaking assurance that the existing rates of subscription to any municipal system would be maintained for a longer period than, say, two years, in the event of the system being acquired by him. A conference is being arranged between the five authorities owning telephone systems to discuss the matter. G.

Dominion of Canada.

Ottawa, Ont., May 12.—The government has a bill before Dominion Parliament to regulate the export of electric current from Canada. General regulations, concerning the export of electric current, natural gas and petroleum, are to be made by the government, but the administration is vested in the minister of customs, who will have power to grant and revoke the needed licenses. Exportation, without license, will be severely punished, the minimum fine being placed at $1,000. There is a proposed amendment to exempt from the law those companies that have acquired rights under the charters from the Dominion government.

The Canadian General Electric Company of Peterboro, Ont., recently applied to the council of that city for a fixed assessment of the company's property at $150,000, in consideration of the erection of new buildings to cost from $300,000 to $400,000, practically doubling its works and giving employment to 2,000 men. The application was almost unanimously granted, the council finding it easier to come to a conclusion since the company threatened to remove to Toronto, where the Canada Foundry Company, an allied concern, has 75 acres of land and a fixed assessment. About fourteen years ago Peterboro gave the company 30 acres of land and a fixed assessment of $100,000 to secure the original plant.

The Montreal Light, Heat and Power Company, through its subsidiary company, the Provincial Light and Power Company, has plans completed by which it will deliver 5,000 horsepower into Montreal by November 1st. Contracts for the canal and dam work, as also for the power house and electrical machinery, will be awarded at once. The exact location of the new plant will be near the summit of Cedar Rapids, five miles from the town of Vaudreuil. It is expected that the company will secure 15,000 horsepower from the falls. The construction of the new plant and the transmission lines to Montreal will be carried out under the supervision of Mr. W. McLea Walbank, the first vice-president of the Montreal Light, Heat and Power Company.

J. F. H. Wyse of the electrical engineering firm of Wyse & Middlemist of Toronto has returned from Nova Scotia, where he has been employed by the Maritime Coal, Railway and Power Company to inquire into and report on the company's project to generate power and transmit electricity from Chignecto Mines to Amherst, Sackville and other nearby centers. Mr. Wyse states that the scheme was absolutely practical and would be rushed ahead. The Nova Scotia company intends to build a big electrical generating plant near the mouth of its coal mines, six miles from Amherst, and transmit power. W.

New England.

Boston, May 12.—The Salem Electric Lighting Company is about to build an office and storehouse, 34 by 140 feet, on Lafayette Street in Salem, Mass. The company will install an additional Mackintosh & Seymour compound engine of 1,500 horsepower, making the horsepower at its plant aggregate 3,535.

The Boston and Worcester Street Railway Company reports for the six months ending March 31st as follows: Operating expenses, $125,177, against $114,274 last year; net earnings, $70,581, against $47,634 last year.

The Western Union Telegraph Company has transferred its division headquarters from Hartford to New Haven, Conn., because the New York, New Haven and Hartford Railroad Company and the Southern New England Telephone Company have their head offices in that city.

The Newton Street Railway Company is fitting up four smoking cars at its Waltham (Mass.) car shops, and will put them on the Boston Suburban company's line between South Framingham and Worcester, Mass., next fall. They will be the first smoking cars to be installed on New England electric railways. Each has a smokers' compartment seating 11 persons. If these cars prove successful more will be built for the Boston Suburban Companies' lines.

W. Scott Libbey, manager and one of the principal owners of the Auburn and Lewiston (Me.) Electric Light Company, is to give a building to Bates College at Lewiston, which is to be used for the college literary societies and the commencement exercises. Mr. Libbey was operator in the Western Union Telegraph Company's Lewiston office in 1878 and later became its manager. He was one of the projectors of the dam across the Androscoggin River at Deer Rips, at which is generated the power used on the Lewiston, Brunswick and Bath electric railway.

Michael Seretto of Boston bought the Rockland, South Thomaston and Owl's Head Street Railway at the sheriff's sale, May 8th. The road was sold to satisfy Mr. Seretto's claim of $17,492 for unpaid services in the construction, which was allowed by the Supreme Court. Arthur F. Littlefield and F. T. Kimball are managing the road as receivers. Mr Seretto has filed a bill in equity asking for the dissolution of the receivership.

The Connecticut Valley Street Railway Company has asked the Massachusetts railroad commissioners' approval of the blanket freight-carrying privileges which it has received from the selectmen of Deerfield, Whately and Hadley, Mass. The company was formed by the consolidation of the Greenfield and Deerfield, the Greenfield and Turners Falls and the Northampton and Amherst companies, each of which had obtained special legislative acts authorizing the carrying of freight.

The Old Colony Street Railway Company announces that it will begin a freight service between Providence, R. I., and Brockton, Mass., next Monday. This will be an extension of the service from Taunton to Brockton. Later the company will install a freight and express service from Brockton to Whitman, Abington, North Abington and Rockland, Mass.

The Massachusetts Legislature has rejected an amendment to the revised laws which provides that municipal light boards shall not contain persons employed by gas or electric-light companies or any company which makes or sells any article used by gas and electric-light companies, and that municipal plants shall charge the same rate for gas and electricity used by the municipality as for that used by other consumers, except that street lights shall be at such rate as the city or town may determine.

The Boston and Lowell Interurban Railroad Company has been granted a franchise in the city of Medford, Mass. The Medford aldermen have adopted an order prohibiting riding on the running boards of street cars in that city. B.

New York.

New York city, May 12.—The corner-stone of the United Engineering Building was laid on Tuesday of this week. The stone is of granite and covers a metal box containing, among other things, a gold plate bearing the offer of Andrew Carnegie, dated March 11, 1904, to devote $1,500,000 to erect a building for the joint use of the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Institute of Electrical Engineers and the Engineers' Club. Only a few outside the conference committee were present. Mrs. Carnegie laid the corner-stone, using a silver trowel. She was accompanied by her daughter. President E. E. Olcott of the United Engineers' Society made the introductory address, and Mr. Carnegie was called upon and in his remarks congratulated the engineers upon their work.

The Erie Railroad has several important questions to decide as to the best and most convenient methods of serving the thousands of people who have adopted New Jersey as an abiding place. For years its commuter business has been growing so rapidly as to overtake additional facilities, and now the company is facing the question of what method will give the quickest and most convenient service. It is proposed to build a four-track open cut through Bergen Hill and eliminate the tunnel for passenger service. The question of motive power has practically been decided in favor of electricity, and the improvements in this direction will involve the electrification of 250 miles of suburban railroad. The matter of the electrification of the Erie suburban lines is now in the hands of a special commission appointed several months ago. The report of this commission will probably not be completed for six months. The questions submitted by the Erie Railroad to its commuters to determine their preferences in the matter of transportation facilities from Jersey City to New York were answered by 10,386 of the road's daily passengers. This is about half the number of persons who travel back and forth from their homes over the Erie Railroad. The answers show that 72 per cent. of these commuters prefer a terminal at some point below Canal Street, while only 10 per cent. desire the use of a New York terminal between Eighteenth and Thirty-fourth streets. At present 79 per cent. of the Erie commuters travel by the Chambers Street ferry, while only 11 per cent. use the Twenty-third Street line. The Erie hasn't decided yet whether it will use a tunnel to Manhattan.

The surface railways of Manhattan are recovering the business lost by the opening of the Subway, according to figures of local passenger traffic for the first quarter of 1906, issued by the state railroad commission. In that period the Metropolitan system carried 89,454,010 passengers, an increase of 8,769,413, whereas in 1905 the traffic showed a loss of 1,027,946 fares as compared with 1904. In 1905 there was a falling off of 7,526,978 transfers, but in the first three months of 1906 there was an increase of 6,826,867 in the number of transfers issued. Taking the city as a whole there were 297,339,165 passengers carried, an increase of 37,061,250, or 14¼ per cent., while the gain of 1905 over 1904 was only 12 per cent. In the entire city the number of surface transfers issued in the quarter was 68,212,755, an increase of 10,822,871, and the car mileage was 56,998,216, a gain of 6,522,434.

The elevated showed a small falling off in January and February, which was overbalanced by a big gain in March as compared with that month last year when the strike was on. The Subway reported 41,029,733 passengers for the quarter, an increase of 11,491,007, or almost 40 per cent. The total increase of the business of the Interborough-Metropolitan lines for the three months was 23,479,448 passengers, making a total of 196,217,728 fares.

The Brooklyn lines showed the following gains in business, comparing the first quarters of 1905 and 1906: Brooklyn Rapid Transit Company, 70,163,154 to 80,184,600; Coney Island and Brooklyn Company, 6,197,683 to 6,520,794; Van Brunt Street line, 397,025 to 418,310. The Bronx lines carried 8,353,317 passengers in the quarter, a gain of 2,217,599.

Lee De Forest, who has been experimenting with Dr. Alexander Graham Bell's tetrahedral kites as

a means of receiving space-telegraph messages, arrived here a few days ago on the Amerika. He conducted the experiments at Bantry Bay, on the southwest coast of Ireland, and they were highly successful, he said. His purpose was to test the kites as elevated conductors and he found their use not only interesting but practical and advantageous. The kite alone, however, would not be perfect for the purpose, because it could not be raised in a calm. The balloon would not do, for a wind would make it unmanageable. A kite balloon, he said, would be the correct device, for it could be kept at an elevation of more than 1,000 feet. Mr. De Forest said he could vouch for having received, as reported, by means of kites at Bantry Bay a message sent from the Manhattan station of his company 3,000 miles away.

Mayor McClellan objects to the tenor of the remarks made by A. B. Boardman, counsel to the Rapid Transit Commission, to the commission when Mr. Boardman declared that private capital could not be induced to invest in subway building under the Elsberg bill. To this view the members of the commission generally assented. "We shall get bids for new subways, all right," said the mayor, "but even if we should not, the city could build piecemeal, taking one or two subways at a time, and the increased property valuation along the line would help us on our borrowing capacity. Paris does not seem to have had any trouble in getting bidders for its subway on a 35-year operation basis, six bidders having competed. It costs more to build there, too."

At the Advertising Show in this city there was a large exhibit of flashers and electric signs by the Advertising Mirrorgraph Company and the same style of an exhibit by the Thermo Electric Lighting Company. Space was also occupied by the Crocker-Wheeler Company with motors and dynamos for use in connection with the printing business. Charles J. Bogue had a searchlight on exhibition.

The public buildings trustees of Albany at their last meeting took action whereby bids are to be submitted for the construction of a Capitol light plant. A prominent electrical engineering firm in New York city has submitted plans for the work. For many years the Albany Electric Illuminating Company has furnished light for the Capitol and also the State Hall and Geological Hall. The contracts are said to have been profitable. Governor Higgins believed the lighting could be done at less cost and did all he could while he was in the Senate to have the contract let at a lower figure. Finally, while he was lieutenant-governor, a bill was passed appropriating $60,000 for a state plant. Practically all of this money is still available. The last contract with the Albany lighting company expired a year ago, and Governor Higgins saw to it that it was not renewed. The company has since furnished light from month to month. C. I. C.

Southeastern States.

Charlotte, N. C., May 12.—A telegram from Anderson, S. C., states that the plant of the Anderson Water, Light and Power Company, at Portman Shoals, about 10 miles distant, has been destroyed by fire. This was a comparatively new development and represented a considerable outlay of money.

J. C. Slack, R. C. Crawford, R. M. Dave and Oscar Shanks, all of Pittsburg, have been spending some time at Spartanburg, S. C., investigating a waterpower on Pacolet River, and it is likely that they will secure rights and proceed with a development of some magnitude in the near future. Mr. F. H. Knox of Pennsylvania, an electrical engineer who has spent some time in Spartanburg with a local electric railway, conducted the party over the proposed site, about six miles from the city.

The town of Waynesboro, Ga., will vote on the question of issuing $60,000 in bonds for municipal improvements, to include an electric-light plant of modern design and construction. The election will be held in June.

W. C. Wolfe of Orangeburg, S. C., E. C. Johnson of North, S. C., and associates will apply for a charter for an interurban electric railway from North, on the Seaboard Air Line, to Orangeburg and on to the Santee River. The capital named in the application for the charter is $1,100,000. It is also a part of the plans of the promoters to develop waterpowers on the Edisto River, near Orangeburg. The total mileage is 45, and includes a system of electric street cars in Orangeburg.

What is known as the "Chatterson ordinance," providing for a license system of taxation on companies selling electricity for light and power in Louisville, Ky., only as a side issue, is now regarded as certain to pass the aldermanic board. It is declared, too, that opposition to small lighting companies has been withdrawn and the ordinance is generally approved.

Financial circles in Baltimore are awaiting the announcement of the financial plans of the Maryland Electric Railway Company, which, it is believed, will be made known shortly. Interests closely allied with the United Railways Company acquired the charter of the Maryland concern and are understood to have in view the use of this charter to raise money for new barns and extending suburban lines. [illegible] way Company [illegible] to be $1,000,000, and other [illegible] for. [illegible]

Ohio.

Cleveland, May 12.—Suit [illegible] Circuit Court at Cincinnati [illegible] Company to foreclose [illegible] mortgage [illegible] field and Western traction road [illegible] of mortgage bonds. A receiver [illegible] road. The Dayton, Springfield and Urbana [illegible] made a party defendant.

Representatives of the eastern [illegible] has agreed to take over the Cincinnati Gas and Electric Company on a lease [illegible] Cincinnati for the purpose of arranging the papers [illegible] and that the $3,000,000 guarantee for the payment of the [illegible] stipulated is ready and as soon as the papers are made out the contract will be consummated. The date set for taking over the business is July 1st.

Officers of the Order of Interurban Railway Trainmen, in session at Lorain for several days this week, were elected as follows: Grand master, W. P. Rutledge, Lorain; counsel, W. L. Hughes, Lorain; chaplain, Rev. N. J. Hadley, Lorain; secretary and treasurer, C. L. Root, Cleveland.

Construction men on the Schoepf Lima-Toledo line have reached Columbus Grove, and the rails are now being distributed between Lima and that point. It is the intention to have this section of the road completed by the latter part of June, if possible, and then work will be continued to Leipsic, 26 miles from Lima.

The Cleveland, Van Wert and Indiana Traction Company of Van Wert has been incorporated with a capital stock of $10,000 by I. R. Tudor and others.

Conditions now would indicate that the stockholders of the Eastern Ohio Traction Company will pay the assessment for the purpose of putting the company on its feet and making improvements, rather than have it sold under foreclosure proceedings. The assessment was to be $38 a share under former arrangements, but it is possible that some of the improvements will be cut out at the request of the objecting stockholders and this sum will then be reduced.

An increase of capital stock from $3,500,000 to $5,000,000 has been made by the Cleveland Electric Illuminating Company. The money secured from the new stock will be used to pay for improvements and extensions now under way and those which are to be made in the near future. An additional station will probably be built.

The Igniter Appliance Company of Cleveland has been incorporated with a capital stock of $10,000 by C. W. Hunt, W. C. Hine and others.

O. M. C.

Michigan.

Grand Rapids, May 12.—The village of Montague voted at a special election to accept the proposition of the Pere Marquette Light and Power Company to furnish electric lights for the village, the village to erect a power house and install the necessary apparatus. The village of Hart votes on a similar proposition from this company May 14th.

The village of Gaylord has voted to expend $5,000 for the purchase of new equipment for the municipal electric light and water plant.

A company has been organized at Traverse City to build a dam for the development of electric power to be used principally for operating the paper mill to be erected in that city. The company has a capital stock of $50,000 and its president is Dan J. Albertson of Kalamazoo.

After suspension for the winter, operations are again in progress on the water-power canal of the Chandler-Dunbar corporation's Edison Sault Electric Company. The capacity of the plant will be about 4,500 horsepower and it will be so constructed that the capacity may be doubled in a very short time.

A conference of 40 business men interested in the proposed Detroit, Owosso and Saginaw traction line was held recently in Owosso and an organization formed with E. P. Sherman of Bancroft as president. The proposed route was divided into 15 districts of 10 miles each and a director appointed to take charge of the promotion in each district. Gasoline motors are being considered for the operation of the cars.

The survey of the right of way of the proposed Grand Rapids, Hastings and Battle Creek interurban railway is being rapidly pushed. This road is to touch a number of inland lakes and resorts.

The Michigan State Telephone Company has purchased the exchange at Sunfield and is making extensive improvements.

The Citizen's Telephone Company of Grand Rapids has purchased the exchange at Saranac and is extending the rural lines to add 200 telephones this season. L. W. B.

Indiana.

Indianapolis, May 12.—The Michigan City street-railway system and the interurban line connecting Laporte and Michigan City has passed into the possession of the Northern Indiana Railroad Company, represented by Arthur Kennedy of Pittsburg, Pa., J. M. McSmith and J. M. McCance of South [illegible]

[illegible] president of the new company.

[illegible] Porter, Leo A. [illegible] of New York, [illegible] Green of Boston, [illegible] Jr., of Cincinnati, [illegible] of Indianapolis.

Articles of incorporation were filed [illegible] the Central Railway Company of Indiana [illegible] tric railway 100 miles in length [illegible] through Hendricks, Morgan, Johnson, [illegible] Shelby, Hancock and Boone counties [illegible] cipal terminal at Brownsburg, Hendricks County. The new company is capitalized at [illegible] and Charles H. Burras of Chicago is the principal owner of stock in the company.

The Winona Interurban Company [illegible] passengers from Peru to Goshen [illegible] by the last of August. The company has [illegible] pleted its $300,000 power house at Winona Lake and is now using a part of the Winona Lake and Goshen interurban road for traffic. The company will begin work soon on its line between Peru and Winona Lake. The distance of 40 miles has been divided into four sections and each section will be worked independently of the others. The company will use the Peru and Chili branch of the Wabash steam road, which has not been in use since the Wabash surrendered the Eel River line to the Vandalia company five years ago.

The Indianapolis, Newcastle and Toledo Electric Railway Company has decided to erect its power plant at Newcastle. This will be one of the largest plants of its kind in the West, and will furnish power for the entire system. The Electrical Installation Company, which will construct the road, and the Allis-Chalmers Company, which will furnish equipment, have opened offices on the fourth floor of the Traction Terminal Building. Orders for rails and spikes are now being placed for early delivery, and it is thought the first dirt will be thrown next week. The railway company has opened up a branch office in Newcastle.

A municipal electric-light plant is proposed by the new City Council at Kokomo. Although the present contract with the traction company to light the city does not expire for three years, the company agrees to relinquish to the city when its new municipal plant is completed. S. S.

Illinois.

Peoria, May 12.—The Illinois Traction Company will spend $5,000,000 in construction this year, according to Wm. B. McKinley. The work here is progressing, though a strike of the concrete mixers has temporarily stopped the bridge approach work. They want an increase from $1.75 to $2.25 per day. In Springfield the company has purchased a corner and will erect a depot, and also one in Morton. It has about decided to leave out the town of Mackinaw on account of the excessive prices asked for land through which the company had decided to run. Some of the owners ask $600 an acre for land that was recently sold for $150. The plans for the bridge here have been inspected by J. R. Fuller, United States engineer, and he has given his approval.

The plans for a large waterpower dam at Keokuk have been completed. The dam will be 6,000 feet in length, 35 feet wide at the bottom and about 30 fet high. Generators will be on a vertical shaft with three turbines on same shaft. The estimated cost is six to 10 million dollars, and it will take two or three years to build it. Mr. Hugh L. Cooper is consulting engineer.

From the offices of the company in Champaign there were filed in the Peoria County recorder's office papers incorporating the Peoria Railway Company. The incorporators are W. H. Burke, Charles A. Wright and K. L. Doyle. The capital stock is to be 10,000 shares at $100 each. The local officers of the Central Railway Company, which is now part of the McKinley syndicate, are of the opinion that the new company has been formed to take over the Central Railway Company and to give the McKinley syndicate a large scope in this section.

The Elgin Merchants' Light Company of Elgin has been granted incorporation papers, capital $2,500, to furnish light, heat and power. The incorporators are John H. Stickling, John Reinhert and Frank Stickling.

The Springfield, Clear Lake and Rochester Inter-

urban Railway has been incorporated with principal office at Springfield. The capital is $120,000 and the incorporators are Ira F. Twist, Wm. G. Brown, C. E. Miller, I. M. Bell and L. E. Hawell, all of Rochester.

The National Electrical Workers have moved their offices from Washington, D. C., to Springfield, Ill., and are now located there permanently.

The village of Ladd is going to sell its municipal lighting plant, as it has continually been losing money.

The plant at Princeton has also been a poor investment and has proven an expensive luxury—causing a loss of several thousand dollars each year.

Mayor Tolson, in his message to the City Council, urges the placing of the city wires underground. He also requests the electric-light company to place its wires underground. V. N.

Texas.

Austin, Tex., May 11.—Considerable attention is being given to the building of interurban electric railways and the installation of electric-light and power plants in Texas at this time. It is said by those familiar with the subject that favorable conditions for investments of this character exist in many parts of the state. Several interurban electric lines are proposed to be built out of Dallas to neighboring towns. McKinney, Sherman and other prosperous towns of that section are to be connected by electric lines. It is stated that the Northern Texas Traction Company, which owns and operates the electric line between Ft. Worth and Dallas has in view a number of important extensions. The building of an electric line between Ft. Worth and Mineral Wells is being promoted. Projects are also on foot to give Waxahachie, Greenville, Cleburne and other towns electric railway connection with Dallas.

The construction of an interurban electric railway between Temple and Marlin is proposed by a syndicate of Pennsylvanians who are interested in other similar enterprises, and the prospects for the early building of the road are said to be bright.

R. A. Reese of San Antonio is acting as the representative of a syndicate of eastern men who contemplate building an interurban electric railway between Austin and San Antonio, a distance of 80 miles.

The firm of William Gallatin, Carroll & Co. of New York has been investigating the situation with the view of financing the building of an interurban electric line between Austin and Lockhart, a distance of about 30 miles.

The building of an electric railway to run from Georgetown to Briggs, by way of Florence, a distance of 22 miles, is under consideration.

The building of an interurban road between Houston and Galveston, a distance of 51 miles, now seems to be assured. This project has been on foot for several years, but preliminary work preparatory to actual construction has now begun. It is stated that the road will cross Galveston Bay upon the new causeway that is to be constructed by a company which was recently organized for that purpose. The surveys for the proposed road have been made and the right of way and franchises secured.

W. D. H.

Northwestern States.

Minneapolis, May 12.—The Beloit (Wis.) Traction Company has filed articles of incorporation with a capital of $50,000. It is proposed to build six miles of track to operate in conjunction with the Rockford, Beloit and Janesville interurban. J. B. Dow is president.

The Red Wing Gas and Electric Company of Red Wing, Minn., has filed a petition to have the corporation dissolved, having sold its entire plant.

It is proposed to build a new concrete dam at Fergus Falls, Minn., to provide power for the electric-light plant.

The Zumbrota (Minn.) Electric Company has been incorporated with a capitalization of $20,000. George Person heads the list of stockholders.

The contract for the electrical equipment of the Fort Dodge (Iowa), Des Moines and Southern Electric Railway has been awarded to J. G. White & Co. of New York. A central power station will be located at Fraser, with sub-stations at Boone, Kelley, Lanyon, Fort Dodge and Des Moines.

The City Council of St. Paul, Minn., is considering an ordinance granting a franchise to the Northern Heating and Electric Company. This is the successor to the American District Steam Company, which has a heating franchise for the downtown district, and wants it extended to lighting also.

The council at Eveleth, Minn., is considering the advisability of putting in a municipal electric-light system.

H. N. Lowry has sold the electric-light plant at Villisca, Iowa, to George T. McNeal of Osceola, the consideration being $28,000. R.

Rocky Mountain States.

Moscow, Idaho, May 12.—The firm of Taylor & Kingbury has purchased the electric fixtures of the Moscow Light and Power Company and will establish offices on South Main Street, Moscow. The firm will take charge of all wiring work.

A franchise has been granted to the Culdesac Milling Company of Culdesac, Idaho, to construct and maintain poles and wires in streets of that city for supplying light and power. Business houses and residences will be supplied.

A 50-year franchise has been granted the Idaho Light and Power Company of Payette, Idaho, to maintain an electric-light and power plant in the city of Payette. One of the conditions upon which the franchise was granted is that a portion of the service must be in operation by the first of November, 1906.

The electric power plants at Newport and Bonners Ferry, Idaho, are to be united under the name, Northern Electric Light Company, which has been incorporated with a capital stock of $35,000. A. M. Winston and M. A. Folsom of Spokane are the incorporators and owners.

The Nez Perce Co-operative Telephone Company will receive a franchise from the city of Grangeville, Idaho, provided the company will use 45-foot poles, so as not to interfere with the wires of the Pacific States Telephone Company.

Mayor Herman J. Rossi of Wallace, Idaho, is attempting to have the Western Union Telegraph Company and the Rocky Mountain Bell Telephone Company use the same wires in that city. A.

Pacific Slope.

Oakland, Cal., May 10.—Jesse R. Shafer and H. W. Hawrichant, who formerly conducted a district messenger service in San Francisco, have applied to the Board of Works of Oakland for permission to string wires for transmitting messenger calls. A franchise is said to be unnecessary, but the city attorney was instructed to ascertain the legal phases of the matter.

Articles of incorporation have been filed at Bakersfield, Cal., by the Pacific Light and Power Company with a capital stock of $10,000,000. H. E. Huntington is president and the principal place of business is Los Angeles, Cal. It is understood that the company will extend its lines in the vicinity of Bakersfield.

A new electric-light and power company is being organized by the business men of Olympia, Wash.

Consolidation has been effected in New York by the Clark-Seligman-Pratt interests, by which all the electric power, light and trolley systems in the lower valley, occupying a radius of 50 miles around Portland, Ore., have been merged. The Portland General Electric Company, Portland Railway Company, Oregon Water Power and Railway Company of Portland, Ore., Citizens Light and Traction Company of Salem, Ore., Vancouver Light and Traction Company of Vancouver, Wash., Union Light and Power Company of Silverton, Mount Angel and Woodburn, are included in the combine. The deal involves $30,000,000. The owners of the affiliated interests are E. W. Clark & Co., Philadelphia bankers; J. and W. Seligman, New York city and Charles Pratt & Co., also of New York.

A. Lindstrom of the American DeForest Wireless Telegraph Company has opened offices in the Mohawk Building, Portland, Ore., and will establish a station in Portland as soon as proper arrangement can be made.

Articles of incorporation have been filed for the Northern Electric Light Company with a capital stock of $35,000. The incorporators are A. M. Winston and M. A. Folsom. The place of business will be Spokane, Wash. A.

Spokane, Wash., May 9.—Prof. O. L. Waller of the Washington State College at Pullman, under the authorization of the Town Council of Sunnyside, Wash., has prepared plans and specifications for an electric-light and water system for Sunnyside.

The British Columbia Construction and Distributing Company, Ltd., is the new name under which the West Kootenay Power and Light Company of Grand Forks, B. C., will be known in the future.

The electric power and light plant of the Palmer Mountain Tunnel and Development Company at Loomis is completed, and that town is supplied with a lighting system from the company's plant.

The Washington Water Power Company of Spokane is actively building its high-tension, transmission line from Spokane into the Palouse country, and current for power and lighting purposes is expected to be available for distribution in June. A number of towns will use power from Spokane.

Jay P. Graves, head of the Inland Empire Railway Company, recently incorporated for $20,000,000, admits that he and associates contemplate the development of some of the vast water powers which they have recently acquired. Mr. Graves already has a franchise which will permit him to put in an electric power and lighting system in Spokane in rivalry to that of the Washington Water Power Company. B.

PERSONAL.

Albert E. Hayes, recently with the General Electric Company at West Lynn, Mass., has accepted the position of electrical engineer in the same company's transformer department at Schenectady, N. Y.

E. L. Clark, president of the Valentine-Clark Company, Chicago, has just left with his family on a much-needed vacation. Mr. Clark will spend several weeks at Hot Springs, Va., and will also visit a number of eastern cities. He expects to attend the National Electric Light Convention at Atlantic City.

J. M. Bramlette of Philadelphia, formerly of St. Louis, has been chosen as general superintendent of the Michigan United Railways and will reside in Kalamazoo. He will have direct charge of all the lines of the corporation in the state.

C. Z. Hughes has been appointed traffic manager of the Youngstown and Ohio River Railway Company. He formerly held a similar position with the Pittsburg, Lisbon and Western, whose line was recently leased by the traction company.

Edwin H. Smythe, formerly of the Western Electric Company and more recently with the patent-law firm of Rector & Hibben, has opened at 738 Monadnock Building, Chicago, an office of his own as a patent expert, particularly in telephone cases.

The council of the Faculty of Sciences of the University of Paris has confirmed the initiative of the minister of public instruction in appointing Mrs. Curie to the chair of the university occupied by her late husband, with whom she was associated in the discovery of radium. This is the first time a woman has occupied this high position.

Dr. R. T. Glazebrook, F. R. S., the director of the National Physical Laboratory of Great Britain, has been selected by the council of the Institution of Electrical Engineers as the president for next session. Dr. Glazebrook is well known in the United States and was an official delegate to the International Electrical Congress of 1904 in St. Louis.

Joseph F. Porter, the new executive head of the merged light, traction and power companies in Rock Island and Moline, Ill., and Davenport, Iowa, is given high praise as a man, a citizen and a business manager by the Alton (Ill.) Telegraph, a newspaper published in the city where Mr. Porter resided before being transferred to Davenport by the new owners of the tri-city utility corporations. Mr. Porter was formerly president of the Alton, Granite and St. Louis Traction Company.

Edward Rosewater of Omaha, Neb., has announced his candidacy for the United States senatorship. Mr. Rosewater founded the Omaha Bee and has been its editor since 1871. Earlier in life he was a telegraph operator, serving in the military telegraph corps during the Civil War and subsequently becoming manager of the Pacific Telegraph Company in Omaha. Mr. Rosewater has many friends in the electrical fraternity who will wish him well. At present he is abroad attending the Universial Postal Congress.

Leon Bly has severed his connection with the Westinghouse Electric and Manufacturing Company's San Francisco district office in order to go to Alaska for the Guggenheim mining interests, in connection with the installation of a 2,000-horsepower electric power-transmission plant. Westinghouse electrical equipment has been ordered for the new installation, which will be located about 30 miles north of Dawson. Waterpower will be used to generate electric current for the operation of gold dredges. Mr. Bly will sail for the North within a month.

W. S. Edwards, who has been for years a manufacturer of gas and electrical fixtures in Chicago, was attacked and severely beaten on May 14th by two men whose identity has not yet been positively established. He is president of the Edwards Manufacturing Company; formerly was at the head of the Gas and Electrical Fixtures Manufacturers' Association, and has been conspicuous in the attempt made by that organization to settle the strike of the Gas and Electric Fixtures Hangers' Union. At present Mr. Edwards is in a hospital, and concussion of the brain is feared.

Allard Smith, superintendent of construction of the suburban territory of the Chicago Telephone Company, recently delivered a paper before the engineering students at the University of Wisconsin on the telephone field for young engineers, its opportunities and character of training. Among other examples of engineering propositions met in this work Mr. Smith spoke of the design and construction of an underground conduit and cable system from Chicago to Kenosha, 40 miles, which he would do this year, offering in itself many varied problems of telephone engineering and construction.

American electrical engineers will be sympathetically interested in the following item of news from the London Electrician of May 4th: "We are glad to inform our readers that Professor Perry is progressing favorably toward recovery from the accident which he met with on Good Friday, but he is not yet allowed to see visitors. Colonel Crompton was driving Professor Perry in his motor car, when the car came into collision with a tramcar at Acton, and Professor Perry was thrown out, severely injuring the upper part of his arm and bruising his face. The shock was so great that it was more than a week before an operation could be performed, when it was found necessary to remove a portion of the humerus and several small fragments of bone. Although Professor Perry may not fully recover the

use of the upper part of his arm, he is expected to be able to use his arm from the elbow downwards. We are glad to say that Colonel Crompton escaped injury."

The Illinois Traction Company has made a number of promotions in its forces. M. L. Harry, who has been general superintendent of the Decatur Railway and Light Company, has been promoted to the head of that company and also of the Springfield and St. Louis Railway and the Springfield and Northeastern, which gives him supervision over the road from Clinton to St. Louis. A. V. Schroeder of Springfield has been made assistant superintendent. Wade Waterson is to be in charge of the lines between Springfield and St. Louis and L. O. Williams is to be superintendent of the line from Springfield to Decatur.

Seniors at the Worcester (Mass.) Polytechnic Institute have accepted situations as follows: C. A. Packard, with the engineering department of the New England Telephone and Telegraph Company at Boston; C. G. Graham, with the American Telephone and Telegraph Company at New York; F. C. Green, Jr., with the Allis-Chalmers Company at Cincinnati, Ohio; J. D. Cave, Mark Eldridge, S. W. Farnsworth, H. W. Rogers and W. L. Towne, with the General Electric Company at Schenectady, N. Y.; A. L. Childs, J. E. Smith, W. D. Stearns and R. W. Woodward, with the Westinghouse Electric and Manufacturing Company.

E. R. Conklin, secretary and general manager of the Interstate Telephone Company, accompanied by J. W. H. Andrews and William Ferguson, both of London, made a thorough examination of the property of the Interstate company in Peoria, Ill. Mr. Andrews is a traction expert and Mr. Ferguson is connected with a large English bond and investment company. None of the gentlemen would state the object of their visit. In company with Mr. Conklin they will visit all the exchanges of the Interstate company. Peoria officers of the company discredit the rumor of the formation of a new system, but admit that English capital might be used for some large extensions.

ELECTRIC LIGHTING

Perry, Okla., is about to hold an election to vote on electric-light and water bonds to the amount of $30,000.

The Long Pine Power Company is about to put in a waterpower plant to supply electricity for electric lights for Long Pine, Neb.

Sault Ste. Marie, Mich., has voted to appropriate the sum of $90,000 for extensions and improvements to the gas and electric-light system.

The Brownwood Gas and Electric Company of Brownwood, Tex., has been incorporated with a capital stock of $80,000 by S. P. Goggin and others.

According to the Frankfurter Zeitung of April 21st, it has been decided by the Vienna Town Council to acquire from the International Electricity Company the whole of its undertaking in that city as from May 1, 1908.

A franchise has been refused the Independent Light, Heat and Power Company by the council at Fond du Lac, Wis., after securing an agreement with the Eastern Wisconsin Railway and Light Company for lower rates.

Sealed proposals will be received at Clinton, S. C., until May 29th for the installation of a system of waterworks and electric lights. Plans and specifications are on file at the office of J. A. Bailey, clerk of the commission, Clinton, S. C., and Charles C. Watson, consulting engineer, 1302 Main Street, Columbia, S. C.

D. R. C. Brown, president of the Roaring Fork (Colo.) Electric Light and Power Company, is arranging to build another large modern light and power plant, which will be situated a few miles below Aspen, Colo. The plant will harness the waters of Castle Creek and the Roaring Fork, and a drop of 2,200 feet through 40-inch pipe will generate sufficient power and light for all emergencies in Aspen and the villages between Aspen and Carbondale.

Proposals will be received by the South Park commissioners at their office, Fifty-seventh Street and Cottage Grove Avenue, Chicago, until May 26th for the construction of an electric-light station in Washington Park. Bids are invited for the furnishing and erection of the structural iron work, and a separate bid is invited, in a lump sum, for doing all other work provided for in the specifications therefor. Plans and specifications may be obtained at the office. E. G. Shumway is secretary of the board.

President Thomas N. McCarter of the Public Service Corporation has offered to light the new City Hall, City Hospital and all municipal buildings in Newark, N. J., on a five-year contract, for five cents a kilowatt-hour. The proposition also includes current for power purposes. Action was deferred by the city officials, one of them asking that a committee be appointed to ascertain what the cost of a municipal electric supply would be. It [illegible] and the Board [illegible] lighting the [illegible] plant.

The village [illegible] purchased the old [illegible] and will [illegible] operated by the [illegible] ient for the purpose.

About $250,000 will be expended [illegible] and extension to the [illegible] light plant at Jackson, Tenn. [illegible] charged by L. W. Bott and [illegible] ville, Ky.

ELECTRIC RAILWAYS

The Financial Chronicle estimates that the gross earnings of all the electric railways in the country last year were between $130,000,000 and $140,000,000.

The Chicago and Milwaukee Electric Railroad Company reports gross earnings of $57,014 for April. The operating expenses were $24,149. Corresponding figures a year ago were reported $35,827 and $16,560.

The Sistersville and Parkersburg Electric Company has been chartered in West Virginia with a capital of $25,000 to build a railway line from Sistersville to Middlebourough. The line will pass through some excellent territory.

A new engine type generator of 100 kilowatts capacity, to be used as an exciter for the large turbo alternator recently installed in the plant of the Philadelphia Rapid Transit Company, Second and Grand avenues, has been ordered from the Crocker-Wheeler Company.

The Evansville and Henderson Electric Railway Company of Henderson, Ky., has been incorporated to build a line between the two towns named in the title. J. E. Bonhannon, A. L. Rich, C. C. Tennis, C. H. Battin and E. G. Reitman, the last of Louisville, are interested in the new company.

W. T. Goodloe, president of the Cumberland (Tenn.) Traction Company, is at the head of a new company which has received a charter to build an electric railway from Big Stone Gap to Norton, Va. The road will have branches to several mines and will connect with four other roads at each terminus.

The City Council of Yellville, Ark., has granted C. L. Morgan of Detroit a franchise to build an electric railway through the town. Mr. Morgan secured the franchise in the interest of Detroit capitalists who are heavy property owners in Marion County and have lately taken a number of zinc-mine leases in the district.

The Ithaca (N. Y.) Street Railway Company announced a few days ago that it had received official permission from Cornell's board of trustees that it might lay its trolley tracks across the campus quadrangle, and that work would begin about the middle of June. Over 2,000 undergraduates signed a petition protesting against the grant.

The formal exchange of bonds of the Louisville, Anchorage and Pewee Valley Traction Company was made at Cincinnati last week. The company is now known as the Louisville and Eastern. The road was purchased last December by a syndicate in which Harry B. Gates of Indianapolis and a number of eastern capitalists are interested. At about the same time these men made arrangements to extend the line to Frankfort, and about $2,000,000 has been provided for the purpose.

Indiana cities touched by the recently merged electric railways are to have an interurban base-ball league. C. C. Reynolds and W. R. McKowan, officials of the consolidated roads, originated the idea as a means of increasing traffic on the several lines. Six clubs will constitute the league, and represent, respectively, Lafayette, Crawfordsville, Martinsville, Lebanon, Frankfort and Greenfield. The interurban companies bear the bulk of expenses and players will be paid regular salaries from the gate receipts. Prizes will be given to the winning teams.

It is announced that the International Railway Company of Buffalo, N. Y., and the Toronto Railway Company will erect a bridge across the Niagara River below Niagara Falls. A bill has been introduced in the New York Legislature incorporating the Trans-Niagara Bridge Company with a capital of $1,000,000, to construct a bridge for electric-railway purposes. A commission has been named, five of whom are given power to locate the bridge and open offices at Niagara Falls for the purpose of selling stock. Frank A. Dudley of Niagara Falls is one of the commissioners.

POWER TRANSMISSION.

Some details of the plans of the McCall's Ferry Power Company, which proposes to build one of the largest hydro-electric power plants in the world on the Susquehanna River, are coming to the public. It is reported in York, Pa., that the dam is to be 3,000 feet long and 30 feet in height. It is the policy of the company to build up new indus-

[illegible] port, Ill. [illegible]

[illegible] for the running [illegible] plant at Weber [illegible] Dead Gate. [illegible] ponded on the [illegible] Fremont Canal. [illegible] River and carries [illegible] section of country [illegible] Little Mountain.

Concerning the Niagara [illegible] tion, Canadian authorities [illegible] where federal jurisdiction ends and provincial jurisdiction begins. Mr. Hyman, federal minister of public works, has introduced a bill into parliament respecting the exportation across the [illegible] boundary of electric power generated [illegible] which sufficiently asserts the federal jurisdiction on the Canadian side. The Ontario government appointed commissioners to regulate the distribution of [illegible] within the province, and establishes government control of the entire surplus available above the [illegible] allowed by the federal authorities to be exported.

The Lackawanna Steel Company has contracted to take current from the Niagara, Lockport and Ontario Power Company. The Buffalo works of the steel company are therefore receiving extensive electrical equipment consisting of seven 1,500-kw. power transformers and a number of motor-generator sets. The transformers receive a current of 50,000 volts, and for its distribution through the steel works the equipment required will represent an expenditure of about $250,000. The contracts entered into will mean the general employment of electric power throughout the plant. The electrical machinery will be furnished by the Westinghouse Electric and Manufacturing Company.

The Canadian Westinghouse Company is supplying the Provincial Light, Heat and Power Company with apparatus to be used in the development of another large water-power plant near Montreal. The initial installation will consist of three 3,750-kilowatt revolving-field alternating-current waterwheel-driven generators of 4,000 volts, three-phase, 7,200 alternations; also 12 2,500-kilowatt, 44,000-volt oil-insulated water-cooled transformers. This new power station will be used for supplying additional power to the Montreal Light, Heat and Power Company at Montreal. The step-up transformers will be wound for 4,000 to 44,000 volts, and the lowering from 40,000 to 12,500 volts. The transmission line is about 30 miles in length.

PUBLICATIONS.

Band mills, single cutting and double cutting, and their appliances are treated in Bulletin No. 1700 from the sawmill department of the Allis-Chalmers Company, Milwaukee.

The new 100-page catalogue of the Trumbull Electric Manufacturing Company of Plainville, Conn., which will be sent on application to those interested, covers electric-wiring material, and is unusually comprehensive and well prepared. Switches, cut-outs, cord adjusters, rosettes, fuse-holders, terminal lugs, etc., are among the many things listed.

The Manila Electric Railroad and Lighting Corporation, which is the public utilities monopoly in the Philippines capital, has made its report for the year ended December 31st. The figures actually represent less than nine months of operation, dating from April 10, 1905, when the company began business. Gross earnings were $733,520 and net $353,548. Income of $1,122 from other sources raised the total net earnings to $354,670. Fixed charges were $195,109, and $159,561 was carried to surplus.

Alternating current ceiling fans are manufactured extensively by the Hunter Fan and Motor Company of Fulton, N. Y. To bring its product to the attention of the trade the company has issued two small fan-motor catalogues which are particularly attractive. The well-known Type K alternating-current ceiling fans with four blades are the ones described. Two new types have been introduced, both employing induction motors. The motors are designed for 40, 50 and 60 cycles and for voltages from 50 to 250 volts.

SOCIETIES AND SCHOOLS.

Commencement week at Purdue University, Lafayette, Ind., will begin June 3d. The graduating exercises will be held at Fowler Hall on June 6th, beginning at 9:30 a. m. Professor A. W. Small of the University of Chicago will deliver an address.

The Order of Railway Telegraphers will meet in Cedar Rapids, Iowa, on June 9th. F. W. Lacey of Dubuque, general chairman of the Telegraphers, and a committee of two others have made the preliminary arrangements for the meeting. There will be a business meeting of the order, followed by a banquet. The members of the order will bring their ladies with them, and it is expected that 200 or 300 will be present from a large number of states.

The French Association for the Advancement of Science will hold its annual meeting at Lyons in the middle of August this year. In connection with this visit the local Society of Agriculture, Science and Industry will hold a competitive exhibition of small electric motors of less than one horsepower as applied to workshop and domestic uses, such as watchmaking, marquetry work, small elevators, ventilators, carpet cleaning, cooking, etc. Intending exhibitors must send their exhibits by June 15th. The exhibition will be open from July 1st to August 15th.

The next meeting of the Central Electric Railway Association will be held in Dayton, Ohio, May 23d. Special cars will be arranged on all roads reaching Dayton to carry the members. A paper on "Fire Insurance at Cost" will be read by Henry N. Staats of Cleveland, and Mr. Replogle of the Cambria Steel Company will open a discussion on "Axles for Interurban Cars." Railroad Y. M. C. A. work will be discussed by E. L. Hamilton, railroad secretary at Chicago. "The Best Methods of Stimulating Summer Riding" is the subject of a paper to be read by J.W. Brown, superintendent of transportation of the West Penn Railways Company. Other subjects will be: Lost articles, sealing milk cans, best method of inspecting motors for low bearings, best style of trolley car, best method of handling employes' transportation and best method of computing car mileage and car hours in detail.

AUTOMOBILES.

To test the energy consumption of electric vehicles a 62-mile test run was recently made in Paris over dirty and slippery roads. A number of vehicles carrying four passengers and weighing over two tons covered the distance, it is reported, at an average speed of nearly 15 miles an hour and consumed less than 160 watt-hours per ton-mile. First prize went to a vehicle which required 155 watt-hours per ton-mile. The energy consumption of this vehicle in ordinary conditions is from 110 to 120 watt-hours per ton-mile, it is said.

TELEGRAPH.

The Western Union has made a rule that night messages shall not be accepted later than 2 a. m.

The headquarters of the Seventh district, eastern division, of the Western Union Telegraph Company has been removed from Hartford to New Haven, Conn. F. E. Clary is superintendent.

SPACE TELEGRAPHY.

An extension of the space-telegraph system of Lower California is reported by Consul Kaiser at Mazatlan. The machinery installation will be made at San Jose del Cabo, at the end of the peninsula, and at the port of La Paz, in Sinaloa, by a German company which secured the contract and will install benzine motors with cooling machinery, continuous-current dynamos, storage batteries, etc.

Widespread indignation has been caused in Japan over a report issued by a prominent German newspaper at the effect that the wireless telephone method of Professor Kimura was stolen from the German inventor Ruhmer. An official denial has been made to the allegations, in which it is demonstated that Kimura's system is radically different. Kimura ten years ago won distinction in pure mathematics at Yale. Later he developed the Japanese system of wireless telegraphy, which contributed materially to Admiral Togo's victory over Rojestvensky's fleet.

MISCELLANEOUS.

The estimated investment in summer amusement parks in this country will reach a total of $100,000,000 this year, says the Railway and Engineering Review. The total number of parks is estimated at 2,000, and three-fourths of that number are controlled by and operated for electric-railway lines.

The Francis Cotton Mills has recently adopted Westinghouse-Parsons turbines for its power plant at Biscoe, N. C. This plant adds one more to the list of cotton mills using steam turbine power. Some of the plants in this field are those of the Pelzer (S. C.) Manufacturing Company, 1,500-kilowatt; the Oneita Knitting Mills, Utica, N. Y., 500-kilowatt; Henrietta (N. C.) Mills, Gray Manufacturing Company, Charlotte, N. C.; Modena Cotton Mills, Gastonia, N. C., and the Lumberton (N. C.) Cotton Mills. These plants are now in highly successful operation.

Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 26th for the enclosures for mail conveyors in the Federal Building, Chicago. Drawings and specifications may be had of the supervising architect or at the office of the custodian, Chicago.

The Union Stock Yards and Transit Company of Chicago recently purchased an Allis-Chalmers 28 and 50 by 48-inch Reynolds heavy-duty cross-compound Corliss engine as an addition to the present power outfit. The power plant of this company was illustrated and described in the Western Electrician of March 12, 1904.

The present total production of rubber throughout the world is estimated by French experts at 57,000 tons. The consumption of rubber by the principal countries of the world in 1904 was, in tons, as follows: The United States, 26,470; Germany, 12,800; Great Britain, 10,000; France, 4,130; Austria-Hungary, 1,320; Holland, 1,218; Belgium, 748, and Italy, 588 tons.

Investigation is said to have shown that a number of the big downtown water mains in Pittsburg, Pa., are in a dangerous condition as a result of electrolysis due to leakage of power from the traction lines. E. E. Brownell of Chicago, who made the examination, is quoted as saying that the mains at two points will have to be entirely replaced at a cost of about $60,000.

The Elliott Laundry Company of Baltimore, Md., has recently contracted for an electrical equipment consisting of 20 Crocker-Wheeler motor outfits, ranging from one-fourth to 15 horsepower, for driving various laundry machinery, and one generator of 80 kilowatts capacity for additional power. This installation also includes three motor-driven ventilating fans, which will mean a great improvement to the equipment.

General Manager G. B. Hippee of the Des Moines City Railway Company and Master Mechanic James E. Welch have been working for several months on a gas engine of 100 horsepower, which is now completed and ready for an actual test. The engine will be fitted to one of the company's standard cars and will be experimented with, both for passenger and freight service. It was originated and built entirely in the local shops of the company. The weight of the engine is 3,200 pounds, and it has six cylinders.

Concerning reports of the use of electricity for tanning leather, Hide and Leather says among other things: "There have been plausible theories advanced to the effect that electric currents running through the sides accelerate the chemical union of the gelatin of the hide with the tannin of the bark liquor. Investigation and experiment, however, have demonstrated that any hastening of the process was really accomplished by strengthening the liquors or mechanical agitation of the sides. Electricity is a great thing—but not for tanning."

A correspondent of the London Times Engineering Supplement says: "The enormous and unprecedented price of tin is becoming a very serious matter to the makers of bearing metals, who find their costs of production greatly enhanced, while finding it difficult, if not impossible, to recuperate their losses from the customer. Under these circumstances I venture to inquire whether it would be possible to utilize a combination of lead and bronze for the same purpose. It is quite clear that if tin permanently assumes the position of a precious metal, some substitute must be found for the materials now in use."

The Indiana Steel and Wire Company of Muncie, Ind., publishes the following results of tests of its No. 12 B. B. galvanized telephone wire, the tests being made by L. F. Morehouse, instructor in electrical engineering at the University of Michigan: Diameter, 0.1117 inch; area, 0.009798 square inch; breaking weight, 583 pounds; tensile strength, 59,700 pounds; weight per mile, 174.8 pounds; resistance in ohms per foot at 68° F., 0.05832 ohm; resistance in ohms per mile at 68° F., 30.79 ohms; elongation in eight inches, 18.8 per cent.; twists in six-inch piece before breaking, 40; galvanizing test was very satisfactory.

A new problem in transportation confronted the Allis-Chalmers Company in the case of a large frame and slide of a horizontal rolling-mill engine, destined for shipment to the Carnegie Steel Company's plant at Sharon, where it will be installed for heavy service. This single piece, which in the rough casting was of approximately 133 tons, will weigh considerably over 100 tons as a finished part ready for shipment. In seeking a suitable means for overcoming the difficulty of shipping such a piece, it was learned that no single car had ever been built capable of carrying it, and that a special car, designed especially for the purpose, would be the only possible solution. Accordingly orders were placed with the West Milwaukee car shops of the Chicago, Milwaukee and St. Paul Railway for two 16-wheel flat cars of the required capacity, which are the first of their kind in existence. A few details of construction, showing the unusual sizes of these new cars, are as follows: Length over end sills, 40 feet two inches; width over side sills, eight feet nine inches; height, rail to floor, four feet 4½ inches; wheel base, 36 feet two inches; wheels, diameter, 33-inch standard; journals, 5½ inches by 10 inches; weight of car, estimated between 50,000 and 60,000 pounds; rated capacity, 200,000 pounds.

In a paper contributed by E. Stassano to the Faraday Society, April 10th, a furnace was described and illustrated, which is being installed by the Forni Termoelettrici Stassano Company for the Italian War Office. It is of the well-known Stassano arc type, and absorbs 140 kilowatts, yielding 2,400 kilos of steel in 24 hours. The current is a rotary one, with 80 volts between each phase. The consumption of electrodes is under five kilos a ton of steel, and the cost of renewing the refractory covering of the furnace 10 francs a ton of metal made. The furnace is principally used for refining pig iron and smelting scrap. The product ordinarily made is used for artillery projectiles.

TRADE NEWS.

Charles A. Chapman, consulting engineer, has removed his office from 1041 to 1537 Marquette Building, Chicago.

Sealed proposals are being invited until June 2d for furnishing two motor-generator sets at the New York navy yard. Specifications can be seen at the Bureau of Yards and Docks, Navy Department, Washington, D. C., and will be furnished by the commandant of the yard.

The National Battery Company has moved into its new offices in the Old Colony Building, Chicago, suite 450. It formerly occupied suite No. 415. The Chicago office is under the management of Mr. Bertram Smith, who has been doing efficient work during the last year in the western territory.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until May 29th for furnishing certain southern naval stations with electrical conductor and supplies embraced in schedule 545, obtainable at the navy pay office in New Orleans, La., or upon application to the bureau.

Sealed proposals are being invited for furnishing the Haskell Institute at Lawrence, Kan., with five electric motors, aggregating about 23 horsepower, with transformers, cut-outs, fuses, switches, etc., set in place, ready to run. Further information will be given by H. B. Peairs, superintendent of the Institute, Lawrence, Kan.

The constructing quartermaster at Fort Hunt, Va., is inviting sealed proposals until June 11th for furnishing and installing electric-light fixtures and wattmeters in the post exchange and gymnasium building and constructing a feeder line and making service connections at Fort Washington, Md. Details will be furnished upon application to the officer mentioned.

Fairbanks, Morse & Co., San Francisco, Cal., now occupy temporary headquarters at 969 Broadway, Oakland, Cal., until they are able to return to their permanent location in San Francisco, where they were recently burnt out in the disastrous conflagration following the recent earthquake. Meanwhile their many customers are receiving the customary prompt attention for which the company is noted, and the sale of its well-known specialties—scales, gasoline engines, steam pumps, motors, generators, windmills, etc.—has not been diminished.

A report from Commercial Agent C. J. King at Lille, France, calls attention to the merits of a French society for the protection of trademarks, to which American exporters are admitted, and which Mr. King believes is a substantial avenue for the extension of trade in France. He writes: "Taking into account the actual state of competition in trade and the consequent continual overflow of spurious products upon the world's markets, it is highly conceivable that a moral institution should come into existence to check the avidity of the counterfeiter, protect the honest producer and reassure the confidence of the buyer or consumer."

The North Electric Company has opened a branch office and warehouse at Kansas City, Mo., where it will carry a large stock of telephones of all kinds, switchboards, construction material and miscellaneous supplies. This branch is in addition to the Dallas branch office and warehouse at Dallas, Tex., and is made necessary in order to take care of the rapidly increasing business in the states adjacent to Kansas City. The company will be prepared to make shipments from Kansas City after May 20th. The Chicago office of the North Electric Company has been discontinued. Business west of the Mississippi River will be handled from the Dallas and Kansas City branch offices and warehouses and that east of the Mississippi River will be handled as heretofore from Cleveland.

BUSINESS

W. H. Kelton, for several years with the H[illegible] Electrical Company in Aurora, Ill., and H. E. [illegible]ler of Chicago have opened an electrical and mercantile supply store in North La Salle Street, Aurora. In the basement a machine shop will turn out all kinds of work.

Fairbanks, Morse & Co. of Chicago have recently sold a large number of their standard [illegible] to the Republic Iron and Steel Company, [illegible] Ore Company, La Rue Mining Company and the Rhodes Mining Company, for use in these companies' large iron mines in Minnesota.

The Nungesser Electric Battery Company, manufacturer of the famous "1900" dry cell, has recently issued a small booklet containing information in relation to all sizes of dry batteries of its manufacture. A copy will be mailed upon request by addressing Nungesser Electric Battery Company, 3519 King Avenue, Cleveland, Ohio. The Nungesser company is doing a business which is most gratifying to the company. The increase in business has [illegible]

[illegible] The [illegible] La [illegible] [illegible] Patent [illegible] [illegible] from the [illegible] Lamp [illegible]

In the [illegible] at the [illegible] [illegible] Electric and [illegible] a very busy time at present [illegible] into the department [illegible] motors. Some of these [illegible] will be used for hauling [illegible] for manufacturing plant [illegible] is now finding [illegible] tion of material from the [illegible] ing, and a very large number are [illegible] panies which are gradually finding [illegible]

[illegible] drawing [illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 8, 1906.

819,706. Electrical Measuring Instrument. Theodore Abtmeyer, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 10, 1904.

The device embodies a stationary coil, a movable coil mounted upon knife-edge bearings and provided with a pointer, and means for raising and supporting the coil independently of its bearings. A stationary index, a movable scale and one or more springs interposed between the scale and the movable coil are the other features.

819,707. Automatic Speed-increasing Device. George Baehr, McKeesport, Pa., assignor to the National Tube Company, Pittsburg, Pa. Application filed September 17, 1904.

Self-regulating mechanism for electric motors whose armatures are constantly under load comprises automatic means controlled by the load on the motor and arranged to decrease the strength of the motor field when the load on the motor armature is increased, and to increase the strength of the field when the load on the motor armature is decreased. (See cut.)

819,738. Electric Motor-control System. Adolph H. Daus, Chicago, Ill., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 17, 1905.

Series electric motors are provided under this patent with normally balanced coils in the motor circuit, an interrupting device for the circuit and a local governing circuit for the interrupting device that causes the device to open the motor circuit when the pulls of the normally balanced coils are rendered unequal by an accidental ground connection.

819,770. System of Electrical Distribution. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 30, 1904.

Dynamo-electric machinery having a shunt field-magnet winding has also an auxiliary machine having its armature in series relation to the field-magnet winding of the main machine and its field-magnet winding in series relation to the main distributing circuit. A shunt motor drives the auxiliary machine that is connected across the main distributing circuit.

819,779. Oscillaphone. Walter W. Massie, Providence, R. I., assignor to the Massie Wireless Telegraph Company, Providence, R. I. Application filed August 18, 1905.

An insulating element has stop means upon the upper side, terminals between which the stop means are located, a bridging element to rest on the terminals and a permanent magnet, the insulating element being bored to receive the magnet.

819,787. Controller for Synchronizing Switches. Hugh J. McMahan, Monessen, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 10, 1905.

Synchronizer for alternating-current machines embodies a switch for coupling the machines, means for controlling the switch and means for actuating the switch-controlling means earlier when the dynamos approach synchronism faster than a predetermined rate.

819,793. Electric Incandescent Lamp. William J. Phelps, Detroit, Mich. Application filed June 1, 1903.

A type of double-filament lamp is described, the filaments being arranged in two coils which are not in the same plane.

819,808. Electric Block Signal for Railways. Walter E. Sands, Brooklyn, N. Y., assignor to the L. A. Thompson Scenic Railway Company, New York, N. Y. Application filed March 18, 1905.

One rail section at each point is electrically connected to one pole of a current supply and the other to the other pole. There is a solenoid for each track point, two signals, an electric circuit for each signal, one including the armature when one solenoid is energized, and the other the armature when the other solenoid is energized, the energizing of each solenoid closing the circuit to its corresponding signal.

819,814. Initiation Apparatus. John M. Seibert, Pekin, Ill. Application filed July 24, 1905.

Conducting floor strips charged by an induction coil are placed for the initiate to walk upon with conducting shoes.

819,815. Electric Regenerator. Joel C. Slaughter, Dallas, Texas. Application filed July 28, 1902.

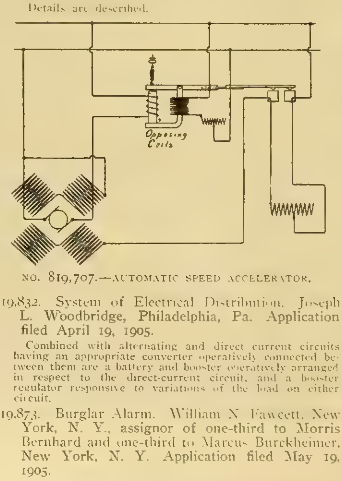
An electric regenerator comprises two or more induction coils and a condenser. The delivery ends of the primary wires of the induction coils are connected to the ends of the [illegible] the primary coils are adapted to be [illegible] to an alternating-current generator [illegible] the wire forming the secondary [illegible] electrical connection with the condensing plates of the condenser.

819,816. System of Motor Control. Harve R. Stuart, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 20, 1904.

A rheostat varies the current delivered to the main motor. There are a reversible operating motor for the rheostat, a relay switch for reversing the circuits of the operating motor and a pressure gauge switch for changing the circuits of the relay switch that may occupy either of two predetermined positions, and is dependent upon the fluid pressure produced by the apparatus. Its position is changed when the pressure falls below or rises above predetermined limits.

819,822. Snap Electric Switch. Allen A. Tirrill, Schenectady, N. Y. Application filed September 26, 1904.

Details are described.



NO. 819,707.—AUTOMATIC SPEED ACCELERATOR.

819,832. System of Electrical Distribution. Joseph L. Woodbridge, Philadelphia, Pa. Application filed April 19, 1905.

Combined with alternating and direct current circuits having an appropriate converter operatively connected between them are a battery and booster operatively arranged in respect to the direct-current circuit, and a booster regulator responsive to variations of the load on either circuit.

819,873. Burglar Alarm. William N. Fawcett, New York, N. Y., assignor of one-third to Morris Bernhard and one-third to Marcus Burckheimer, New York, N. Y. Application filed May 19, 1905.

In a burglar alarm are a battery and electromagnet and a circuit including the battery and the magnet. Separate wiring for one or more separate closures included within the circuit, and a separate switch for each closure, which switches serve for closing or opening the circuits of the closures, together with means operated by the magnet for closing a local battery, complete the system.

819,933. Regulation or Control of Dynamo-electric Machines or Electric Motors. Charles P. E. Schneider, Le Creusot, France. Application filed October 22, 1904.

In a dynamo or motor regulator are combined an armature, field-magnet poles, pole extension pieces in rows intermediate the magnet poles and armature, guide means for the extension pieces and a revoluble supporting frame for each row of the pieces. (See cut on next page.)

819,935. Electric Incandescent Lamp. Carl Schübel, Vienna, Austria-Hungary, assignor to the firm of Electrische Gluhlampen-Fabrik "Watt," Scharf & Co., Vienna, Austria-Hungary. Application filed September 25, 1905.

Associated with an incandescent electric lamp having leading-in wires is a T-shaped bridge at the bottom of the lamp to support the ends of the outside wires. This forms a free space between the bridge and bottom of the lamp, the joint between the leading-in wires and outside wires being in free space.

819,971. Electric Motor and Generator. John F. Beck, Chicago, Ill., assignor of one-half to Edward F. Hamm, Chicago, Ill. Application filed March 2, 1903.

An armature provided with a circular series of notches or winding recesses has a lap-winding arranged upon the armature body and engaging the recesses. This wind[illegible]

[illegible]

820,025. [illegible] Wilson [illegible] G. [illegible] 23, 1905.

[illegible]

820,031. Process of Reducing [illegible] Thomas L. Willson, New York, N. Y., [illegible] to the Union Carbide Company, [illegible] filed January 28, 1897.

A [illegible] calcium oxide [illegible] the chemical charge [illegible]

820,040. Battery Plate. Owen H. [illegible], Chicago, Ill. Application filed August 19, 1904.

A battery plate [illegible] tudinal bars provided [illegible] grooves and a series of [illegible] posite faces of the plate [illegible] other.

820,041. Means for Actuating Signals. [illegible] B. Ferdinand, Milwaukee, Wis. Application filed September 8, 1903.

A wheel having an [illegible] signal mechanism associated [illegible] jects into the tire and [illegible] ism, and a rod mounted [illegible] actuated by the tire when the [illegible] the rod serving to close the circuit [illegible] ism.

820,047. Dry Battery. Charles J. Heckmann, Fort Lee, N. J. Application filed May 25, 1905.

Details are described.

820,063. Selective Telephone System. Noble S. McKinsey and Anton R. Nelson, Susanville, Cal. Application filed June 15, 1904.

In each telephone is a button carrier [illegible] tons, one for each telephone of the system, [illegible] sponding series of push buttons, and also means [illegible] the pressure upon any push button [illegible] responding stationary button, closing a break [illegible] to place the telephone on the line.

820,064. Selective Telephone. Noble S. McKinsey and Anton R. Nelson, Susanville, Cal. Application filed December 27, 1904.

A party line of which one wire [illegible] is provided with a resistance at central [illegible] that of any talking circuit in the system. [illegible] central connect the other wire [illegible] sponding wire of any other [illegible] Selector magnets at each station [illegible] the [illegible] party line, and means at each station ground the other wire.

820,070. Panel Switch and Cut-out. John H. Trumbull, Plainville, Conn., assignor to the Trumbull Electric Manufacturing Company, Plainville, Conn. Application filed May 25, 1904.

Removable insulated bases are arranged [illegible] side by side and in rows touching each other, the [illegible] ends of the panels in each row having [illegible] ranged line-wire grooves. Circuit-wire terminals [illegible] the opposite end of each of the removable bases.

820,078. Timing Mechanism for Electric Circuits. August R. L. Wille, Leipsic, Germany. Application filed September 18, 1903.

An improved check or indicator for determining the time that the current is used in vehicles driven by electricity consists of a controller, a clock and means for connecting the wheelwork of the clock with the controller in such a manner that when the current to the motor is switched off the clock is stopped.

820,105. Electrolytic Ship-bottom Cleaner. George W. Frazier, Allegheny, Pa., assignor to the Pittsburgh Electrolytic Manufacturing Company, Pittsburg, Pa. Application filed October 30, 1903. Renewed March 20, 1906.

A conducting plate forms one electrode of the apparatus, and tackle is constructed to suspend the plate from the vessel movably contiguous to the side below the water line. Insulating fenders are arranged to prevent contact between the plate and the sheathing or hull of the vessel. A conductor leads abroad from the plate and a source of electricity has one pole connected with the conductor

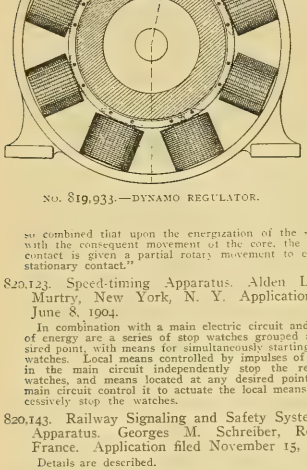
and the remaining pole connected with the sheathing of the vessel. (See cut.)

820,113. Water Purifier. Frank B. Hinkson, Newcastle, Pa., assignor to the Electric Liquid Purifying and Filtering Company, Pittsburg, Pa. Application filed May 31, 1905.

Water purification is accomplished by a device consisting of a shell having a water inlet at one end and a water outlet at the other end, a series of annular electrodes located within the shell and disposed, one within another, means for insulating the electrodes from each other and from the shell or casing, and electrical conductors connected, respectively, with the inner and outer electrodes.

820,119. Automatic Electric Circuit Changer or Switch. Frederick T. Kitt, Denver, Colo. Application filed February 15, 1904.

An electromagnetic switch is described in one specification of the patent as follows: "A solenoid, a sliding core therefor, a contact fastened to the core, stationary contacts, a lug projecting from the core, a stationary cam with angular surfaces co-operating with the lug,



No. 819,933.—DYNAMO REGULATOR.

so combined that upon the energization of the solenoid, with the consequent movement of the core, the movable contact is given a partial rotary movement to engage a stationary contact."

820,123. Speed-timing Apparatus. Alden L. McMurtry, New York, N. Y. Application filed June 8, 1904.

In combination with a main electric circuit and source of energy are a series of stop watches grouped at a desired point, with means for simultaneously starting all the watches. Local means controlled by impulses of current in the main circuit independently stop the respective watches, and means located at any desired point in the main circuit control it to actuate the local means to successively stop the watches.

820,143. Railway Signaling and Safety System and Apparatus. Georges M. Schreiber, Roubaix, France. Application filed November 15, 1904.

Details are described.

820,169. Resonance Circuit. Georg von Arco, Berlin, Germany. Application filed October 4, 1905.

Resonance circuits contain a conductor consisting of a stranded wire composed of insulated strands, the conductive material of each strang being 0.2 millimeter or less in diameter.

820,176. Telephone System. Charles L. Boyce, Detroit, Mich., assignor to the American Telephone and Telegraph Company. Application filed March 7, 1902.

A cut-off relay included in a high-resistance circuit is controlled by the cord connecting apparatus. A line signal in a local circuit includes the armatures of the relays, the circuit through the line signal being closed when the line relay is energized and the cut-off relay is de-energized. A supervisory signal included in the high-resistance circuit and means whereby the de-energization of the line relay causes a decrease in the resistance of the circuit through the supervisory signal are the other requisites of the system.

820,187. Automatic Exchange Selector. Claude D. Enochs, La Crosse, Wis., assignor to the Western Electric Company, Chicago, Ill. Application filed October 16, 1905.

A selector for an automatic telephone exchange consists of a rotatably mounted ratchet wheel, a stepping pawl and a retaining pawl for controlling the rotation of the wheel and an electromagnet having a quick-acting armature and an armature possessing considerable inertia for controlling the operation of the pawls. (See cut.)

820,211. Electrical Connection for Switchboards. Hubert Krantz, Brooklyn, N. Y. Application filed July 21, 1903.

In combination with the insulating plate of a switchboard and the bus-bar are means for supporting the bus-bar comprising a post projecting from the plate and a bushing forced onto the post, and having an integral blade abutting against and mechanically and electrically secured to the bus-bar for supporting it.

820,213. Sight Indicator for Telephones. Frank R. Lay, Greenfield, Ind., assignor of one-half to Walter W. McCole, Greenfield, Ind. Application filed April 22, 1905.

Two telephones have associated with them a slight indicator having a face plate with a symbol representing each telephone. A finger is adapted to point to one or the other of the symbols, and electrical means in the indicator actuate the finger, the electrical means being connected with the telephones.

820,258. Detector for Electromagnetic Waves or the Like. Ragnar H. Rendahl, Berlin, Germany, assignor to Gesellschaft für Drahtlose Telegraphie M. B. H., Berlin, Germany. Application filed April 18, 1905.

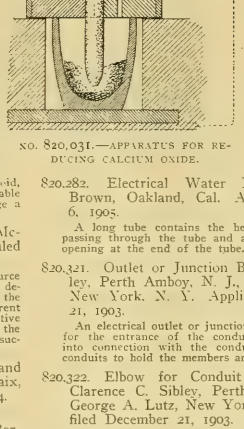
Apparatus for detecting ether waves comprises an electrolytic detector, means for varying of adjusting the non-energy-consuming property or factor of the detector independently of its energy-consuming properties.

820,260. Electrical Switch Indicator. William A. Rideout, Sr., Oshkosh, Wis. Application filed December 11, 1905.

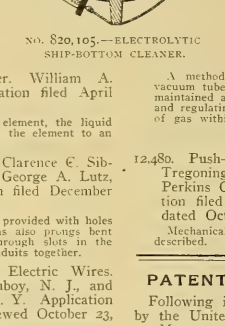
The patent specifies a contact block connected to the switch, an indicating board and a pivotally mounted indicating pointer. Electromagnets are arranged to attract the pointer, turning it in one direction or the other. An electric circuit is completed by suitable means to energize one or the other of the magnets, thus causing the pointer to be swung in one direction or the other. A signaling device, the operating mechanism of which is energized by the motive power of the indicating device, is also included.

820,280. Trolley Stand. Warren W. Annable, Grand Rapids, Mich. Application filed January 31, 1905.

A pivoted pole support, springs to yieldingly elevate the pole and means for automatically reducing the tension of the springs when the means strike an obstruction are the essential parts.



No. 820,031.—APPARATUS FOR REDUCING CALCIUM OXIDE.



No. 820,105.—ELECTROLYTIC SHIP-BOTTOM CLEANER.

820,282. Electrical Water Heater. William A. Brown, Oakland, Cal. Application filed April 6, 1905.

A long tube contains the heating element, the liquid passing through the tube and around the element to an opening at the end of the tube.

820,321. Outlet or Junction Box. Clarence E. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Application filed December 21, 1903.

An electrical outlet or junction box provided with holes for the entrance of the conduits has also prongs bent into connection with the conduits through slots in the conduits to hold the members and conduits together.

820,322. Elbow for Conduit for Electric Wires. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Application filed December 21, 1903. Renewed October 23, 1905.

An elbow for conduits comprises members movably connected together, means for closing the openings adjacent to the adjacent ends of the members and sections located in the members and having their outer ends at a distance from the ends of the members to permit the entrance of the ends of conduits into the members.

820,327. Sewing-machine Motor. Harold R. Wellman, Riverside, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed August 17, 1905.

A motor is mounted in the bracket beneath the countershaft and below the table. A driving wheel operated by the motor has angularly disposed frictional engagement with the driven wheel.

820,333. Electricity Meter for Alternating Currents. Hermann Aron, Charlottenburg, Germany. Application filed May 27, 1904.

A pair of shunt magnet coils upon the opposite side of the rotary member from the armature are provided with cores magnetically connected at the ends farthest from the rotary member. One or more short-circuited coils varies the relative phases of current in the magnet coils. A bridge piece between the opposite ends of the magnet cores is adapted to form therewith an imperfect magnetic circuit. A series magnet coil is carried by the bridge-piece.

820,348. Vapor Electric Apparatus. William R. Burrows, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 10, 1905.

A frangible vessel has a leading-in conductor, the conductor consisting in part of platinum embedded in the wall of the vessel. The conductor has another part consisting of non-amalgamating metal, and a body of mercury surrounds the last-named part and contacts with it.

820,350. Signaling System for Telephone Trunk Lines. Merritt S. Conner, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed April 9, 1900. Renewed October 5, 1905.

A trunk line having a source of current is connected with the main line. A switch unites the trunk line with the telephone line. A signal instrument is at one terminal of the trunk line and a high-resistance signaling instrument in the trunk line for controlling the operation of the first-mentioned signaling instrument.

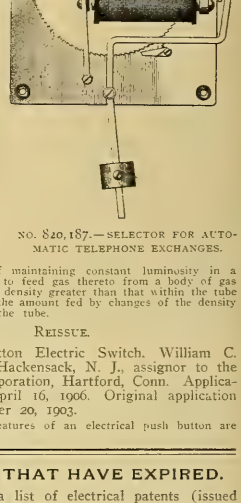
820,360. Multiple Switchboard for Telephone Exchanges. Milo G. Kellogg, Chicago, Ill. Application filed February 13, 1892.

In a telephone exchange system are two telephone lines, each permanently closed at the central office through the helices of a polarized call annunciator and the two lines temporarily switched together for conversation into a single circuit with the annunciators connected so as to respond to the same polarity of current.

820,364. Vacuum-tube Regulator. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York, N. Y. Application filed August 21, 1905.

A vacuum tube is connected with a body of gas of greater density than that in the tube. A mass of porous material is interposed in the passage between the tube and the body of gas, means for varying the extent of surface of porous material exposed to the pressure of the body of gas in order to regulate the flow of gas in the tube being provided.

820,365. Vacuum-tube Regulator. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York, N. Y. Original application filed August 21, 1905. Divided and this application filed February 7, 1906.



No. 820,187.—SELECTOR FOR AUTOMATIC TELEPHONE EXCHANGES.

A method of maintaining constant luminosity in a vacuum tube is to feed gas thereto from a body of gas maintained at a density greater than that within the tube and regulating the amount fed by changes of the density of gas within the tube.

REISSUE.

12,480. Push-button Electric Switch. William C. Tregoning, Hackensack, N. J., assignor to the Perkins Corporation, Hartford, Conn. Application filed April 16, 1906. Original application dated October 20, 1903.

Mechanical features of an electrical push button are described.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on May 14, 1906:

403,092. Connector for Electric Railways. L. Daft, Plainfield, N. J.
403,100. Electric Alarm Clock. T. H. Grady, Brooklyn, N. Y.
403,104. Electrical Signaling Apparatus. A. A. Hatch, Kansas City, Mo.
403,110. Electrically Heated Vacuum Pan. G. B. Johnson and M. Johnson, Elgin, Ill.
403,157. Method of Electric Welding and Shaping of Metals. E. Thomson, Lynn, Mass.
403,158. Dynamo-electric Machine. H. E. Walter, Schenectady, N. Y.
403,177. Time Switch and Secondary Batteries. C. E. Buell, New Haven, Conn.
403,180. Electrical Float Signaling Apparatus. J. E. De Mier, Las Cruces, N. M.
403,192. Electric Railway. R. M. Hunter, Philadelphia, Pa.
403,193. Means for the Electrical Propulsion of Boats. R. N. Hunter, Philadelphia, Pa.
403,197. Apparatus for Metalizing Electrotype Molds. S. P. Knight, Brooklyn, N. Y.
403,244. Apparatus for Registering the Consumption of Electric Energy. L. Brillie, Paris, France.
403,253. Galvanic Battery. C. Colle, Lille, France.
403,258. Vibratory Telegraphy. S. D. Field, Stockbridge, Mass.
403,262. Covering for Electric Cables. E. F. Garland, Lynn, Mass.
403,270. Exchange System for Telegraphs. J. H. Robertson, Rutherford, N. J.
403,292. Combined Telephony and Telegraphy. J. H. Robertson, Rutherford, N. J.
403,308. System of Electrical Distribution. E. P. Thompson, Elizabeth, N. J.
403,311. Electrical Measuring Instrument. E. Weston, Newark, N. J.
403,312. Portable Tangent Galvanometer. E. Weston, Newark, N. J.
403,316. Device for Holding Telephones. S. J. Adams, Detroit, Mich.
403,345. Rheostat. J. L. Gish, Jackson, Mich.
403,374. Electric Riveting Apparatus. E. E. Ries, Baltimore, Md.
403,429. Process of Electroplating Lead Pipes. L. D. Hosford, Brooklyn, N. Y.
403,439. Electric Controlling Device for Elevator Carriages. W. E. Nickerson, Cambridge, Mass.
403,440. Electric Controlling Device for Elevators. William E. Nickerson, Cambridge, Mass.
403,441. Electrically Controlled Elevator. W. E. Nickerson, Cambridge, Mass.
403,442. Electric Controlling Mechanism for Elevators. W. E. Nickerson, Cambridge, Mass.
403,451. Electric Battery. J. A. Barrett, Brooklyn, N. Y.
403,458. Multiple Switchboard Testing Apparatus. J. J. Carty, New York, N. Y.
403,472. Printing Telegraphy. Z. P. Hotchkiss, Oak Park, Ill.
403,483. Testing Apparatus for Multiple Switchboards. J. J. O'Connell, Chicago, Ill.
403,487. Dynamo-electric Machine. F. A. Perret, Brooklyn, N. Y.
403,492. Electromedical Apparatus. T. J. Smith, Brooklyn, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVIII. CHICAGO, MAY 26, 1906.

Features of Engineering Interest in a Large Cold-storage Plant.

Abundant opportunity for the exercise of engineering knowledge and judgment is afforded by the design of an equipment for the modern cold-storage plant. To heat a building and keep it at an approximately even temperature is not such a difficult problem in these days of efficient heating and ventilating systems, but to keep a building cold, and maintain certain portions of it at different predetermined temperatures from, say, 40° above to 6° below zero, Fahrenheit, presents difficulties that the electrical generating part of [illegible] actually needed for present requirements.

The power plant and refrigerating [illegible] are located in the basement of the building, the structure being located on the bank of the North Branch of the Chicago River, water [illegible] and the engines are run condensing. Beginning with the electrical equipment, in portion of Fig. 1 will show the arrangement of the generating apparatus. The generators are two in number, and, together with all the motors about the plant, were furnished by the Northern Electrical Manufactu[illegible]

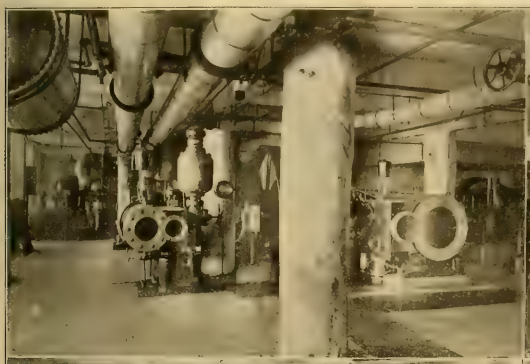


Fig. 1. View Showing Two Electrical Generating Units and Motor-driven Brine-circulating Pump.

Fig. 2. View of Main Switchboard. Ammonia Compressors at Right.

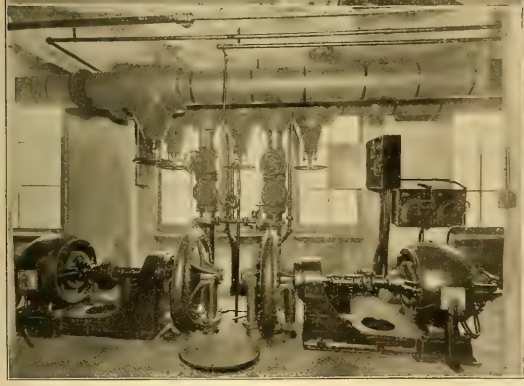


Fig. 3. A Pair of Motor-driven Circulating Pumps.

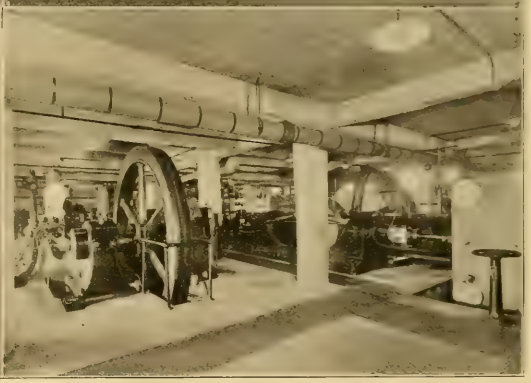


Fig. 4. Two of the Compressor Engines for Refrigerating Plant

FEATURES OF ENGINEERING INTEREST IN A LARGE COLD-STORAGE PLANT.

that are not so easily overcome. Compared to heating plants, there are very few cold-storage plants built, excluding, of course, the small refrigerating equipments which are generally adjuncts of large structures. It may, therefore, be safely said that cold-storage equipments have not been developed to as great a degree of excellence as have those for heating and ventilating purposes, and that the designer of the plant has more latitude in which to show his originality in this line of engineering.

An example of a well-designed cold-storage warehouse, in which there are a number of new and interesting features, is the plant of the North American Cold Storage Company in Chicago, located at 109-121 North Canal Street. The plant was designed by Mr. C. A. Chapman, consulting engineer of Chicago, it being an enlargement and rehabilitation of a plant in the original building on this site, which has recently been enlarged and made modern in every respect.

In planning the electrical equipment for this plant, provisions were made to supply current for a butter-renovating department, which would have required a considerable outlay in motors, but this idea was abandoned, for the present at least, so

ing Company of Madison, Wis. The generators are of the engine type, delivering direct current at 250 volts, and direct-connected to Buckeye engines. The larger generator is of 250 kilowatts capacity, running at 150 revolutions a minute and driven by a cross-compound 13 by 26.5 by 24-inch bored-guide-bed engine. The smaller one is of 125 kilowatts capacity, 200 revolutions a minute, driven by a tandem-compound engine 10 by 21 by 18 inches in dimensions.

Current is taken from the generators to the switchboard, which is shown in Fig. 2, for distribution. The switchboard is of white marble and contains nine panels. Five of these, as will be seen, are load panels, two are for the machines, with one totalizing panel. They are supplied with all the necessary instruments, switches and circuit-breakers, including standard integrating wattmeters and direct-reading voltmeters and ammeters.

The ninth or end panel of the switchboard carries two revolution counters and one each of the following gauges: Live-steam indicating, live-steam recording, combination pressure and vacuum indicating, and same recording, and two each indicating and recording ammonia gauges. The revolution counters are electrically operated by means of

the installation of the boilers on the floor line of the building, which was governed by the level of the river, they are set in a pit. The bottom of this pit consists of a steel platform set in concrete. Below the floor level of the pit is a sump, from which seepage water is lifted by means of a motor-driven centrifugal pump mounted on a vertical shaft. The blow-off of the boilers, being below the river line, all emptying water from the boilers during cleaning has also to be taken out by the sump pump. These two boilers deliver all the steam required by the electrical units, refrigerator engines and steam pumps.

The boiler feed water is handled by a pair of 12 by seven by 12-inch Dean, single-cylinder, end-packed plunger pumps. For boiler-feed purposes the water of condensation of all the engines is used, the make-up water being drawn from the circulating water in the steam and ammonia condensers. This circulating water is taken from the river, which is very foul at this point, and is treated by a Sorge purifying system.

Sufficient draft for the boilers is obtained by a chimney 206 feet high and five feet four inches in diameter, built by the Weber Concrete Chimney Company. The gases from the furnaces pass to this

chimney through a brick and steel breeching. The boilers are supplied by Cahall chain grates, motor-driven.

A surface condenser is used in the plant, of sufficient capacity to supply both the electrical units and the ammonia-compresser engines. It is of the cylindrical form, having 1,800 square feet of condensing surface. It was built by the G. F. Blake Manufacturing Company. Two eight by 14 by 12-inch Blake horizontal air pumps are used in connection with this part of the installation.

There are installed two ammonia compressors, one cross compound with steam cylinders 24 and 48 inches, and two ammonia cylinders 18 inches, all 48-inch stroke. The other one is tandem compound with steam cylinders 13 and 26 inches and one ammonia cylinder 14 inches, all 36-inch stroke. The former has a capacity of 250 tons, the latter 75 tons and both machines were supplied by the Vilter Manufacturing Company.

Condensing water, as before stated, is taken from the river. It comes through an intake into a settling well built below the basement. The intake consists of a wrought-iron pipe perforated with small holes to act as a screen. This pipe pro-

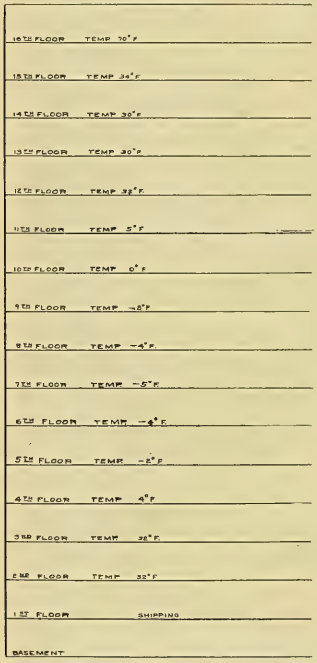


FIG. 5. DIAGRAM OF GRADUATED TEMPERATURES ON DIFFERENT FLOORS OF COLD-STORAGE PLANT.

jects into the river and is protected from passing vessels by a pile construction.

After passing through the intake the circulating water for the condensers is forced through the latter by two six-inch Kingsford double-suction centrifugal pumps, the shafts of which are direct connected each to a 50-horsepower motor, as shown in Fig. 3.

Fig. 1 shows, besides the electrical-generating units, one of the two motor-driven brine pumps. This is shown to the left and at the rear in the picture. These pumps are of the Gould triplex double-acting type, 11 by 12 inches in dimensions. Each is driven by a 50-horsepower variable-speed motor, which is controlled by field manipulation. Connection to each pump is made by a double set of gears and pinions. The pinions are provided with a suitable locking arrangement and proportioned so as to allow of any interchange of gearing. Since there is a motor-speed control of 50 per cent. and since the capacity of the pumps may also be reduced by one-half, the combined range of control of the pump capacity is 75 per cent.

Water supply for the building is taken from the city service and is distributed to the several floors by two seven by 4½ by 10-inch Dean single-cylinder horizontal pumps.

An application of electric current which is of considerable importance in this installation is the supply of four Otis elevators of the direct type. Each has a capacity of 3,500 pounds at 150 feet a minute. Two of the elevators have additional lifting and counterweight cables whereby their capacity may be increased to 5,000 pounds at approximately 80 feet a minute. The hoists have a back-gear arrangement, which allows of the change of speed to accommodate the change in load. Two of the elevators serve the older portion of the building, and replace steam equipments originally installed.

In the design of this cold-storage building (which is 16 stories high) the system of graduated temperatures has been carried out; that is to say, the temperatures of the various floors of the building are gradually lowered from the top and bottom of the building toward the center. The sixth, seventh and eighth floors are the freezing floors. In this manner the best effect is obtained from the insulation of each room. The radiation of each room is, of course, directly proportional to the area of radiating surface and to the temperature of the outside atmosphere. With the graduated system it is possible to keep the inner compartments at a constant low temperature with almost no absorption of heat, except that which is given off by the materials placed therein to be cooled.

As an example of the efficiency of the system, it may be mentioned that when the plant was first put in operation the refrigeration was turned on to the interior compartments, and was, through an oversight, left on several hours after the temperature has been reduced to the desired point. The temperature in these compartments was consquently reduced far below that required. When the refrigeration was turned off, instead of coming rapidly back to the normal, the temperature rose scarcely at all, and great difficulty was experienced in getting it back where it should be without actually using artificial heating means.

The accompanying diagram (Fig. 5) shows clearly the gradations in temperature on the several floors, being highest at the top and bottom and lowest near the middle. The height of the building, it may be remarked, is somewhat unusual for the locality, which is somewhat removed from the downtown district.

One of the interesting features of the plant is the apparatus for testing the efficiency of various heat-insulating materials. This consists of a small room, the top, bottom and three sides of which are insulated with the best grades of insulating material, and through which practically no heat can pass from the interior to the exterior of the room. The remaining side of the room, however, which is about 20 square feet in area, is composed of a metal surface and the poorest insulator of heat obtainable. Upon this is placed the insulating material to be tested.

Inside of this insulated room are placed a number of electric heaters which are connected to an outside source of current at a switchboard which is supplied with the necessary instruments to measure the energy supplied to the heaters. The conductors passing to the heaters are large so as not to consume an appreciable amount of energy, and pass through heat-insulating bushings in the wall of the compartment. Thermometers also lead through the walls at various points, carefully insulated, and can be read from the outside.

In the operation of the device the insulation to be tested is put in place and the current turned on. From 55 to 3,000 watts may be absorbed and turned into heat by the electric heaters. By measuring the current that is delivered to the heaters (the loss in transmission being negligible) the exact amount of heat given off by the heaters may be determined in terms of British thermal units. By reading the thermometers the exact amount of heat in the room may be determined at any time, knowing the temperature and the cubical contents of the room. The difference between the heat delivered to the room by the heaters and the actual heat in the room is, of course, the amount which has been radiated by the conducting wall covered with the material to be tested, for none of the other walls conducts away an amount of heat sufficient to be taken into consideration.

An ingenious method of heating the sixteenth floor of the building, which is rented to outside persons, has been adopted. This is accomplished by surrounding the chimney of the power plant, which passes up through one corner of the building, by a duct. From this duct the heating ducts for the sixteenth floor are tapped and in winter are entirely sufficient to heat that floor. In the summer the heat is allowed to escape to the roof. This arrangement serves the double purpose of heating the top floor and also of keeping the heat of the chimney from escaping to the floors which are devoted to cooling purposes.

A Curious Home-made Knife Switch.

Burn-outs which sometimes occur in electrical systems are not infrequently caused by the ignorance or carelessness of persons who have little knowledge of the danger that may arise from makeshift work in the wiring of their premises. An example of the curious and almost laughable "home-made" contrivances which are found in actual service is shown in the accompanying illustration, which appeared in the last quarterly Fire Report of the

AN EXAMPLE OF A HOME-MADE KNIFE SWITCH.

Electrical Bureau of the National Board of Fire Underwriters. This is a home-made knife switch which was found actually connected in circuit in an Oklahoma city. As the picture well shows, it consists of a piece of board with a little strip of asbestos on one side. The switch blade is a thin strip of metal, presumably tin or copper, which is nailed at one end to the board. It slides between two small strips of metal at the top for jaws. The wires pass through the board from the back and are apparently nailed in place.

New Quarters for Electrical Engineers at Cornell.

The trustees of Cornell University at Ithaca, N. Y., have recently assigned to the Department of Electrical Engineering of Sibley College the major portion of Franklin Hall, now occupied by the department of physics. The latter department is now moving into commodious quarters in the new Rockefeller Hall of Physics, just completed. The electrical engineering department will thus be supplied with new quarters for conducting various lines of work. The electrical engineering laboratory will continue to occupy a part of the main building of Sibley College, as Franklin Hall does not contain sufficient floor space to accommodate all of the apparatus.

Franklin Hall, after the remodeling which will be necessary this summer, will contain large de-

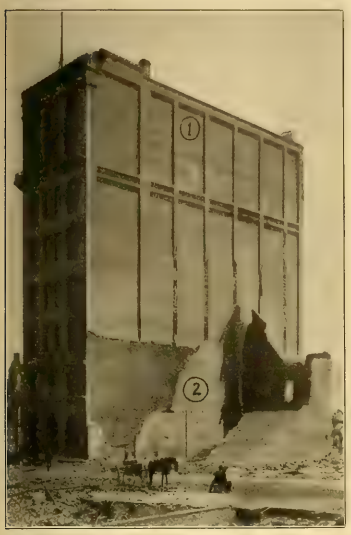
FRANKLIN HALL, CORNELL UNIVERSITY, NEW QUARTERS OF ELECTRICAL ENGINEERING DEPARTMENT.

signing and lecture rooms, a number of smaller recitation rooms and offices, and the telephone and railway laboratories. It is understood that the new arrangement will be only temporary, as the enlargement of the main Sibley College buildings will be an urgent necessity if the present rate of growth continues.

Some San Francisco Episodes.

One of the greatest sufferers by the earthquake and fire of April 18th in San Francisco was the Pacific States Telephone and Telegraph Company. Scarcely one of its exchanges escaped damage, and most of them were destroyed or so badly shaken or burned as to be useless until almost completely rebuilt. The New West Office at Pine and Steiner streets was saved, and is now the headquarters of the company. The main operating building at 216 Bush Street is practically a total ruin. The New Exchange Building was also burned. The New South Office was badly shaken and burned, with the loss of a new switchboard. The Public Office at 154 Geary Street was unroofed and gutted. The Park Office, although injured, was not burned, and is now in operation. The East Office at Hyde and Sutter streets was damaged, but is now used as the bookkeeping headquarters. The Old Mission Office is simply a mass of debris. The Old South Office on Jessie Street was practically destroyed by earthquake, and fire completed the devastation. The accompanying pictures will show the appearance of some of the exchanges after the fire.

San Francisco has long had the reputation of being one of the most advanced cities in the world in the extent and excellence of its telephone service. Before the calamity the operating company



1. Temporary Board Installed in this Building.
2. Ruins of New Main Operating Office on Bush Street. Not Harmed by Earthquake, but, with New Switchboard, Destroyed by Fire.

RUINED TELEPHONE EXCHANGE IN SAN FRANCISCO.

had, in round numbers, 50,000 connected subscribers to its service. Today it has 2,200. This is a sad contrast. Possibly 8,000 applications for connections are on file, but in many cases there are no buildings in which to install the telephones. As to the overhead construction, its condition after the fire may be imagined. But the underground cables were in very fair condition, and the whole situation is being gradually cleared. There is no doubt that in the end San Francisco will have as good or better telephone service than before the earthquake; but a prodigious amount of work is in sight before this result shall have been accomplished.

The regular correspondent of the Western Electrician at San Francisco contributes this:

Oakland, Cal., May 16.—The Pacific Gas and Electric Company and its subsidiary concerns, the San Francisco Gas and Electric Company and the California Gas and Electric Corporation, are restoring their system in San Francisco and vicinity as rapidly as changed conditions will permit. A large one-story storeroom, with some office accommodations, has been hastily constructed at Fifth and Howard streets, the old Pacific Gas Improvement Company's gasworks site, where a large storehouse had been abandoned a few weeks before the fire.

Several weeks ago the San Francisco Gas and Electric Company opened about a dozen sub offices in various parts of the city, so that bills might be paid and gas shut off without making a trip to the main office at 415 Post street, which was destroyed by the fire. Several of these sub-offices that were outside the burned district have been reopened. J. C. Jones, chief engineer of the gas department, says that the gas-works are now in good enough condition to supply all the gas that is

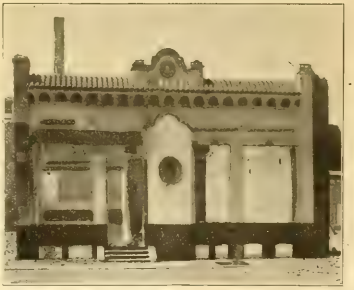
Cross shows ruins of Old Mission Office. Total Wreck from Earthquake and Fire.

PILE OF DEBRIS THAT WAS ONCE A SAN FRANCISCO TELEPHONE EXCHANGE.

needed in the unburned districts. On the night of May 12th 2,300 gas lamps for street lighting were lighted for the first time since April 17th. This relieved the Stygian gloom that had nightly enveloped the entire burned district and all but a few streets that had had arc lights for a week before. Several thousand gas connections have since been made to dwelling houses and stores, considerably relieving the cooking situation. Nearly the entire population had been cooking in the streets for more than three weeks.

Representatives of the San Francisco Gas and Electric Company say that the Jessie Street station between Third and Fourth, which was considerably damaged by the earthquake and more so by the fire, will be rebuilt. Some of the boilers have already had steam up, although the big stack was broken off. Chief Electrician Fitzpatrick fell a victim in the performance of duty. He waited long enough to shut off the motor-generators during the shock of April 18th, and on reaching the street was crushed beyond recognition by the falling smokestack. A view showing the broken chimney appeared in the Western Electrician May 5th. Before April 18th work had already progressed far in restoring the new sub-station section of the Jessie Street station that was badly damaged by fire on February 22d. It is asserted that there will be considerable salvage on the three 1,000-kilowatt motor-generator sets that were in operation there at the time of the earthquake. The principal damage to the machinery is said to have been caused by the Scott & Van Arsdale Building falling on the motor-generators, which did not suffer very much from fire. The Eighth and Kansas street sub-station was saved, enabling the current from the Standard Transmission lines to be distributed in the city.

The Visitacion Valley plant, where the three



Old South Office, Jessie Street, Destroyed by Earthquake and afterward Burned.

RUINED TELEPHONE EXCHANGE IN SAN FRANCISCO.

5,000-horsepower gas-engine-driven generating sets were being installed, has been repaired. One of the big engine bed-plates was cracked. The frequency changers and complicated switchboards in connection with this station were put out of commission for several days by the earthquake, but are again in operation, so that the United Railroads

[redacted]

the Potrero plant will [redacted]

[redacted]

May 12th [redacted] cover [redacted] ceding [redacted] gratifying [redacted] interests it represents, and to forecast a steady and permanent upbuilding [redacted] ness security."

Well named "Energy," the [redacted] the California Electrical Works of San [redacted] the "Earthquake Edition"—has been issued on time, and is of particular interest. The company is one

East Office at Hyde and Sutter Streets. The Bookkeeping Department of the Pacific States Telephone and Telegraph Company is Now Located in this Building.

DAMAGED TELEPHONE EXCHANGE IN SAN FRANCISCO.

of the Pacific Coast agents of the Western Electric Company of Chicago, and its well constructed building at 642 Folsom Street is a center of the electrical supply trade of San Francisco. By unremitting labor, this building was saved from the fire with comparatively little injury, and in it work is now proceeding as in the past. Some idea of how it was done may be gained from the following paragraphs, quoted from "Energy:"

Through the destruction of a neighboring plant, we were without power and light. A 40-horsepower gasoline engine came by express from Los Angeles, and with generators from our own stock, lowered by means of block and tackle from the fourth floor, supplied us with a temporary plant. It would take pages to describe the difficulties overcome in locating and obtaining this engine in a distant railroad yard in Oakland, its removal to San Francisco and its installation in our building there without handling appliances of any kind. Trucks were obtained, but there were no horses, and men were sent miles into the country to obtain them.

Street-car equipment was destroyed. Automobiles were purchased for use by our city sales department, for the purpose of making emergency deliveries and for the transportation of employes between the office and their temporary homes.

We were without telephone service. Our house system was quickly placed in working order and a temporary line installed to the West Exchange, the only one left standing, giving us a connection with the outside world.

About 150 men were at work and had to be fed

and housed. A commissary department was promptly organized to provide for them.

Printing houses were burned out, and a complete printing plant in Oakland was taken over to supply our needs in this direction.

During the height of the fire we filled one order for 150 cells of gravity battery for use of the Fire Alarm Department. The order was written on a paper bag and signed by a total stranger to us without reference to the credit department.

The West Exchange of the Pacific States Telephone and Telegraph Company maintained service for the police, government and fire-alarm departments by the use of a Western Electric charging outfit, operated by a gasoline engine, and erected

This picture shows a portion of the rear wall, which fell at first earthquake shock. The brick chimney was damaged and is now being taken down. Water tank, containing 70,000 gallons, was not thrown down.

BUILDING OF CALIFORNIA ELECTRICAL WORKS, FOLSOM STREET, SAN FRANCISCO, WHICH WENT THROUGH EARTHQUAKE AND FIRE WITH ONLY SLIGHT DAMAGE.

in a tent in the adjoining street. Connection with the ferry station was made by means of an expensive silk-and-cotton-covered switchboard cable erected on sawhorses in the streets.

The greatest factor in the saving of our building was wire-glass. One side of the building was a blank wall. In the other side and rear were windows of wire-glass set in metal frames filled with concrete. The fire came from the rear and swept around both sides, where it literally beat and pounded against the glass, but could not find an entrance, and the glass stands today badly cracked, but intact. A prominent contractor who examined our building after the fire states that many buildings could have been saved had this form of construction been used.

The business of the last few days has thoroughly demonstrated that the best salesman is the one that can write the fastest.

Standardization Rules.

An interesting and important part of the report of the board of directors of the American Institute of Electrical Engineers for the year ended April 30, 1906, was that relating to standardization. It reads as follows:

The standardization committee has held four meetings and will hold one or two more before the summer. The principal work undertaken was the revision of the committee's former report, which in the future it is proposed to call "Standardization Rules of the A. I. E. E."

This revision includes the correction and rearrangement of old matter, the introduction of new definitions and classifications and recommendations regarding new apparatus and new conditions. After the committee finally passes upon the revised rules, they will be submitted to the various manufacturers and engineers interested, for suggestions and criticisms. Then, after further consideration by the committee, the rules will be referred to the board of directors. It is hoped that the result will be a set of rules generally acceptable and permanent for some years to come.

It is proposed to incorporate with the rules certain appendices, such as "Copper Wire Resistance Table," "Specifications for Testing Rubber-covered Wires," "Notation," and other matters related to standardization.

In accordance with the resolutions passed at the International Electrical Congress, St. Louis, 1904, the British Institution of Electrical Engineers, acting as organizer, has secured the appointment of national delegates from various countries and arranged for a meeting to be held in London the latter part of June. The committee is in favor of standardizing certain general features and methods in connection with electrical apparatus in regard to which it is hoped that international agreement can be secured.

New Passenger Station of the Pennsylvania Railroad in New York City.

Plans are now practically completed for the new passenger station of the Pennsylvania Railroad in New York city. It will be unique in the number of entrances and exits that will be provided. This condition is due to the fact that each of the four sides of the structure is a front, opening respectively on two wide avenues and two important streets, which latter have been widened by the company to 80 feet each. The frontage on the avenues is 430 feet and on the streets 780 feet, the sides of the structure forming a perfect parallelogram. As the tracks are 40 feet below the surface of the streets, the station is divided into three levels. From the street level upward the walls of the structure rise to the height of 60 feet, except in the center, where the roof of the general waiting room reaches a height of 150 feet, and the corner of Eighth Avenue and Thirty-third Street, where there is an elevation of four stories for office purposes. The architectural design of the entire exterior is a Doric colonnade, 35 feet high, surmounted by a low attic, raising the general elevation to 60 feet. The unusual extent of the building in area and its general type are suggestive of the great baths of ancient Rome. In fact, the baths of Caracalla, still magnificent in their ruins, were the inspiration of this architectural plan.

The exterior construction is to be of pink Milford granite. This is a particularly effective structural stone, and its soft shades of color are uncommonly pleasing to the eye.

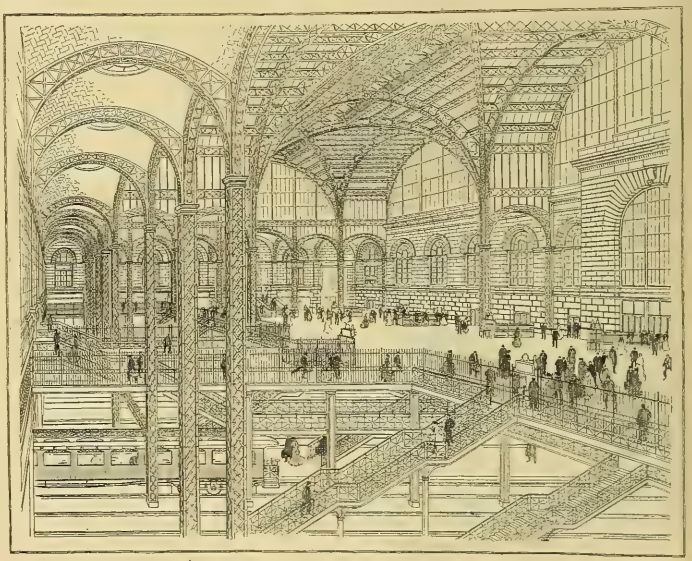
The main entrance is fixed in the center of the structure on Seventh Avenue, opposite the intercepted end of Thirty-second Street. This is for foot passengers only, and from the street entrance to the stairway to the main waiting room there extends an arcade 225 feet long and 45 feet wide, flanked by shops, which will be occupied by merchants whose wares will appeal especially to the requirements of travelers. At the corners of Thirty-first and Thirty-third streets and Seventh Avenue are open pavilions, which furnish carriage entrances for incoming and outgoing traffic. Under cover, carriages descend from the street level by a slight gradient about 20 feet to the level of the station proper, the Thirty-first Street incline being assigned as an entrance and the Thirty-third Street ascent as an exit. By this arrangement carriage passengers are delivered at the most convenient entrance to the general waiting room.

The general waiting room, the largest of its kind in the world, 320 feet long, 110 feet wide and 150 feet high, is the central section of the plan. Within its spacious walls will be located the ticket offices, parcel rooms, telegraph and telephone offices and baggage-checking windows, all so disposed as to situation that a passenger may proceed from one to the other seriatim, with a minimum amount of exertion and without retracing his steps. Adjoining the general waiting room on the west are two subsidiary waiting rooms, 58 by 100 feet, respectively, for men and women, provided with seats, and opening into retiring rooms, with lavatories attached.

Parallel to and connecting with the main waiting room by a wide thoroughfare, and west of the subsidiary waiting rooms, is the concourse, a covered assembling place over 100 feet wide, extending the entire width of the station and under the ajoining streets. An idea of the width of this concourse is gained by a comparison of it with the lobby of the Jersey City train shed, which is narrower by 25 feet. This may be termed the vestibule to the tracks, as two sets of stairs descend from it to each of the train platforms on the track level. The concourse and adjacent areas are open to the tracks, forming a courtyard 340 feet wide by 210 feet broad, roofed by a lofty train shed of iron and glass, similar in design to the famous train sheds of the new stations in Frankfort and Dresden, Germany. In addition to the entrances to the concourse from the waiting room there are also direct approaches from Thirty-first and Thirty-third streets and Eighth Avenue.

The gates of the stairs descending from the concourse to the trains will bear signs announcing the name, destination and the time of departure of the train on the particular platform where the stairs land.

Auxiliary to the main concourse and located between it and the tracks is a sub-concourse, 60 feet wide, which will be used for exit purposes only.



CONCOURSE AND TRACKS OF NEW PENNSYLVANIA RAILROAD STATION IN NEW YORK CITY.

This passageway is 18 feet above the tracks, but is connected with the track level by two stairways and one elevator from each platform. From it ample staircases and inclines lead directly to Thirty-first, Thirty-third and Thirty-fourth streets, to Eighth Avenue and to future rapid-transit stations under Seventh or Eighth avenues. Direct connection may also be made with the proposed subway stations on Herald Square without ascending to the street level.

The northern side of the station extending along Thirty-third Street will be assigned to the suburban service of the Long Island Railroad, into which trains will run from all points on Long Island by way of the East River tunnels. Ample entrances and exits are provided on Seventh and Eighth avenues and Thirty-third Street, so that this traffic can be handled in connection with the adjacent subways and the surface lines on the surrounding streets independently of the rest of the station.

The third level, which is at a depth below the surface of the street corresponding to the height of a four-story building, is the track level. When the two tracks emerge from the tubes under the Hudson and reach the entrance to the station yards at Tenth Avenue they begin to multiply, and at Ninth Avenue and extending into the station the total number has grown to 21. There is also a reduction in the number of tracks leading out of the station to the east to a total of four for the main line, two passing under Thirty-second and two under Thirty-third Street, and thence under the East River to the Long Island City yards. The track surface of the station may be compared to two unfolded fans joined together at the open ends, the handle of one extending under the Hudson and that of the other under East River. Within the station area, covering 25 acres of ground space,

there are 16 miles of track. The trackage area will afford ample facilities for easy movement of many hundred trains per day by the prompt and efficient means of electric power.

The designs for the station were made by McKim, Meade & White, architects of New York, and will be executed under their direction.

The Hawthorne Shops of the Western Electric Company.[1]

By H. R. King.

The Hawthorne shops of the Western Electric Company (West Twenty-second Street to Ogden Avenue on Forty-eighth Avenue, Chicago) consist of six principal groups of buildings. The office, foundry, forge shops and machine shops, devoted to the manufacture of direct and alternating-current motors and generators, are located west of the Belt Railway. The cable and rubber plants, for the manufacture of telephone and power cables and rubber in the various forms in which it is used for telephone service, are found on the east side of the railway.

THE NEW HAWTHORNE WORKS OF THE WESTERN ELECTRIC COMPANY.

In addition to these buildings, there is a gas plant, watertower, power plant and two crematory buildings. The entire plant covers approximately 1,000,000 square feet of floor space and is located on a tract of land of 110 acres. The Chicago Terminal and Manufacturers' Junction Railway tracks pass through the property and connection is made by an elevated spur track to the main line of the Chicago, Burlington and Quincy Railway. The grounds are artistically laid out, and the driveways connecting all the buildings are paved with concrete block.

The foundry is a brick and steel structure, having a Luci Viti tile roof, and is 400 by 176 feet, and 75 feet at its highest point. It is divided into three bays. Over the center or main bay, which is for large work, are located two 30-ton cranes. The west bay is 75 feet wide and has a low roof, it being used exclusively for benchwork. The east bay, which is 30 feet wide, is divided into sections containing the cupolas, storage bins and core ovens.

The machine shop, lying at right angles to the foundry is 860 feet long and 150 feet wide, and is of the same type of construction as the foundry, except the roof, which is of iron and tarred-roof construction. There are three bays; the center one, 76 feet wide, is devoted to the manufacture of generators and motors. The north bay, 48 feet wide, contains such machine tools as are required in the manufacture of small types of machines. In this bay is located the testing department. The south bay has two floors, the upper one being devoted to the manufacture of small field coils and the winding of small armatures. It also contains the small-detail and finishing departments. The lower floor contains the commutator and large-detail departments, stockrooms and general shop offices, including that of the shipping department. The lighting is obtained from overhead skylights and side windows. Over the main bay are located two 30-ton, and over the north bay six 20-ton cranes. The entire plant is equipped with a system of industrial railways.

Cable and Rubber Plants.

Entering the cable plant from the south is a railway track connecting the receiving department, which covers 15,000 square feet, at which the raw material is received. Adjacent to this are the insulating and wire-twisting departments, covering 22,500 square feet, and from which the material passes into the cable-twisting room, covering the same area. From here the cable passes into ovens, covering an area of 10,000 square feet, and is finally delivered through small openings in the wall to the press room, where the lead sheath is applied. This room is 360 by 100 feet. At the south end is located a storage pit for lead, in which, under normal conditions, is stored 4,000,000 pounds.

Immediately adjoining this section is a room 100 by 50 feet, in which is a battery of six impregnating

1. Abstract of a paper presented to the Electrical Section of the Western Society of Engineers, May 15, 1906.

area of 40,000 square feet. A portion of this plant is two stories high, the second floor being devoted to the process of drying crude rubber. The buildings of the cable and rubber plants are identical in that they are of brick and steel construction—a special feature being a saw-tooth roof construction, so built that the windows face the north. This type of roof is used entirely in this section of the plant, except in the pressroom of the cable shops, where crane service is furnished by one 20-ton and one five-ton crane, and in that portion of the rubber plant having two stories.

Power Plant.

The boiler room has an area of 20,700 square feet and is designed for two chimneys, each 12 feet inside and 22 feet outside diameter, and 250 feet in height above the boiler-room floor. One of these chimneys has been built and the other is in process of construction. Provision has been made for two batteries of boilers of eight each, a chimney dividing each battery into two sets of four. At present

WATER TOWER AT HAWTHORNE WORKS.

there has been installed eight boilers of the Aultman & Taylor Company's make, each with a heating surface of 5,080 square feet and operating at 150 pounds. Contracts have been made for increasing the boiler capacity 25 per cent. The present boilers are so arranged that superheaters may be installed at a later date, should it be thought advisable.

Aultman & Taylor chain-grate stokers are used, having a grate area of 77 square feet. Each set of four boilers is provided with a Greene fuel econo-

[illegible] tons capacity, located below each [illegible] these bins the ash may be drawn out [illegible] cars and taken, by means of a [illegible] track, to various places about the plant where [illegible] may be required.

Continued uncertainty of the coal supply, due to strikes and other conditions beyond the control of the manufacturer, has led to a careful consideration of the problem of coal storage. The Western Electric Company, after carefully investigating the question, decided to follow the practice followed by the British Admiralty. Two storage bins, one of 4,000 and the other of 10,000 tons capacity, each located below the normal ground level, have been constructed, into which coal may be dumped from cars and taken out by means of a locomotive crane fitted with a grab bucket. Carefully executed tests in Europe show that nearly 30 per cent. of the heating value of coal is lost in six weeks when stored exposed to the air. By keeping the bins flooded the company expects to reduce the loss of the coal to approximately two per cent. of its heating value after six months to a year storage. By this system of storage there is provided sufficient coal to operate the plant under normal winter conditions for four months.

A Cochrane open feed-water heater of 8,000-horsepower capacity and two 14 by 10 by 15-inch Worthington duplex vertical-type boiler feed pumps are located in the boiler room.

The engine room and condenser pit have a total floor space of nearly 10,000 square feet and contain a power plant of capacity for continuous service of 3,000 kilowatts and for two-hour service of 4,500 kilowatts. There are four units, one each of 300, 500, 1,000 and 1,200 kilowatts capacities.

The larger generator is driven by a vertical cross-compound Rice & Sargent engine made by the Providence Engine Works. The diameters of the cylinders are 32 inches and 62 inches, the stroke 48 inches, and the piston speed 800 feet a minute, the revolutions per minute being 100. The 300 and 500-kilowatt generators are driven by a horizontal cross-compound engine and the 1,000-kilowatt by a vertical cross-compound made by the Filer & Stowell Company. The cylinder diameters, stroke, piston speed and revolutions per minute are, respectively, as follows: Three-hundred-kilowatt, 16 by 32-inch cylinders, 700 feet a minute, 100 revolutions per minute; 500-kilowatt, 20 by 40-inch cylinders, 700 feet a minute, 100 revolutions per minute; 1,000-kilowatt, 30 by 60-inch cylinders, 640 feet a minute, 80 revolutions per minute.

Three Wheeler surface condensers are located in the condenser pit, two of 3,200 square feet and one of 4,500 square feet cooling surface; also three Blake duplex single-acting air pumps, 7½ by 16 by 10-inch units for the smaller condenser, and nine by 20 by 12-inch units for the larger condenser. The condenser water is obtained from a reservoir of 5,000,000 gallons capacity, which is primarily for fire-protection purposes. Two 1,500-gallon-per-minute fire pumps derive their supply from this reservoir.

Two 10-inch and one 12-inch motor-driven centrifugal pumps are used for circulating the water and operate under a load of 37 and 45 horsepower, respectively. These pumps are called upon to furnish only sufficient power to overcome the friction of the pipes, as the condensers are located below

the level of the water in the reservoir, the suction and discharge pipes being submerged.

A 20-ton crane with a five-ton auxiliary hoist is located over the engines and a 15-ton crane over the condenser pit.

In addition to the reservoir previously referred to a watertower of artistic design has been provided, in which are located six steel tanks with a total capacity of 213,000 gallons, connected with the sprinkler system, the bottom of the lowest tank being 38 feet above the highest sprinkler in the plant. Means are also provided for connecting these tanks with the hydrants throughout the plant. The watertower also has tanks containing water for sanitary purposes. City water is used in both the reservoir and the tower.

Drinking water is obtained from a shallow well, 300 feet deep, at the rate of 40 gallons a minute, by a direct-acting deep-well pump, and is piped to all departments. The water has a temperature of about 56° F.

Compressed air is used for the purposes of pneumatic tools, blowing out cables and electric machinery and operating molding machinery.

Uncarburetted water gas, used in the heating and baking ovens and annealing furnaces about the plant, is furnished by two generators, each with a capacity of 25,000 cubic feet an hour.

All buildings are heated by direct radiation except the foundry and machine shops, the foundry being equipped with a hot-air system furnished by the New York Blower Company, while the machine shop has a combined direct radiation and hot-air system using the Garden City Fan Company's apparatus. In the wintertime one or more engines are operated non-condensing, the steam circulating under slightly less than atmospheric pressure.

The crematory, having an area of approximately 1,600 square feet, cares for the shavings and chips from the carpenter shops. It contains a boiler and Dutch oven specially designed for the purpose. Provision for a 100 per cent. increase in capacity has been made.

Fire Protection.

Realizing fully the serious results to the business of the company of temporarily crippling even one of the departments of the plant, careful consideration has been given to the fire hazard; neither money nor thought has been spared to reduce this hazard to a minimum and to provide means to quickly control any blaze that might break out. The result has been that the company is saving yearly large sums of money in its insurance cost, and it now feels that as a result of the money expended there has been produced a manufacturing plant in which the fire hazard has been reduced to a minimum.

FOUNDRY AT HAWTHORNE WORKS.

An engineer trained in the inspection of manufacturing properties devotes his entire time to the fire-protection devices and to the safeguarding of all of the processes of manufacture. In general the different departments have one-story buildings by themselves, each far enough removed from its neighbor to eliminate the danger of fire spreading. Large areas are divided by heavy fire walls with double tin-clad fire doors at the openings.

The walls are of brick, with wire-glass windows at exposed points, and the floors of concrete or concrete with wooden surface. The roofs are tile on structural steel.

With the exception of three buildings the property is protected throughout by automatic sprinklers. The three exceptions are the foundry, forge shop and main body of the machine shop, in which there is absolutely no combustible material.

An interesting feature is a circle of sprinkler pipes with heads on the sides of each steel post supporting the roof in the machine shop. These heads are about 15 feet above the floor and are designed to protect these posts from danger that may arise from inflammable material gathering about their bases. The sprinkler system is supplied with water through an elaborate yard system of about 13,000 feet of 10 and 12-inch water pipe, the feed into each building being controlled by a gate with a post indicator so that the supply may be regulated without entering the building, a valuable feature in time of fire.

Forty-five hydrants, each with three or four independent gates, are located about the property on the same yard mains that supply the sprinkler system and are so placed as to make possible the complete surrounding of any one building by fire streams. Each hydrant is protected by a wooden house in which are stored hose play pipes, axes, lanterns, etc.

In the fire house adjoining the tower containing the sprinkler tanks are two 1,500-gallon Underwriters' fire pumps ready for instant duty. There is available in the tower for the sprinkler system and hydrants 213,000 gallons of water, and as soon as the pumps are placed in operation an additional supply of 3,000 gallons a minute so long as the 5,000,000-gallon reservoir holds out. Running both pumps full capacity the reservoir will last for 27 hours.

An ex-member of the protective department from the city of Chicago is the chief of a fire department composed of employes and devotes his time solely to the apparatus and the training of the brigade. A system of 47 fire boxes has been installed, permitting prompt notification to the fire house and the members of the fire brigade.

Electrical Equipment.

The four generators located in the engine room are the Western Electric Company's "L" design and have several features of especial interest. The pole-pieces are laminated, and the frame is cast around the assembled poles, a novel method of casting being employed. With a cast-in pole-piece trouble is usually experienced in securing a completed frame having equally spaced poles, as the shrinkage strains are apt to distort the pole-setting, resulting in unequal distances between the tips of the poles. To prevent this irregularity, the poles of these machines are assembled in a heavy cast-iron clamp which is placed in the mold. The arrangement is such that the shrinkage strains are taken up in the yoke and do not distort the position of the pole-pieces, thus assuring uniform air-gap flux distribution, a condition necessary for satisfactory operation.

That part of the armature conductor lying outside of the armature core has an enlarged section, while that part lying inside of the core has a reduced section over that usually employed in machines of these sizes. By this means a shallow slot is obtained, thus reducing the reactance of the coils during commutation and producing conditions essential for sparkless range. The effect of the enlarged sections at the ends of the armature is to increase the radiating surface of the coil, and by reason of the high conductivity of copper to draw from the armature core the accumulated heat, thus permitting of large overload capacities with a minimum temperature rise.

The main switchboard, located on the gallery in the engine room, consists of 18 30 by 78-inch marble panels placed 15 feet above the floor.

As the generators operate at 230 volts, the main switchboard is so arranged that the two smaller units may be operated in series so that 550 volts may be available for testing purposes, the shunt-field coils being of sufficient capacity to permit of an increase in the terminal voltage of the machines.

The various buildings are connected with the power house by a system of well-lighted and ventilated tunnels for the various services. These tunnels have a uniform height of seven feet and vary in width from four to 10 feet.

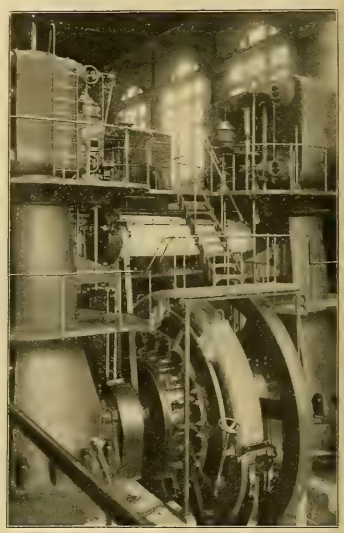
Connecting with the tunnel leading to the machine shop is a system of concrete trenches surrounding the iron plates of the testing floor. Within these trenches are cables leading into junction points at which are available for testing purposes all voltages from 30 to 600 volts, both direct current and alternating current of 25 and 60 cycles.

The yard and building illumination consists of arc lamps, two in series on 220 volts, and incandescent lamps for local lighting.

All of the machinery in the entire plant is electrically driven, an individual-drive system being employed except in a few cases. The main machine shop and cable plant contains many variable-speed motors which are operated from a three-wire system. A compensator, or voltage balancer, located in each of these buildings, is of sufficient capacity to carry the unbalanced load resulting from the variable-speed motor load.

Miscellaneous Features.

In the insulating department of the cable plant are located 80 special insulating machines, each having five heads operating simultaneously to insulate five wires. The arrangement is such that two machines are driven by one 3½-horsepower variable-speed motor, operated by a specially designed controller.



A GLIMPSE OF THE POWER PLANT AT HAWTHORNE WORKS.

After the wires are insulated they are twisted together in pairs by the twisting machines. The driving motors are of the encased type, one horsepower, running at 1,300 revolutions a minute, and operate the twisters through spiral gears.

In the room adjoining that containing the twisters are located the cable-twisting machines. The largest one of these machines will carry nearly 600 spools of twisted pairs of wires.

In the lead-covering department there are several 30-horsepower slow-speed motors, each direct connected to the crank shaft of a high-pressure pump operating a hydraulic press used in the process of covering the cables with lead casing. The lead-covered cable as it is delivered by the presses is wound upon large wooden reels for shipment.

There is a small machine shop in the cable plant where the special machinery is built and repaired.

MACHINE SHOP AT HAWTHORNE WORKS.

The machine tools in this shop are motor-driven, the larger ones individually.

Wood-working machines in the pattern shop are driven individually by electric motors, which are encased in square wooden boxes, protecting the motors from dust and shavings.

In the rubber plant are several examples of large machines electrically driven. In the department where the crude rubber is washed there are a number of colanders, each geared to a 20-horsepower 670-revolution-a-minute motor, also several dust grinders geared to a shaft under the floor, which is connected through a spur gear to a 200-horsepower

motor, located in a pit of sufficient depth to permit this connection by a single reduction.

In an adjoining room a 200 horsepower motor, located below the floor, drives, through positive gearing, five rubber grinders, each of which may be thrown in or out of service by means of a large clutch. A smaller grinder is individually driven by a 50 horsepower 600 revolution a minute motor, through a rawhide pinion and double reduction.

A double tinfoil mill is direct geared through a double reduction of spur gears to a 300 horsepower 450 revolution a minute motor. The large gear is about 10 feet in diameter, with a 12 inch face.

Apparent Blindness Due to Alleged Electrical Shock.

From Brisbane, Queensland, Australia, the Western Electrician has received the following inquiry:

"Residents in the Antipodes hear many wonderful tales of happenings in the United States. Among the startling items of news is the attached paragraph. May I trouble you to inform me briefly as to how much, if any, of this is true?"

And this is the newspaper item referred to:

A Chicago jury awarded Ruth Bostrom, a 10 [illegible] and was [illegible] her home.

Thereafter the girl [illegible] but little and that [illegible] She was nervous and [illegible] went to school [illegible] remained at home in the afternoon [illegible] attended school [illegible] before the accident that [illegible] vision has been so impaired that [illegible] read. She has complained of no [illegible] except intolerance of light. On [illegible] eye are found to be [illegible] react to light. There is [illegible] covered which suggest impairment either [illegible] or field of vision, subjectively it [illegible] pears that both are impaired.

The girl was examined by neurologists, who find an anesthetic condition of the right side of the body. These specialists agree that her present condition is purely functional and not organic. They further agree that it may result from fright, [illegible] or other psychic cause. In Illinois a condition which results from fright unaccompanied by physical injury does not create liability. To bring herself within the law the complainant, who brought suit against the street-railway company for damages, alleged physical injury in each count of her declaration, resulting from an electric shock, and introduced as a witness Dr. H. Preston Pratt, an eclectic physician who professes to have studied electricity extensively.

Mr. W[illegible]

anesthe[illegible] plaintiff and the [illegible] hysterical and not structural.

INTERIOR OF MACHINE SHOP AT HAWTHORNE WORKS.

year-old blind girl, £5,000 damages for injuries sustained by receiving an electric shock. She was paralyzed while walking near an electric wire owned by the Union Traction Company. The jury accepted the theory, advanced in support of the girl's case, that it is not necessary to touch a highly charged wire to receive a shock. It was stated that a shock might be received by a person who was four feet away from a live wire.

There is sufficient truth in the foregoing publication to make an accurate and more detailed account of considerable technical interest. The following facts were courteously supplied, on request, by Mr. T. J. Scofield, attorney for the Chicago Union Traction Company:

On April 10, 1902, a trolley car on North Avenue passed through a subway and as the car emerged the trolley wheel left the wire and broke a guard wire, which fell on the trolley wire, which was carrying about 500 volts. The broken wire struck the ground just after the car passed over the street intersection across which the plaintiff, Ruth Bostrom, a minor of about 12 years of age, was walking. The child was about three or four feet from the wire. A sharp report and a blinding flash of light followed. The wire was at no time nearer to her than a distance of three or four feet. She continued across the street to a shop, retraced her

At the trial, which took place last February, the facts were embodied in a hypothetical question which plaintiff's counsel submitted to Dr. Pratt. In answer, he stated that anybody who stood near a wire, within a distance of 25 feet, if sufficiently sensitive, would be conscious of the fact that there was electricity in the air; he did not state that a person in such a position could receive an electric shock. Dr. Pratt further asserted that waves pass from electric wires through the air. This was the only evidence that electricity came in contact with the girl's body.

As against the evidence of Dr. Pratt the defense called Mr. S. G. McMeen, a well-known electrical expert and engineer of Chicago; Prof. P. B. Woodworth of the Lewis Institute of Chicago, a technical school, in which he is professor of electrical engineering, and Mr. Paul F. Williams, who installed the electrical exhibits at the St. Louis Exposition of 1904, with two other men of good electrical ability. These experts testified that to receive a shock iff was a very sweet little girl. That she is hysterical is apparent. I do not believe the verdict can stand. The evidence does not warrant a verdict, conceding negligence on the part of the crew operating the car in connection with the trolley pole."

Electric Lighting in the Far North.

Returning to Winnipeg, Man., from the Mackenzie River district in the Northwest Territories, where he has charge of the affairs of the Hudson Bay Company, Mr. Thomas Anderson gave some details of life near the Arctic circle. The inhabitants are chiefly Indians, but they are prosperous. Mr. Anderson has headquarters at Fort Simpson on the Mackenzie River. Speaking of Fort Simpson, Mr. Anderson is quoted in the Winnipeg Free Press of recent date as follows:

"A noteworthy feature is the fact that we have an electric-light plant. The plant is operated by the engineer who has charge of the boats in the summer. The light is used for illumination in the stores, offices and dwellings and is in use all winter. When summer comes the boats are in use, and the long days render artificial light unnecessary. During the summer at Fort Simpson there is no real darkness, but about four hours of twilight. When we push down the river to the Arctic we reach the land of the midnight sun, where for weeks there is continuous day. We reach this region after a trip of about 700 miles."

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

Features of Engineering Interest in Large Cold-storage Plant. Illustrated 413, 414
A Curious Home-made Knife Switch. Illustrated 414
New Quarters for Electrical Engineers at Cornell. Illustrated. 414
Some San Francisco Episodes. Illustrated 415, 416
Standardization Rules of the American Institute of Electrical Engineers 416
New Passenger Station of the Pennsylvania Railroad in New York City. Illustrated 416, 417
The Hawthorne Shops of the Western Electric Company. By H. K. King. Illustrated 417, 418, 419
Apparent Blindness Due to Allied Electrical Shock 419
Electric Lighting in the Far North 419
Editorial 420
Southwestern Electrical and Gas Association.—Convention in Galveston May 16-18, 1906 421
Wireless at San Francisco During the Great Fire 421
Mormon Church May Dispose of Business Enterprises 421
Trolley Triumphs in San Francisco 422
Chicago Street-railway Situation 422
Causes and Effects of San Francisco Fire 422
Of Interest to Inventors 422
Annual Meeting of the American Institute of Electrical Engineers 422
Government Power Bill Before the Ontario Legislature 423
American Steel and Interurban Railway Engineering Association 423
Milwaukee Convention of the American Institute of Electrical Engineers 423
Arrangements for Atlantic City Convention 423
Electrical Contractors to Meet in Cleveland 423
Electrical Section of Western Society of Engineers 423
Book Received 423
Selling Electricity 424, 425
Purring Motors in Too Small Sizes 424
Central Station Electrically Decorated Attracts Customers. 424
Company and Consumer 424
The Campaign in Wilmington 424
Educating the Consumer 424
Municipal Electrical Enterprise at Ipswich 424
Central-station Advertising 424
Electric Heat for the Laboratory 424
Sign Business Increased by the Electrical Show in Fond du Lac 425
New Rates in Winnipeg 425
Public Meter Testing in New York 425
For the Sewing Machine 425
The Cooper Hewitt Mercury-vapor Lamp 425
Air Deflector for Electric Fan. Illustrated 425
Organization of the Northern Colorado Power Company 425
Chicago Edison and Commonwealth Ordinance Delayed 425
Submarine Working by Compressed Air and Arc Light. Illustrated 426
Blast-furnace Gas Engine in Pittsburg District 426
Forest Preservation in Its Electrical Aspects 426
Small Lighting Plant for the Isthmus 426
A Veto for Niagara Bill 426
Opening of Simplon Tunnel 426
German Method of Electrically Towing Boats 427
A New Form of Sealing Press. Illustrated 427
Indiana Independent Telephone Association 427
Indiana Telephone Items 427
Telephone News from the Northwest 427, 428
Southeastern Telephone Developments 428
Plans for Chicago Telephone Convention 428
Manufacturers to Ask Telephone Franchise in Chicago 428
Telephones and Telegraphs in the United States in 1902 428
Bell Output for April 428

DEPARTMENTS.

Correspondence 429, 430, 431
Great Britain 429
Dominion of Canada 429
New England 429
New York 429, 430
Southeastern States 430
Ohio 430
Michigan 430
Indiana 431
Northwestern States 431
Illinois 431
Pacific Slope 431
Personal 431
Electric Lighting 431, 432
Electric Railways 432
Power Transmission 432
Publications 432
Societies and Schools 432
Telegraph 432
Miscellaneous 432, 433
Trade News 433
Business 433
Illustrated Electrical Patent Record 433, 434

DATES AHEAD.

American Institute of Electrical Engineers (annual convention), Hotel Pfister, Milwaukee, May 28th to June 1st.
National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

A LARGE quantity of electrical machinery and apparatus is still required to meet the needs of San Francisco. Manufacturers will do well to watch the articles appearing in the Western Electrician to gain an idea of the electrical requirements of the work now under way.

WIRELESS communication proved its usefulness at the time of the great fire in San Francisco following the earthquake, although not to the extent it would have done had not the wireless station in the city itself been put out of commission early in the progress of the conflagration. This station was placed on the roof of one of the principal buildings in the central portion of the city, and being in the path of the flames was rendered unavailable before it could be used. Had this plant been located in a safe location, there would have been, perhaps, a different story to tell during the time that the ordinary telegraphic and telephonic facilities of the city were disabled. But as it was the space-telegraph outfit of the U. S. S. Chicago was pressed into service as soon as that cruiser came into the harbor, and proved of the greatest value, although used, apparently, mainly for the important purpose of communicating with the army and navy forces, and not to supplement the efforts of the telegraph companies to get news to the outside world. The story of the "wireless" participation of the Chicago in the events of the trying days immediately following the earthquake is given elsewhere by a correspondent of the Western Electrician, and makes interesting reading. We are glad to be able to print it and to say that the space-telegraph force on shipboard deserves no less credit than the telegraph operators on land who remained at their posts to the last possible moment with such devoted courage.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS will hold its twenty-third annual convention in Milwaukee next week, beginning on May 28th and ending June 1st. This period includes Decoration Day, and, rather curiously, the programme indicates that there is no intention, at present, of withholding work on this holiday of stirring memories.

It has been some years since the Institute has held a western convention, and we trust that western members generally will take advantage of the present opportunity to attend the meeting. Milwaukee is always a pleasant city to visit, and it has, also, several important electrical industries. The new Public Service Building, in which the convention sessions will be held, is a unique and interesting structure, and is in itself an attraction. A good programme has been arranged, and there is every reason to expect that the gathering will be a profitable and pleasant one.

In endeavoring to make the society one of truly national interest and scope—not merely centered and controlled in the city of New York and its neighborhood—the Institute is confronted by a task that will tax all its energies. An honest effort has been made to meet the situation by means of the local branches; but, after all, the branches remain branches, and the interest languishes. It is difficult to get men enthusiastic over a sideshow when the main performance is in the big tent. Providence has made the United States a large country, with widespread intelligence, enterprise and activity. It would be difficult, and we believe it is not intended, to show that any higher degree of professional attainment inheres in the electrical engineers of New York than in those of, say, Boston, Philadelphia, Pittsburg or Chicago. But there must be headquarters, and as the convenience of the greatest proportion of members is met by a meeting-place in New York, the office of the society has always been in that city. Nevertheless five-sixths of the membership is geographically located at places of considerable distance from New York and is somewhat less interested in the meetings there and the United Engineering Building than the local members. Then, too, the honors of the Institute in the shape of offices have gone to New Yorkers or men living near New York in the large majority of cases. In this situation it is a difficult problem indeed to devise a plan whereby the five-sixths of the Institute shall take as much interest and manifest as much enthusiasm as the one-sixth which receives in a greater degree the benefits of the society.

But, without attempting to solve this problem, it is to be remembered that the annual conventions are always held throughout the country, and as the Central West has been selected this year the hundreds of members in this territory, for their own sake and that of the Institute (which is, when all is said, the premier electrical association of the country and of much help to all members), should come out in full force.

WE ARE disposed to be rather doubtful of the accuracy of the statistics of electrical manufactures as given out by the United States Census Bureau. Here, for instance, are some figures furnished us by a correspondent in Washington and evidently taken from a Census bulletin. We do not place much confidence in them, for reasons to be shown, but give them for what they are worth.

The electrical industry is making wonderful progress in the city of Chicago alone. This is shown by the fact that in 1900 there were in the city 71 establishments for the manufacturing of electrical machinery, electrical apparatus and electrical supplies, with a capitalization amounting to $11,216,185. In 1905 the number of establishments had increased to 96 and the total capitalization to $21,271,367. On the payrolls of these establishments in 1900 were 1,113 salaried employes, who received $610,917; in 1905 the number had increased to 1,599, who are receiving $1,367,419. In addition to this in 1900 employment was furnished to an average of 5,787 wage-earners, who were paid $2,710,641 in wages, whereas in 1905 the number had increased to 5,927, who are receiving $3,098,885. The cost of materials used by the establishments in 1900 was $4,283,265; in 1905 it had increased to $7,501,453. In addition to this there was in 1900 a miscellaneous expense amounting to $1,545,390; in 1905 this item stood at $1,899,184. The value of the output of all the establishments in 1900 was $11,357,986, in 1905 it stood at $16,291,546.

Several of the items in the foregoing are dubious or obviously incorrect, and the whole is therefore discredited. Take one item—capitalization. On June 1, 1905, the capital stock actually issued (not authorized merely) of one Chicago electrical manufacturing company was $15,000,000. This is, to be sure, the largest in the city, but it is quite absurd to suppose that the capitalization of all the other electrical manufacturing establishments does not amount to more than $6,000,000, making the $21,000,000 given.

Again, there is an evident mistake in the number of employes. On June 1, 1905, the number of persons on the payrolls of the largest company was 6,804. (This number was increased later in the year to about 8,000 and now stands at about 12,000.) But the census figures for all salaried employes and wage-earners in all of the 96 establishments were only 7,526. Thus there is left for 95 electrical manufacturing establishments in Chicago a total of 722 persons employed—which is merely fanciful.

The value of the output of all electrical manufacturing establishments of Chicago in 1905 is placed at $16,291,546, which, in our judgment, is much too low. No doubt the Chicago telephone manufactures alone of 1905 were worth $15,000,000.

The truth is that in a great industry of a great country it is impossible to obtain statistics which are absolutely exact. Errors—sometimes important errors—will creep in, due to omissions, duplications, inaccuracy or carelessness. The Census statements and tables are simply approximations of varying degrees of excellence. They are often nearly correct, no doubt; but it is a mistake to accept them as absolute.

Before the Census Bureau or anybody else took up the work of collecting statistical information of electrical manufactures in the United States the Western Electrician established (on January 7, 1899) its annual New Years estimates of the value of machinery and apparatus manufactured in the country during the preceding year for electrical purposes. These estimates are simply what they purport to be—estimates. But they are prepared with great care, with the help of some of the best-informed men in the industry, and they have constantly grown in importance and reliability. They are published while the information is timely and valuable, and we believe that they give the best general survey of the extent and progress of the electrical manufacturing interests at the date of publication.

Southwestern Electrical and Gas Association.

Galveston, Tex., May 18. The annual convention of the Southwestern Electrical and Gas Association closed here today after a three day session. There was a good attendance and much interest was shown in the different subjects treated of in papers and discussed.

The convention was opened Wednesday morning, May 16th, with an address of welcome by Mayor Landes. M. M. Phinney delivered the response, in which he took occasion to pay high compliment to the people of Galveston for the manner in which they had overcome obstacles in rebuilding the city after its destruction by storm.

G. C. Gunn of Fort Worth, Tex., read a paper on the subject of "Up-to-date Methods of Increasing the Business of Public service Corporations."

This paper was followed by a "Question Box," in which a number of interesting subjects were taken up and discussed. This general discussion occupied the remainder of the forenoon and all of the afternoon sessions.

The second day's programme opened with the reading of a paper by S. J. H. White of Fort Worth, Tex., on "What Is Electricity." In his concluding remarks Mr. White said:

"From what I have said, then, as Sherlock Holmes would say, I deduce the theory that 'electricity is that form of energy which is produced by a uniform oscillation of the molecules of matter.'

"A dynamo is simply a mechanical device for producing a uniform oscillation of the armature molecules. A dynamo may be designed, as we know, to produce any shape of curve or combination of curves we desire.

"Electricity is not made; is not generated, in the true sense of the word. It is simply the latent electricity in the copper and iron of which the dynamo is constructed put into motion. There is a well-defined ratio between weight of dynamo and kilowatt output. Some manufacturers secure a higher ratio than others. Exceed a certain defined ratio of output to weight and we get more heat than electricity. In such cases you are forcing too many molecules of the armature to oscillate, with the same results you secure in an incandescent lamp. First heat, and if carried far enough, light, and plenty of it. Then the next day when you see your customers uptown you get sound—loud, awful sounds, of a kind none of us like.

"I regret I have taken up so much of your time, gentlemen, and yet I have not said as much as I would like to say; but let me add one more word, please. Think this matter over; reason it out for yourselves, and you will find as I have in my daily work, that whether this theory of mine is right or wrong, that it is most awfully useful and convenient in practice, and removes many and many a perplexing problem. The theory also applies to primary batteries, to static electricity, and perhaps secondary batteries, but I have given the latter very little thought in this connection."

Frank J. Duffy of Beaumont followed Mr. White with a paper on the subject of "Relations of Public-service Employes to the Public." He urged the need of courtesy on the part of all public-service employes.

The "Question Box" was reopened, and the several subjects submitted provoked a general discussion which lasted until the close of the forenoon session.

The visitors took advantage of the intermission to visit the grade-raising canal as guests of H. S. Cooper of the Galveston Electric Company. They witnessed the work of the dredge in the canal and were much interested in the grade-raising process.

When the afternoon session opened H. S. Cooper of Galveston read a paper on the subject of "Care, Maintenance and Inspection of Street-railway Rolling Stock."

Among other things he said:

"First and last and all the time, keep your rolling stock clean. If your conditions are such that you can't keep it perfectly clean or ordinarily clean, keep it as clean as you possibly can. 'Dirt shows up worst on a clean spot;' therefore try to make that 'clean spot' so large that it will extend from the track to the trolley wheel. Cleanliness is not only akin to godliness, but it is the mother of neatness and care and attention and all the clean virtues—right up to honesty. Dirtiness is catching. I've seen it spread from the cars to the employes until not only his clothes and his manner, but his morals, got dirty. You cannot expect neatness in any form from an employe forced to work in an unnecessarily dirty place.

"Next, train your employes to care for the company's property as if it were their own. Make them fully understand that the rolling stock in their charge are very costly pieces of apparatus, costly to buy, costly to operate, and very costly to repair and renew and maintain. Get this thoroughly into their heads and then put the responsibility of that costliness on them, make the 'running maintenance' of each man an item of record the same as you do—or ought to do—his disciplinary record. Select your best operative motormen and conductors as trainers for the new men, and put some little premium on the office. This cuts both ways: it gives you good maintenance training for the new men and make the trainer [illegible] his own [illegible]."

There was a general [illegible] Mr. Cooper's paper.

At the third day's [illegible] the meeting [illegible] with a paper by [illegible] on the subject of "Telephone Engineering [illegible]."

A paper on the subject of "Organization and Operation of Supply Department" was read by A. W. Q. Birtwell of Houston. Mr. [illegible] the position that there [illegible]. His paper was very favorably received and caused considerable discussion.

A paper by Thomas B. Whitted of St. Louis, on the subject of "The Turbine Engine" was not read on account of lack of time, but printed copies of it were distributed among the members.

The annual report of Secretary Frank J. Duffy of Beaumont was read. He said that the membership had increased from 65 to 83 members, a gain of 18, or nearly 30 per cent. The amount collected for 12 months ended May 15, 1906, was [illegible].

The annual report of Treasurer A. E. Judge of Tyler, showing that the association is in good financial condition, was submitted and approved.

The following named officers and committees were then elected for the ensuing year, their nominations having been made by a committee consisting of F. J. Duffy, R. B. Stichter, Samuel Kahn and David Daly:

President, H. S. Cooper, Galveston, Texas; first vice-president, J. W. McKendon, Fayetteville, Ark.; second vice-president, J. P. Crerar, Denison, Texas; third vice-president, Samuel Kahn, San Antonio, Texas; secretary, E. B. McGinnis, Dallas, Texas; treasurer, A. E. Judge, Tyler; executive committee, H. S. Cooper, J. W. McLendon, J. P. Crerar, Samuel Kahn, M. M. Phinney, H. F. Edgar, J. F. Strickland, R. B. Stichter, Frank J. Duffy, E. B. McGinnis; finance committee, F. M. Lege, J. J. King, W. H. Young; advisory committee, J. A. Fransforth, H. M. Littell, J. D. Oliger, W. H. Chapman, C. W. Ford, C. H. Dunbar, E. D. Kelly, C. W. Kellogg, E. M. Cooper, David Daly and W. B. Head.

Invitations for holding the next annual meeting of the association were extended to the convention on behalf of San Antonio, Dallas, Fort Worth and Austin. No action was taken, the matter of selecting the meeting place being left in the hands of the executive committee.

The business session of the convention then adjourned and the visitors were taken on an excursion on the Gulf of Mexico.

The following is a complete list of the names of those in attendance at the convention:

J. E. Johnson, Dallas; Guy C. Gunn, Fort Worth; Mr. and Mrs. E. B. McGinnis, Dallas; J. G. Fry, Dallas; F. D. Killion, Chicago; V. G. Raggio, St. Louis; Clarence E. Delafield, St. Louis; A. W. Garrels, St. Louis; H. A. Hull, St. Louis; C. W. Hobson, Dallas; U. S. Arnold, Dallas; F. M. Smith, Dallas; C. D. Cain, Dallas; J. R. Cravath, Chicago; W. R. Smith, Dallas; H. L. Hall, St. Louis; C. B. Roulet, Dallas; J. D. Chambers, St. Louis; Fred C. R. Spence, Fort Wayne, Ind.; Sam A. Hobson, Dallas; W. F. Sullivan, Houston; W. M. Brooks, Dallas; George H. Teague, Houston; J. L. Stephens, Charles W. Davis, W. R. Harvis, E. C. Turner, J. E. Lewis, Dallas; J. M. Lower, Galveston; H. R. Rice, Pittsfield, Mass.; I. J. H. White, Fort Worth; D. L. Gable, Dallas; Charles Scherwith, Houston; Thomas B. Whitted, St. Louis; B. D. Baysen, Brownwood; J. W. Laroche, Dallas; E. C. O'Neil, Clarksville; T. B. Edgar, Fort Worth; H. D. Potts, El Paso; C. W. Lawrence, Cameron; S. O. Newton, Weatherford; W. B. Head, Grandview; E. D. Kelly, Hillsboro; Thomas Cook, Waxahachie; G. B. Harpole, Augusta, Ark.; M. M. Phinney, Dallas; E. L. Bassett, Dallas; A. E. Judge, Tyler; F. C. Randall, Houston; H. S. Cooper, Galveston; Frank F. Duffy, Beaumont; Samuel Kahn, San Antonio; Mr. and Mrs. Joseph Sheridan, Cuero; J. C. Morgan, T. W. McLendon, Fayetteville, Ark.; Mr. and Mrs. R. B. Stichter, Sherman; J. S. Bonner, Houston; C. G. Campbell, Bonham; Mr. and Mrs. J. C. McKinley, Irvin Lehane, Chicago; Evan W. Brodes, London, Eng.; David Daly, Houston; W. W. Reed, Houston; George W. Woorham, St. Louis; A. F. Moore, Houston; J. G. Walton, Kansas City; M. M. Arnold, manager Greenville Light Company, Greenville; George W. Armstrong, president Consumers' Light and Heating Company, Fort Worth; W. H. Burdett, superintendent equipment Austin Electric Railway Company, Austin; E. C. Boeck, H. W. Johns-Manville Company, St. Louis; William Broyles, manager Palestine Electric Light Company, Palestine; J. E. Johnson, Westinghouse Electric and Manufacturing Company, Dallas; Frank E. Jonnson, H. W. Johns-Manville Company, St. Louis; M. A. Toy, Terrell Electric Light Company, Terrell; J. J. King, general agent San Antonio Traction Company; A. S. Lendstrom, Western Electric Company, Dallas; L. H. Mace, representing Watts-Uthoff Supply Company, St. Louis; J. D. Oleger, vice-president and manager Cleburne Gas and Electric Company, Cleburne; E. J. Pietzcker, southwestern manager Standard Underground Cable Company, St. Louis; D. F. Woods, Woods Electric Company, Houston; O. W. Uthoff, president Watts-Uthoff Supply Company, St. Louis; Welber H. Young, president Austin Electric Railway Company, Austin; H. F. MacGregor, Houston; W. C. Penfield, Gainesville; W. M. Rickert, Ewing Merkle Electric Company, Little Rock, Ark.; W. E. Perlitz, Smithville Telephone Company and Fayette County Telephone Company, La Grange, headquarters La Grange.

High buildings of the future, if built along the radical lines proposed by Jules Gernaert, an engineer of Brussels, Belgium, will consist of structures built in arcade form—huge arches resting on two foundations and spanning one or more city blocks. These arcades may be 400 or 500 feet high, and a great advantage claimed for this style of construction is its freedom to light and air. They would also, it is said, withstand earthquake shocks, being sufficiently elastic to absorb the vibrations. The scheme admits of the location of the building foundations somewhat back from the borders of the streets, where real estate is possibly not so expensive.

Wireless at San Francisco During the Great Fire.

[illegible]

"In your [illegible] I notice with pleasure [illegible] to the telegraph operators [illegible] the wireless men also, but [illegible] this, we should like to give the readers [illegible] ern Electrician an idea of what [illegible] Chicago and her operators [illegible] calamity.

"Immediately after San Diego [illegible] news of the earthquake [illegible] Forest wireless station in that [illegible] to us. At that time we were 25 [illegible] having left San Diego about three [illegible]. This news, with subsequent messages, [illegible] destination to the scene of the disaster. During this entire trip constant communication was maintained with the shore, and bulletins informing [illegible] the ship of the existing conditions were frequently posted.

"Upon arrival at San Francisco every preparation was completed to meet the situation, and, owing to the interruption of many telegraph and telephone wires, wireless proved its value. Through its services military and civil authorities were enabled to facilitate relief operations and keep in touch with the outside world; also many private messages were sent to anxious friends and relatives all over the country.

"The Chicago's wireless office was so busy that the two operators received no sleep from the night of the 18th until the 23d, and food, which was brought to them, was eaten when convenient. Needless to say, they were quite exhausted, but the re-establishment of telegraphic communication greatly relieved the situation, and conditions were quite normal at the end of two weeks."

To this it is interesting to add the following from the San Francisco correspondent of the Western Electrician, under date of May 16th: "A representative of the American De Forest Wireless Telegraph Company has been in Eureka, Cal., to secure the indorsement of the local Chamber of Commerce for the proposition to install a wireless telegraph plant in an attempt to improve the telegraphic facilities for communication with San Francisco and the Pacific Coast generally. This company proposes to erect a wireless station on Russian Hill, in San Francisco, at an early date, the foundation having been completed. A mast 210 feet in height will be erected."

Mormon Church May Dispose of Business Enterprises.

Reports from Salt Lake City say that it is rumored that the Mormon church intends to dispose of the large business enterprises conducted under the guidance of the church. One of its principal holdings is the Utah Light and Railway Company. This property, according to the report, is to be taken over by a corporation made up of Americans and Englishmen. The new corporation, it is said, will also acquire the Ogden street railway and build an electric line from Juab County, Utah, to Oneida County, Idaho. The new company will be known as the Intermountain Consolidated Railway Company, and will be incorporated both in Utah and Idaho. On the board of directors the rumor names H. H. Vreeland, New York city; Baron d'Oissel, Paris; Sir Thomas Jackson, London; William G. Rathbone, Manchester, England; Alexander McKenzie of Ottawa, Canada; Henry Dupont, Paris; Beresford Hope, London, and a number of Utah men, among them Governor John C. Cutler.

Trolley Triumphs in San Francisco.

[From the regular correspondent of the Western Electrician.]

Oakland, Cal., May 16.—The United Railroads Company now has nearly all of its original electric lines in operation and is daily increasing the number of cars operated. Temporary trolley lines have been opened on Market Street and a number of its diverging streets formerly served by cable cars. In addition to what has already been accomplished the United Railroads will, as soon as its working force can be organized, begin the wholesale conversion of its cable roads wherever practicable into overhead electric lines. Permission to erect poles and wires on Market Street, Sutter Street, and on all other streets where the grades do not make the operation of electric cars impossible, was granted to the company in an ordinance adopted May 14th by the Board of Supervisors. The granting of this permission means much for San Francisco. It means the rehabilitation of the city's transportation system with the least possible delay. It means that cars will be running within 30 days over cable lines which could not be reconstructed and put into operation as cable lines within many months.

Anticipating this action by the Board of Supervisors, President Calhoun has perfected every arrangement to convert the various cable roads into trolley lines immediately. The work has all been carefully planned. A large force of men will be put at work on the lower end of the Sutter Street line and another large force on the section west of Van Ness Avenue. Similarly the reconstruction of other lines will be started at various points, so that it can be rushed to completion with the least possible delay. President Calhoun promises that trolley cars will be running on Sutter Street within 30 days.

The conversion of the cable roads into electric lines will involve much labor and expense. On Sutter Street, for instance, the gauge will have to be reduced from four feet 11½ inches to four feet 8½ inches. At the same time the tracks will have to be shifted so as to afford more clearance for passing cars. On the Clay, Washington and Jackson street lines the gauge will have to be widened. Haight and McAllister streets can be converted into trolley lines merely by the erection of poles and wires, and the overhead electrical equipment will be installed as soon as it arrives from the East. Heavy shipments, ordered immediately after the fire, are now on the way.

The ordinance passed by the supervisors this week settles the question of the future character of street railroads in San Francisco probably for a long time to come. It means the passing of the cable road and the abandonment of the scheme of underground conduits in Market and Sutter streets. By the adoption of the new ordinances the temporary permits under which the company is now operating electric cars on Market Street are made permanent. The only cable lines that will remain in San Francisco when the United Railroads Company concludes its gigantic and costly task will be those on portions of the hilly streets too steep for electric cars and those not embraced in the United Railroads' system. It is said that there will still be some opposition to permanent overhead trolley lines on Market Street and possibly Sutter Street by citizens and the Rudolph Spreckels "crowd," but the United Railroads is confident of ultimate success. The closing of the cable-road slots by heat from the fire has been advanced as a strong argument against the arguments of those who have insisted that United Railroads install an underground conduit system on Market Street. Also the plans for the new municipal system on Geary Street, for which bids have been received as an electric conduit line, may have to be altered.

A.

Chicago Street Railway Situation.

It is understood that the traction companies are willing to negotiate with the city with the view to operating their lines on the "revocable-license" plan, as suggested by Mayor Dunne. This refers more especially to the lines which have been denied the rights claimed by the companies under the 99-year claims. The companies seem to be willing to accept the service sections of the franchise ordinance recently reported by the local transportation committee of the council. These relate to through routing of cars, universal transfers, style of cars and rails, and power house and transmission requirements. Sub-committees have been appointed to look into the matter of substituting trolleys where the old cables are now in operation.

At the City Council meeting this week the local transportation committee introduced an ordinance providing for a test of the Mueller law certificates. It was ordered deferred and published to come up for passage at the next meeting. The ordinance provides for the printing of the certificates. It is expected that as soon as the ordinance is passed a test suit will be filed to restrain the city from issuing the $75,000,000 worth of these certificates recently authorized by the voters. The validity of the certificates will be involved and both sides will endeavor to get the case to the Supreme Court of the state as soon as possible.

Causes and Effects of San Francisco Fire.

Electricity is exonerated from blame for the San Francisco fire by Charles Towe, fire marshal of that city, who, in a letter to William McDevitt, fire inspector of Philadelphia, says:

"The fires were no doubt caused by gas lights, as after the houses were shaken the pipes fell with burners still lighted. Stoves in use were overturned in hotels and restaurants, the hot coals rolling on the floors; the same trouble occurred in dwellings where fires were in use and lighted lamps burning. The gas mains in the street were broken, but gas still flowed, as it did in my house (as I was informed) until noon. Although the street gas mains were broken, the gas was confined by the surrounding earth, which allowed the gas to flow in the mains and to a quantity sufficient to do harm in the buildings. I do not think electric wires cut any figure.

"All chimneys on buildings were cracked if not thrown down. I saw a fire in the residence part of the city which resulted from a woman starting a fire in a stove at 8 a. m., which set fire to the house and resulted in the burning of 75 blocks of buildings. The worst feature of all was the breaking of the water mains—that was the death-blow to our city—leaving us with hardly any water. But how can we guard against a recurrence of such an earthquake? Since the big shake we have had (I am told) 125 other shakes, but as I am riding around in a buggy I do not notice them."

Writing to W. H. Merrill, Jr., of Chicago, F. H. Porter, chief inspector of the Fire Underwriters' Inspection Bureau of San Francisco, says:

"It is apparent that the protected steel frame buildings suffered but trifling damage from the earthquake, and the wooden buildings suffered little unless very old. The buildings of fireproof construction burned very slowly, and where the top floors and trim were not of wood suffered comparatively small damage.

"No building of the protected steel class with wood top floors, wood frames and sashes and wood trim has any chance of withstanding a general conflagration with less than 70 per cent. damage.

"The earthquake started at once a large number of fires in the business section and at the same time destroyed the large water mains supplying the reservoirs. The supply in the reservoirs and street mains appears to have been dissipated by the simultaneous breaking of thousands of building services as well as by damage to street mains. While an independent water supply for fire purposes only would not have suffered from broken service connections, it is impossible at this writing to say whether such mains would have retained efficiency.

"The stopping of this fire in the best residence section at a wide boulevard with only dynamite and a trifle of water (all buildings frame on boulevard) shows the value of such a wide street. We hope to get in several in the rebuilding of the burned district."

Of Interest to Inventors.

A hall of inventions wherein may be demonstrated the worth of every imaginable invention has been projected as one of the interesting and instructive features of the Jamestown Exposition, which will be held at the historic Hampton Roads, Norfolk, Va., next year. The plan proposed provides for the erection of a special building to be devoted to the exhibition, exploitation and demonstration of the working of inventions of every description, to be known as the "Hall of Modern Inventions." At all previous expositions, inventions, however worthy and valuable they might be, were refused admittance under the rules, unless they were being manufactured or were on sale. With a special building devoted to inventions of this character, inventors or their representatives can make a demonstration of their inventions' value, and thereby secure the aid of capital for the development and disposition of the inventions.

The International Congress of Inventors, an organization recently formed at Rochester, N. Y., for the advancement and protection of inventors generally, has for its object to endeavor to improve conditions affecting inventors and allied interests and to co-operate with other bodies, local and national, in such work. It proposes to make more effective the standing of a United States patent so that it will have definite weight before the public without the necessity of a court action. George F. Gallagher is president and Ralph T. Olcott is secretary and treasurer, with headquarters at 16 State Street, Rochester.

Annual Meeting of the American Institute of Electrical Engineers.

The annual meeting of the American Institute of Electrical Engineers was held in the New York Edison Company's building, West Twenty-seventh Street, New York, on the evening of May 15th. President S. S. Wheeler was in the chair.

Officers were declared elected as reported by telegraph in the Western Electrician last week. Referring to the election of Dr. Sheldon as president, J. J. Carty said that he was on the losing side, but he congratulated the winners. He thought all who voted for the losing candidate as well as the successful one would try to make the incoming administration one of the most distinguished and successful in the history of the Institute.

The proposed constitutional amendments, or the proposed new constitution, were not adopted. The vote for them was 1,507 to 161 against, but they were lost because the existing constitution requires an affirmative vote of a majority of all members and associates to make amendments.

Votes of thanks to the New York Edison Company and the New York Telephone Company for the use of rooms for meetings were extended.

There was some discussion in relation to the proposed new constitution. The general feeling seemed to be that of regret that it had not been adopted. Charles F. Scott of Pittsburg (past-president) said that perhaps not enough opportunity had been given for study and discussion of such an important matter. He did not agree with all of the proposed changes, but nevertheless he had voted for the new constitution. He thought the directors should contrive plans for another effort. C. O. Mailloux, chairman of the committee that had prepared the proposed constitution, sympathized with Mr. Scott's position, but said that the very thing that it was suggested the board of directors should do had been done. Mr. Mailloux briefly outlined the work that the committee had done. He thought the amending clause of the present constitution should be changed, so that it would be easier to incorporate improved methods in the fundamental law of the Institute. C. B. Burleigh of Boston said that too much attention could not be paid to the work of the branches. Five-sixths of the members live outside of New York or Brooklyn. It is this proportion that must be cared for primarily by the branch meetings. "I am afraid," said Mr. Burleigh, "that if the branches are not given the attention that their size and prominence warrant, sooner or later there may be a tendency to localize, and that would certainly be very detrimental to the Institute as a whole. I am free to say, too, that I do not think such a course would be of advantage to the different local bodies."

It was decided, on Mr. Scott's motion and Dr. F. A. C. Perrine's amendment, to present the proposed constitution again to the membership, asking the chairmen of the local sections to make a personal canvass in order to bring out a full vote. Speaking for himself, Dr. S. S. Wheeler, the president, said that he was sorry the new constitution had not been adopted. He added: "We ought to make a number of reforms in our organic law and I do not think we should be disheartened by our failure to make a step forward now. I think we must bear it in mind, and keep at it, and try to get the membership thinking about the various points involved, so that in another year or two we can hope to have a new constitution adopted. I think it is very important for the branches that we have adequate provisions covering their organizations and work, and I think it is a great problem just how to arrange that."

The printed report of the board of directors, submitted at the annual meeting, shows that the total membership is now 3,870, an increase during the year of 410. The number of students enrolled is 618. As to branches, "there are now 21 active centers, several in a state of semi-activity, and three or four which are dead or practically so. Work on the United Engineering Building is reported as progressing rapidly. On April 23d the walls were up to the thirteenth floor. On April 30th subscriptions to the land and building fund had reached a total of $132,434, from 644 subscribers. During the year the ordinary receipts of the Institute were $49,423, the balance over disbursements being $8,656.

The library committee reported 10,717 volumes and 515 pamphlets, valued at $22,069, in the library on May 1, 1906.

Gas and water mains in Milwaukee are said to be practically free from electrolysis from the street-railway return currents. Several years ago Milwaukee gas and water mains were affected to a considerable extent. This, however, according to the statement of City Engineer Charles J. Poetsch, has been remedied by the street-railway company putting in heavier rails and also putting in cables in conduits to carry the spent current back to the power house.

Government Power Bill Before the Ontario Legislature.

A new power bill which has for its purpose the supply of cheap electric power to the municipalities of the province of Ontario, Canada, has been introduced into the Ontario Legislature by Hon. Adam Beck. Mr. Beck is chairman of the hydro-electric commission appointed by the Ontario government to inquire into the possibilities of developing power at Niagara Falls for distribution to the various cities by the government. The commission has made its report, and readers of the Western Electrician are familiar with the conclusions of the commission relative to the cost of developing the power and the estimated cost to consumers, but some notes from a Canadian correspondent of the Western Electrician relative to the provisions of the new cheap-power bill will be of interest to central-station men.

Power, according to the provisions of the bill, will be generated at Niagara Falls, the present franchises of the existing companies to be expropriated; the same rule to apply to all companies generating electricity by waterpower all over the province of Ontario. The power, according to the hydro-electric commission's experts, will be sold to the distributor for $11 a horsepower. The government will appoint a commission (permanent) to oversee the relations between the existing power companies and the municipalities. This body will be empowered to fix the rates at which electricity shall be sold in the various portions of the province, and may, with the consent of the crown, expropriate privileges already granted to private companies.

The province will borrow money to be expended by the commission on the construction of transmission lines and distributing plants. Municipalities desiring to participate in the plan may enter into contracts with the commissioners for the supply of power at rates which will include an allowance for transmission and transformer losses.

The municipalities will eventually bear all the cost of the works. They will pay four per cent. interest on the expenditure and an annual sum sufficient to form in 30 years a fund for the retirement of the securities issued to cover the cost. Lastly, they will contribute to the expenses of maintaining, renewing and insuring the works installed.

Complaints that excessive rates are being charged for power, or that municipalities are discriminating in favor of certain manufacturers, may be heard by the commissioners, who may direct what rates are to be paid for power.

It is expected the board of commissioners will consist of E. W. Snider of Waterloo, Ont. (chairman), P. W. Ellis of Toronto (vice-chairman), Hon. Adam Beck of London, W. F. Cockshutt of Brantford, and Reginald A. Fessenden of New York (technical adviser).

The cost of power development at Niagara Falls is given at $6,684,629 for 30,000 horsepower; for 60,000 horsepower at $9,354,611, and for 100,000 horsepower, $11,909,100. These figures include the cost of the development, transmission and distribution. The cost of power generated at Niagara Falls by the construction commission is estimated at $4.95 per horsepower. This would, on a 100,000-horsepower development basis, give Toronto power to run the street-car system for $11 a horsepower and arc lamps for street lighting at $36.48 per light a year. The estimated saving on the Toronto arc-light service is 45 per cent.

It is interesting to note that in explanation of the unwillingness of some of the Canadians to agree to a limitation of the right to divert water from Niagara Falls, the United States Daily Consular Report points to influence effected by the report of the Ontario commission, which promises a large saving to consumers.

American Street and Interurban Railway Engineering Association.

What was formerly the American Railway Mechanical and Electrical Association will hereafter be known as the American Street and Interurban Railway Engineering Association. A new constitution and by-laws has been adopted, the drafting of which was left to the executive committee at the Philadelphia convention in September, 1905. The new constitution and by-laws now conform in every way to that of the American Street and Interurban Railway Association and has been approved by the executive committee of the parent organization.

Individual memberships in the four affiliated street-railway associations are to be confined to the American Street and Interuban Railway Association and the American Street and Interurban Railway Engineering Association. It has also been decided that the first requisite of individual membership shall be that such individuals be associate members of the parent body. In order to preserve the identity of individual membership in the engineering association all associate members shall be privileged to state that they wish to ally themselves with the engineering branch of associate membership, this decision entitling them directly to individual membership in the Engineering Association.

All former members of the American Railway Mechanical and Electrical Association are eligible to membership in the American Street and Interurban Railway Engineering Association, of which S. Walter Mower of the Detroit United Railway is secretary.

Milwaukee Convention of the American Institute of Electrical Engineers.

This year's annual convention of the American Institute of Electrical Engineers will be held in Milwaukee, Wis., May 28th to June 1st, the Hotel Pfister being the headquarters, where members will register. Convention sessions will be held in the Public Service Building, Sycamore Street, Second to Third Street. Following the custom of the Institute, by which the annual conventions are not confined to any particular portion of the country, Milwaukee was this year chosen as the meeting place, and from its central location and the fact that it is the headquarters of important electrical industries, the choice is considered an excellent one.

The Milwaukee local committee consists of John I. Beggs (chairman), W. E. Dodds, W. F. Johnson, H. H. Cutler and Charles W. Burkett.

A promising list of papers has been prepared, and the authors are men who are recognized authorities. The programme is as follows:

Monday (May 28th).—Address of welcome; address of President Schuyler Skaats Wheeler; "Repulsion Induction Motor," by Maurice Milch, engineer, General Electric Company, Schenectady, N. Y.; "Comparison of Two and Three-phase Motors," by Bradley McCormick, electrical engineer, Allis-Chalmers Company, Cincinnati, Ohio; "Direct-current Motor Design as Influenced by the Interpole," by Charles H. Bedell, head of laboratory, Electro-Dynamic Company, Bayonne, N. J.

Tuesday.—"Experiences with Lightning and Static Strains on 33,000-volt Transmission Systems," by Farley Osgood, general manager, New Milford Power Company, New Milford, Conn.; "Cell-type Lightning Arrester," by E. E. F. Creighton, assistant professor of electrical engineering, Union University, Schenectady, N. Y.; "Protective Apparatus for Lightning and Static Strains," by H. C. Wirt, engineer supply department, General Electric Company, Schenectady, N. Y.; "Standardization Rules" (the proposed revision of the existing standardization rules will be reported for discussion by the committee on standardization); "Short-circuit and Ground Currents in Alternating-current Systems," by Charles P. Steinmetz, electrician, General Electric Company, Schenectady, N. Y.; "The Self-synchronizing of Alternators," by Morgan Brooks, professor of electrical engineering, University of Illinois, Urbana, Ill.

Wednesday.—"Magnetic Properties of Electrolytic Iron," by Charles F. Burgess, professor of applied electrochemistry, University of Wisconsin, Madison, Wis., and A. Hoyt Taylor, University of Wisconsin, Madison, Wis.; "Measurement of Temperature by Electrical Means," by Edwin F. Northrup, secretary, Leeds & Northrup Company, Philadelphia, Pa.; "The Educational Value of an Electric Test Car," by Thomas M. Gardner, assistant professor of electrical engineering, University of Illinois, Urbana, Ill.; "The Art of Inventing," by Edward J. Prindle, patent lawyer, New York; "Shunt and Compound-wound Converters for Railway Work," by W. L. Waters, chief engineer, National Brake and Electric Company, Milwaukee, Wis.

Thursday.—"Electrical Connections for Power Houses," by David B. Rushmore, railway engineering department, General Electric Company, Schenectady, N. Y.; "Economies Derivable from the Use of Relatively Small Waterpowers of Low Head in the Middle West," by Dugald C. Jackson, professor of electrical engineering, University of Wisconsin, Madison, Wis.; "Oscillations and Surges Against Ground in Alternating-current Systems," by Charles P. Steinmetz, electrician, General Electric Company, Schenectady, N. Y.; "Some Fundamental Characteristics of Mercury-vapor Apparatus," by Percy H. Thomas, chief electrician, Cooper Hewitt Electric Company, New York; "Safety Devices for Steam Engines, Turbines and Motors," by Charles M. Heminway, treasurer and manager Consolidated Engine Stop Company, New York; "Some Notes on the Lighting of Churches," by Edwin R. Weeks, consulting engineer, Kansas City, Mo.

Tickets will be issued at all the principal stations and ticket offices of the Western Passenger Association, the Trunk Line Passenger Association, the Central Passenger Association, and the Southwestern Excursion Bureau (from all points in Missouri and Kansas under the jurisdiction of the bureau) to members and guests on the certificate plan, which allows the holders of such certificates to purchase tickets from Milwaukee to original starting point, via same route as going ticket, at one-third the regular fare, provided there are at least 100 certificates presented.

It is expected that many engineers attending the convention will take advantage of the opportunity to visit the new West Allis Works of the Allis-Chalmers Company near Milwaukee and the new Hawthorne plant of the Western Electric Company in Chicago.

Arrangements for Atlantic City Convention.

[illegible]

Material for exhibits [illegible] the care of the [illegible] Warehouse Company [illegible] to and from Young's Pier [illegible] $1 for 100 pounds [illegible]

Exhibitors who desire [illegible] cate with Mr. L. W. Byer [illegible] Light and Power Company, Atlantic City, N. J. Mr. Byer will be very glad to do everything in his power to facilitate the [illegible] tion and the supply of electric current. He is [illegible] informed concerning local [illegible] matter. Through the courtesy of Mr. H. J. [illegible] man, member of the association, [illegible] a special convention rate of four cents [illegible] hour. The lowness of this price will do much to make the exhibition a success.

Boxes and crates may be stored on the pier free of charge. Mr. Ernest Shackelford, manager of the pier, is taking a personal interest in the exhibition, and promises to do all in his power to make it a success.

Exhibitors will do well to make their displays attractive to the public. In addition to the convention attendance proper, which promises to be large, the expectations are that there will be a daily concourse of from 2,000 to 3,000 persons. Returning again to all parts of the country, after being impressed and pleased with what they have seen in more recent electrical development, these persons cannot fail to be of material assistance in spreading abroad much that will tend to make central-station service in its various features increasingly attractive to the general public.

Members of the convention committee will be on hand on and after Saturday, June 2d, to render any assistance they may to exhibiting members.

Electrical Contractors to Meet in Cleveland.

Electrical contractors from various parts of the United States will be in Cleveland for three days, beginning July 18th, to attend the sixth annual convention of the National Electrical Contractors' Association of the United States. Those in charge of the arrangements for the convention have already started to work on a programme of entertainment. While there will be a great deal of business transacted of interest to the electrical contractors of the country, the social features for the delegates and their families will include entertainment both on land and water.

Cleveland is undergoing a marked development and work has been started on the grouping plan of public buildings, which has attracted much attention throughout the country. Cleveland electrical contractors will also take pride in showing the part they have taken in the rapid development going on all over the city.

There will be a fare-and-a-third rate to Cleveland granted by the several lines of the Central Passenger Association on account of the convention. Alex Henderson, master of transportation, has already sent out bulletins regarding the railroad arrangements.

The convention committee consists of F. C. Werk of Cleveland, E. M. Lawton of Cincinnati and C. S. Hall of Dayton. Convention headquarters will be at the Hollenden Hotel.

Electrical Section of Western Society of Engineers.

On Friday evening, May 18th, the Electrical Section of the Western Society of Engineers held the last meeting of the season. Work of the section will be resumed again next fall. The subject of the evening was a description, by Mr. H. R. King, of the new factory of the Western Electric Company at Forty-eighth Avenue, Chicago, and known as the Hawthorne plant. Here are manufactured the heavy power apparatus made by the Western Electric Company and also insulated telephone cables and rubber insulating compounds. An abstract of Mr. King's paper appears elsewhere in this issue. The topic was not one which permitted of an extensive discussion, and the meeting was adjourned early in the evening.

Book Received.

"Electrical Engineering in Theory and Practice." By G. D. Aspinall Parr. Published by Macmillan & Co., London (The Macmillan Company, New York). Price in the United States, $3.25.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Purchasing Motors in Too Small Sizes.

A very frequent experience of the sales engineer in trying to place a contract for a number of motors to be used in the direct driving of machinery is to find the prospective purchaser unwilling to select individual motors of sufficient capacity for the proper handling of the work in hand. In cases where motors are specified for a particular duty by a reliable consulting engineer the purchaser is much less liable to try to get along with inadequate sizes, but when the selection of individual motors rests mainly upon the purchaser himself, there is often a tendency to economize in first cost, which in the long run works to the disadvantage of the owner of the machinery.

The purchaser often feels that the representative of the manufacturer is chiefly interested in selling as large an output of his product as is possible, and frequently does not appreciate the careful study which the manufacturer makes of the conditions in different installations in order that the best sizes of machinery may be recommended and guaranteed. There is more good engineering advice given from the district offices of the manufacturing companies than is realized by the general public, and under present-day conditions of business there is very little object in selling apparatus too large for the work in hand, while there is every reason for the supply of equipment which will most nearly meet the conditions. The competition between the makers of electric motors is too keen for any reliable manufacturer to recommend machines too large for the duty proposed; the facility with which the power requirements in any given situation can be electrically tested in advance and tried in service after the installation is made and the relation of these results to the manufacturer's reputation all tend to discourage overrating. The writer has seen very few cases in which motors have been too large for their duty in comparison with the number of installations where the purchaser has cut the sizes too low in the effort to reduce first cost.

It is very important that the purchaser of electrical equipment should be satisfied with the permanent results of his plant. The large manufacturing companies have done well to expend considerable sums of money and much time in the securing of reliable data as to the sizes of motors required in a great variety of conditions. The sales engineer should not hesitate to bring to his prospective customer's attention the results which have been obtained in parallel cases, and actual recourse to the ammeter, voltmeter and thermometer should be had whenever it is necessary to demonstrate the requirements of the situation. When motors which are too small are installed in a plant there are often annoying delays and stoppages of work on account of breakdowns; the cost of maintenance usually is excessive and the entire electrical industry gets a bad name from the owner of the machinery. To select the proper size of motor for different classes of service requires much skill in a great many cases, and the need of reliable data can hardly be exaggerated. Actual results of experience and tests are what the purchaser needs in cases where the price of an individualized equipment seems high. It is a misfortune all around when too small motors are purchased. Where guaranties are made the burden is less likely to be too great upon the motor, but as many motors are purchased singly and without specific guaranties, the importance of the purchaser's buying adequate capacity should be thoroughly impressed upon him. H. S. K.

Central Station Electrically Decorated Attracts Customers.

The Union Light, Heat and Power Company of Fargo, N. D., has decorated its central station by outlining the buildings with incandescent lights. Lamps have been used liberally on the tall smoke-stack, which is crowned with two rows of lights. The illumination attracts the attention of all those in the vicinity, and anywhere the chimney and plant can be seen the effect is impressive. Besides, merchants are impressed at the way people talk about the light company and are induced to try an electrical display of their own.

"Fargo is already deriving benefit from the display of lights by its advertising feature for the city," says the Fargo Forum. "Passengers on the trains are heard to remark about the 'city of lights.' Visitors to the city who spend more or less time on the streets are also impressed with the many electric signs and other electric decorations on the business streets. The many street or porch lights in the residence districts are also of importance in showing the enterprise of the citizens, and visitors remember and tell about these things upon their return home. The Union Light Company is doing a good work in its electric-sign campaign, and new orders are being placed every week."

Company and Consumer.

If you are a user of central-station electric service in Chicago, you are connected with a great system, which consists not merely of two large corporations operating so many generating and substations, but a system composed of the companies *and* their 30,000 customers.

Now, the companies endeavor faithfully to perform their share of the contracts they make with the other members of this great commercial system. They employ the most astute managers and the finest engineers to organize and maintain their business in every department. Their one object has been to make central-station service so reliable, efficient and satisfactory in every way that no Chicagoan would be willing to do without it at home or in business.

There may be one factor, however, in the attainment of complete success in these endeavors which the companies cannot control, and that is the apparatus and the manner of using it for which the consumer is responsible.

While the inspection of arc lamps, motors and most other devices needing considerable current for their operation prevents the connection of worthless machinery to the service, there remains the chance of future derangement, depreciation and even ruin from misuse. Where such has occurred, the consumer is as badly off as though the service itself was inferior, and cost more.

The natural safeguard against this is the readiness of most people to complain to the company when their expectations of results and their cost are not fulfilled.

It is fortunate that this is the case, and no public-service corporation trying to build up an enviable reputation would have it otherwise. On the contrary, the electric-service companies have a special department for handling all complaints, which is organized with the express object of relieving unfavorable conditions and adjusting ordinary features of the companies' service and management to peculiar but necessary demands.

It follows that when a consumer finds anything in his relations with the company which he thinks might readily be altered for the better, he ought to lose no time in acquainting the company with the circumstances. If it is possible to improve the conditions, the company will be glad to do anything not contradictory to its general policy to obtain that result.

So, if there is "something wrong," let the company know about it; and remember that the most good to all concerned will arise through letting the *company* know about it—not all your neighbors.—The Electric City.

The Campaign in Wilmington.

An effective campaign for new central-station business is under way in Wilmington, Del. In that city both the Wilmington Light, Power and Telephone Company and the Wilmington City Electric Company are making an extra effort to secure new customers. Solicitors are sent out to convince prospective users of the advantages that follow the liberal use of electricity in a wide range of applications.

"The solicitors are being so successful," says the Wilmington News, "that from present indications it will be necessary for the old company to enlarge its plant, while the new company will be required to build a much larger power house than was at first contemplated. The new contracts are going to boom the business of electric wiring, for many of the buildings which are to be supplied with electricity are not wired for it, and this will mean work for the various electric concerns about the city. It is expected that the solicitors will be kept busy for some time, and those who have buildings to light are being interviewed extensively by the men who desire to sell current. They are getting contracts, however, and that is what both companies want."

Educating the Consumer.

The Union Electric Light and Power Company of St. Louis is pursuing the sane plan of advertising by making itself helpful to its patrons. One thing it does is to furnish customers with power account sheets, with instructions for keeping exact itemized account of operating expenses. Again, it offers free trials of various apparatus such as turn-down lamps, electric smoothing irons and other devices. This seems to be a sure method of educating the public to the uses and conveniences of electricity and may serve as a suggestion for other concerns.—The Live Wire.

Municipal Electrical Enterprise at Ipswich.

What follows is taken from the Electrical Times of London. It is interesting and somewhat amusing in itself and also interesting as revealing (to the American reader) a rather unexpected instance of electrical promotion in connection with municipal operation.

The gas people have not entirely a monopoly in the matter of circulars advertising the cheapness, brilliancy and other advantages of their light. Several electrical supply undertakings are paying them the compliment of imitation, and, very naturally, the point chiefly insisted on is the superior healthiness of the electric light, a matter on which our gas rivals are very sore. One of these pamphlets I reproduce—as nearly as the printers can imitate it—on a small scale.

Pamphlet No. 16.

Tamper with Nature no longer!
You cannot keep well if you do!

Use Electric Light—the only healthy light; the only method of artificial lighting which does not give off poisonous fumes and vitiate the atmosphere in a house

The "Lancet," in its issue of January 9th, 1905, says:—

"In considering the systems of artificial lighting that are in vogue at the present time, the incandescent system of electric lighting must, of course, rank first from the point of view of health."

Have it installed at the Spring Clean—the most suitable time.

IPSWICH CORPORATION ELECTRIC SUPPLY DEPARTMENT,
February, 1906.

That "of course," coming from so high an hygienic authority as the Lancet, must be gall to the gentlemen who have lately been so bent on proving that gas fumes are rather an advantage to health than otherwise, since they compel you to redecorate more frequently—how very unhealthy a gallery of old masters must be!—but it is not on that account I quote the card. It seems that it was sent around to a number of residents on the line of the Ipswich mains, one of whom, a lady, sent the following reply on a postcard:

LINES ON READING PAMPHLET No. 16.

Oh, Gas is a thing that's pernicious;
It's poisonous, dirty and dear.
Get rid of a system so vicious,
Install our electrical gear.
Your folks will grow fatter and stronger,
Your dogs and your pussy-cats too.
So tamper with nature no longer;
You cannot keep well if you do.

Spring cleaning now looms in the distance,
That dismal and desolate time;
And vain is the thought of resistance,
So heed my mellifluous rhyme.
It's perfectly hopeless to break it,
This ancient tradition of spring.
By starting our system you'll make it
For once a delectable thing.

Chorus: So tamper with nature no longer,
You cannot keep well if you do!

Central-station Advertising.

The plans of the National Electric Light Association for a general exhibit of central-station advertising methods at the Atlantic City convention of June 5th to 8th should result in an interesting display. Promises of contributions have been received from a number of companies, including those in New York, Boston, Buffalo, Baltimore, Portland (Ore.), Chicago, Newark, N. J., Brooklyn, etc. Mr. John Craig Hammond, who was formerly the advertising expert for Mr. H. L. Doherty at Denver and did such good work there, has tendered his services for the exhibit to the chairman of the committee, Mr. T. C. Martin, and will take an active share in the work. Several of the companies are sending a large number of copies of their bulletins for distribution to the convention, and the Philadelphia Electric Company is preparing and will distribute a special Atlantic City edition of several thousand copies for the members as well as for the general public. A large number of the companies are sending framed and unmounted original designs, plain and in color, used for the covers of the bulletins that are now such a feature of the campaign work in selling current, and these will be displayed on the walls, constituting a veritable gallery of advertising illustrations.

Electric Heat for the Laboratory.

Chemists are beginning to appreciate the value of electricity in producing heat for use in their laboratories. A battery of 24 four-inch electric stoves for boiling ether in the test of the city's milk has been adopted by the Health Department of New York. The apparatus has proved most satisfactory, according to the Bulletin of the New York Edison Company. Electric stoves furnish heat quickly and effectively.

During one of the tests the milk is kept in a hot-air bath, for which the heat is produced electrically, the temperature being maintained at 212° Fahrenheit by means of a special electric thermostat.

Numbers of electric sterilizers are employed, costing from one to 3½ cents an hour to operate, according to the size of the sterilizing chamber.

Sign Business Increased by the Electrical Show in Fond du Lac.

A general increase in business is reported by Mr. L. E. Holderman, director of the new business department of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., as a result of the electrical show given by the company the week of April 9th. Especially in the matter of benefits resulting from the liberal use of electric signs the business men seem to have been impressed. On this point the Fond du Lac Daily Reporter of May 14th says:

"Advertising pays. One of the best demonstrations of the truth of this statement may be found in the rapid increase of handsome electric signs on the business streets of Fond du Lac. Before the recent electrical show there were but few such signs to be seen. Within the last few weeks a number of the merchants and business men have adopted this method of attracting attention to their places of business. Most of these new signs are the direct result of the electrical show. It was so clearly demonstrated at this exhibition that an electric sign is an effective means of attracting the notice of customers that many live business men opened negotiations for them. Several signs have already been put in place and others will follow. The brilliant lights not only attract business but they add much to the general appearance of the streets. Strangers who are here at night get a fine impression of our city from the illuminated streets which they would not get were the signs absent. They go away with the idea that Fond du Lac is a live town and a good place to do business in."

New Schedule of Rates in Winnipeg.

The Winnipeg (Man.) Electric Street Railway Company has been awarded the contract to supply electrical energy in Winnipeg for street lighting and water pumping, but not for private use. The present price for arc lamps is 20 cents a night. By the terms of the new contract this will be reduced to 15 cents. Following are provisions of the contract:

When the monthly wattmeter readings show an average daily 24-hour consumption of power of from 1,000 to 2,000 horsepower, the price is to be 0.456 cent per kilowatt-hour. When the monthly readings show a daily 24-hour consumption from 750 to 1,000 horsepower the price is to be 0.532 cent per kilowatt-hour. The rates are thus graded down to a point where the average daily 24-hour consumption only reaches 200 horsepower, when the price is to be 0.76 cent per kilowatt-hour.

These rates are based on the power to be delivered at any point east of Main Street, but should the power be required at the Phillips Street pumping station the city is to supply the wire for transmission purposes, the street-railway company supplying all poles and labor in the erection of the transmission lines. Readings are to be taken monthly from wattmeters, to be placed in the city station on the incoming switchboard, the wattmeters to be the property of the Winnipeg Street Railway Company. Three-phase alternating current at approximately 2,200 to 2,400 volts is to be furnished. The contract is for three years.

Public Meter Testing in New York.

Very gratifying is it to know that, in accordance with the provisions of the city charter, the authorities have made arrangements with Columbia College to test electric-light meters. As may not be generally known, under the charter, any user of electric light may apply to the commissioner of water supply, gas and electricity for a test and be advised concerning the exact condition of his meter. The daily press has stated to the contrary, but in this they have been mistaken.

Columbia College has one of the best-equipped testing laboratories in the country, in charge of men most eminent in their profession. All are at the service of any user of electricity. We take great pleasure in announcing this fact and shall be glad to co-operate with any customer who may desire to have his meter tested in this manner.—Bulletin of the New York Edison Company.

For the Sewing Machine.

With the approach of summer comes the increased activities in every household, an important feature of which takes the form of sewing, and the whirr of the sewing machine will not be lessened by the passing of Easter, for the warm-weather apparel must be gotten ready. It is a particularly trying period for those women to whom the operation of the sewing machine has been interdicted.

As with everything else, however, to which it has been applied, electricity smooths the way.

The sewing-machine motor, as pointed out by the Bulletin of the Portland (Ore.) General Electric Company, may be fitted to a large number of different makes of family sewing machines without altering or defacing the machine.

The Cooper Hewitt Mercury-vapor Lamp.

A recent article [illegible] Cooper Hewitt mercury-vapor lamp [illegible] lighting, makes some interesting [illegible]

"The record [illegible] mercury lamps installed in [illegible] demonstrated that the operating [illegible] Hewitt tube exceed 5,000 hours [illegible]. The New York [illegible] recently renewed four tubes which had been operated over 10,000 hours each, and three of them were in fair operating condition when returned to the factory, but somewhat blackened from long service. As the only cost of maintenance in mercury lighting is for tube renewal [illegible] the original cost of the complete lamp the demonstrated long life of the tube gives a new importance to the figures of its high efficiency. [illegible] continue to operate perfectly until the vacuum becomes impaired, with no consumption of the light giving element."

"In the Cooper Hewitt lamp, a long glass vacuum tube, one inch in diameter and from 17 to 45 inches long in the standard types, mercury vapor is excited to a high degree of incandescence by the passage of the electric current with a generation of heat that is reduced to a minimum. The radiant heat from mercury lamps, therefore, is, in proportion to lighting capacity, a very small part of that given off by incandescent globes or arc lamps, and this high efficiency, which means an all-important saving in current consumption, has incidentally meant also a material reduction in the temperature of workrooms in many installations in which the heat from former lighting methods had been very noticeable in hot summer weather. The operating economy is well established—a candlepower of light for a current consumption of from 0.55 to 0.64 watt, proportionately one-sixth the current required by an incandescent globe, one-third that required by an enclosed arc, and one-half that required by an open arc."

"All but a few of the installations of the last year have been with the 300-candlepower type H, and the 700-candlepower type K direct-current lamps, but the 425-candlepower type C lamp, for alternating-current circuits, recently put upon the market, is now being delivered for various installations where the advantages of mercury-lamp lighting have not before been possible. The H lamps are generally operated in series—two in series on circuits of from 98 to 122 volts, or four in series on circuits of from 196 to 244 volts. The K lamps are operated singly on circuits of from 98 to 122 volts, and two in series on a 196-244 voltage. Series lamps are arranged with extra shunt resistances so that either lamp of a pair in series may be operated singly if desired. Both types of the direct-current lamps are run at 3½ amperes, two H lamps in series on a 110-volt circuit consuming 385 watts, one K lamp installed singly on a circuit of the same voltage consuming the same current, and two K lamps in a series on a 220-volt circuit consuming 770 watts. The new type C alternating-current lamp consumes 275 watts on either 110 or 220-volt circuits, or 0.64 watt to a candlepower.

"The complete Cooper Hewitt lamp outfit, in its latest form, consists of the glass vacuum tube, the holder and reflector, and the auxiliary. The tubes of direct-current lamps have a positive electrode, of iron, at one end, and a negative electrode, of metallic mercury, in a bulb at the other end. The tubes of the new alternating-current lamps have two positive electrodes, of iron, at one end, and a negative electrode, of mercury, at the other end, the alternating current entering the vacuum by the positive electrodes and leaving by the negative electrode. The alternating-current lamps thus really operate as a converter in application of the principle of negative electrode resistance discovered in the first invention of the mercury lamp. They are started, as the direct-current lamps are started, by a temporary tilting to permit the flow of mercury from one end to the other in a small stream which momentarily bridges the vacuum, the resulting arcing of the current vaporizing some of the mercury and the subsequent steady current flow increasing the vapor pressure and exciting it to a high degree of incandescence. Many type H lamps are now made with a small solenoid or magnet on the suspension bar just above the holder for accomplishing this tilting automatically when the circuit is closed. These automatic lamps are used in installations in which it would be inconvenient to reach the tilting chain with the hand or a hook.

"The auxiliary, consisting of two or three coils of resistance wire, an inductance coil, and usually a ballast bulb to correct abnormal voltage variations, all connected in series with the tube, is enclosed in the new lamps under a 12-inch metal canopy and fastened securely to the ceiling above the lamp on a plate attachment, having a crowfoot into which the lamp-suspension bar is screwed, thus becoming a part of the lamp fixture. The special auxiliaries for series lamps have in addition an automatic cut-out and shunt resistance. The new ballast bulb, an interesting feature of the auxiliary, provides protection against undue voltage

[illegible]

Air Deflector for Electric Fan.

[illegible]

[illegible]

the market for attachment to the fan guard. The picture herewith shows the deflector attached to a fan in operation, the ribbons being intended to show the diverging currents of air instead of a direct draft. It is asserted for these deflectors that they keep the air circulating throughout a room, but overcome the objection of a direct draft. These deflectors are made in two sizes for 12 or 16-inch guards. They are the product of the Henry D'Olier, Jr., Company of 119-21 South Eleventh Street, Philadelphia.

Organization of the Northern Colorado Power Company.

Definite arrangements have been made at last in the comprehensive power-transmission development in Northern Colorado which was outlined in the Western Electrician of November 18, 1905. J. J. Henry of Denver is to be credited with the promotion of the project, which has culminated in the formation of the Northern Colorado Power Company, with a capital of $3,000,000. The new company is the result of a combination of the Boulder Light and Power Company, the Cheyenne Light, Fuel and Power Company and the Consumers' Electric Company operating in Louisville. The company is organized to supply power and light to the entire region north of Denver, including the mines of Gilpin County and the Colorado and Southern Railroad. It means the erection of a fine power plant at Lafayette, near the cheap coal, at a cost of $1,500,000, and is generally of much importance to Denver and the state.

There will be about 167 miles of transmission lines. It is said that the contract has already been let for the installation of the power apparatus and transmission lines to Westinghouse, Church, Kerr & Co., and that Westinghouse-Parsons steam turbines will be used in the generating plant at Lafayette.

The officers of the company are: President, William J. Barker, of the Denver Gas and Electric Company; vice-president, J. J. Henry; general manager, C. W. Humphrey, consulting engineer of the Denver Gas and Electric Company.

Chicago Edison and Commonwealth Ordinance Delayed.

At the council meeting in Chicago Monday night the committee on gas, oil and electric light reported the new ordinance for the Chicago Edison Company and the Commonwealth Electric Company. The ordinance is the result of negotiations between the committee and representatives of the companies following the demand for lower rates to consumers of electric current. Someone suggested that the wording of the proposed Section 1 relative to transmitting sounds and signals, together with the consolidation privileges asked, might result in the companies at some time going into the telephone business. The committee was therefore instructed to look into the telephone matter.

Stockholders of the Commonwealth Electric Company of Chicago held their annual meeting on May 21st. The only business tranacted was the re-election of the old board of directors.

Submarine Working by Compressed Air and Arc Light.

Real or imaginary horrors incident to going down to a sunken vessel or other submerged object have kept the number of professional divers at a minimum. At depths of 50 feet or more, even in comparatively clear water, the gloom is said to be impenetrable. For these reasons few people care to don the diver's armor and descend below the surface. It may therefore be said that with the development of an electric searchlight and diver's lamp and a kit of compressed-air tools for submarine repairing a new industry has been developed.

Of the accompanying pictures, Fig. 1 shows what is known as the Yale submarine electric lamp, said to be in practical use in the navies of several nations. Fig. 2 shows the lamp and accessories stowed away in a case aboard ship, and Fig. 3 illustrates the ease with which a chipping hammer or pneumatic drill may be operated 20 feet under water by the aid of the Yale lamp. The lamp, submarine cable, switch, connecting box, wrenches, spare parts and supplies are all included in one chest.

Fig. 1. Submarine Arc Lamp.

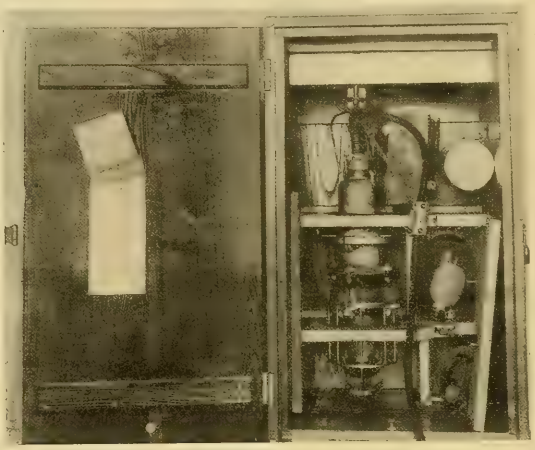


Fig. 2. Submarine Lamp and accessories in Case aboard Ship.

Fig. 3. Submarine Lamp and Pneumatic Chipping Hammer Operating 20 feet under Water.

SUBMARINE WORKING BY COMPRESSED AIR AND ARC LIGHT.

The arc lamp is enclosed in a watertight metallic case, with a glass chamber at its lower end. When in use the diver may carry the lamp by means of the circular guard handle, set it down, or suspend it in a convenient manner directly by the cable, no ropes being required. Its weight under water is only a few pounds—just enough to keep in position in a current or tideway. The submarine cable conducting the current to the lamp leads to the surface and thence to a combined junction and switch plate controlled by the diver's attendant. From this plate connection is made to a neighboring electric circuit, storage battery or small generator outfit supplying the electric power.

By means of the electric light and compressed air it will be possible to make permanent repairs to the hull of a vessel, even under fire. Further, it is predicted that a fleet in cruising trim may be kept fairly clean and in good repair without recourse to the dry dock. The lamp is made by the Electric Marine Manufacturing Company of New York city, which company also owns the patents for the entire apparatus. The Chicago Pneumatic Tool Company will be selling agent of the lamp and appliances.

In order to render the services of a diver of real value in making durable repairs it was found necessary to considerably change the methods of operation and equipment. The question of light, the first step, was solved by the use of the Yale submarine electric lamp, by its inventor, Francis G. Hall; the problem of increasing the workman's efficiency has been obtained by Mr. Hall by means of new submarine pneumatic tools, through the collaboration of the Chicago Pneumatic Tool Company.

Blast-furnace Gas-engine Development in Pittsburg District.

Some time ago the Carnegie Steel Company contracted with the Westinghouse Machine Company of Pittsburg for some large blowing engines to be driven by blast-furnace gas. For the purpose of conducting preliminary experimental work, an engine of 350 horsepower, running at 150 revolutions with 30-inch stroke, was installed, and has since made a remarkable record for itself under the severest possible tests for efficiency, reliability and durability. The two gas blowing engines, said to be the largest ever built in this territory, are now under construction at East Pittsburg for the work at the Edgar Thompson furnaces, Bessemer.

These will be twin tandem units, with Slick air-blowing "tubs" arranged in front or facing, with flywheel interposed between the two sides of the engine. Each of these blowing units will have a capacity of 25,000 cubic feet of free air a minute, operating against a normal blast pressure of 18 pounds and running at a speed of 60 to 75 revolutions a minute. When higher pressure is demanded by the furnaces, the valve gear of the engine may be so altered as to deliver air under pressures up to 25 pounds a square inch in proportionately less quantity. These engines are of the heavy-duty double-acting type, as standardized by the Westinghouse Machine Company, and will be among the largest ever constructed for use with blast-furnace gas.

Very recently the Carnegie Steel Company has contracted with the Westinghouse Machine Company for another blast-furnace gas-engine unit, similar in design to the blowing units above mentioned, except that the engine will drive a direct-connected electrical generator for the purpose of augmenting the present power service at the Bessemer works. The gas engine will have the same stroke as the blowing unit, viz., 54 inches, and operating at a normal speed of 75 revolutions per minute, will develop approximately 2,500 brake horsepower on blast-furnace gas. The generator will be a 1,500-kilowatt direct-current machine connected in parallel with the other steam machinery at the present Edgar Thompson power plant.

Forest Preservation in Its Electrical Aspects.

In its recent annual report the board of directors of the American Institute of Electrical Engineers considers the subject of forest protection briefly. It says:

"So far as forest preservation for the benefit of the electrical industry is concerned, forest fires are of fully as great importance as the effect on the lumber industry, and consequently the members of the Institute should be urged to aid in making effective the laws for the control of forest fires. The committee [of the Institute on forest preservation] also recommends that special instructions be given to employes by companies operating waterpower plants and transmission lines that any aid given by their employes in checking such fires is directly beneficial to these companies.

"The committee is convinced that the forestry work that will be most beneficial to the electrical industry is such as will prevent washing away of the land along the banks of the streams, and it is recommended that hydro-electric companies consider the advisability of obtaining from the government or from a committee of the Institute instructions for the preservation of slopes by planting bands of trees or shrubs at such points as will tend to accomplish this result. If a considerable portion of these trees be chestnut or locust a supply of poles and pins may be obtained therefrom in the future, thereby directly benefiting the companies for their efforts. In order to attract the interest of farmers living on the watersheds of streams it will be necessary to aid them by furnishing additional information and instructions. This subject, so far as the committee can ascertain, has not been taken up by any of the forest associations, although it is apparent that the Agricultural Department is endeavoring to aid in the matter."

The foregoing is particularly timely in view of the destructive forest fires in Northern Michigan and Wisconsin a few days ago.

Small Lighting Plant for the Isthmus.

The Isthmian Canal Commission, Washington, D. C., will soon be in the market for a complete electric-light plant for installation at Golgona, on the Isthmus of Panama. It will consist of one 100-kilowatt generating set, one 160-horsepower engine and two 50-kilowatt generators direct connected, one four-panel switchboard complete, with all necessary equipment. The specifications provide for all necessary line material, interior wiring, etc. It is estimated that about 300 cross-arms will be required, together with 1,000 double-petticoat glass insulators, 15 lightning arresters, 47,000 feet of weatherproof wire, 45,000 feet of double-conductor twisted wire, 2,100 incandescent lamps, 2,000 carbons and other miscellaneous material.

A Veto for Niagara Bill.

Governor Higgins has vetoed the bill passed by the Legislature of New York state to regulate the amount of water which may be taken from the Niagara River for power purposes. In his veto memorandum the governor points out that the bill "provides that the rights of existing corporations shall be limited and restricted to take from the river a quantity of water equal to the quantity which said corporations can, by virtue of their present rights, draw under their present charters." "This provision," says the governor, "either is meaningless as being only declaratory of the present law or else it doubles the quantity of water which such corporations may lawfully use."

Opening of Simplon Tunnel.

The Simplon Tunnel was opened for regular traffic on May 19th by King Victor Emmanuel. The king left Domodessola at 10:55 a. m. for Brigue, on the Swiss side of the mountain. The royal train passed through the 12 miles of tunnel drawn by a steam engine, the electric motor cars not being ready. At Brigue the king, who was accompanied by Premier Sonnino, the minister of public works and a large number of other officials, was received by President Forrer of the Swiss republic and the members of the Federal Council, the National Council and the Council of State and other officials to the number of about 500.

German Method of Electrically Towing Boats.

A new method of electrically towing canal boats and barges brought out by Siemens & Halske of Berlin is described by the United States vice consul at Hanover. Originally the engines were built symmetrically, so that boats could be towed at will either up or down the canal. This plan turned out to be unsatisfactory, and a double system of rails, one on each side of the canal, was tried. This proved to work well, and is the system now in use.

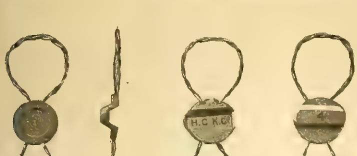
"The gauge of the line is 100 millimeters [illegible], the distance between the wheels 3,700 millimeters. Both wheels run on rails, as the idea of running one wheel on a rail and the wheel nearest the canal on the ground did not give the best results. The wheel frame has in front a turning frame with wheels one meter apart, and a fixed pivot, and a hind longitudinal axle. The total weight of the locomotive is so distributed that the wheels on the land side have to bear the greater portion (six-tenths) in order to keep up the equipoise of the tow rope. For the same reason the pivot of the turning frame is not in the longitudinal axis of the locomotive, but 300 millimeters outside the same toward the land side. Both axles of the turning frame are worked by a 10-horsepower direct-current motor with double-cogged gearing. The motor works at a tension of 550 volts, the speed and steering being regulated by the usual parallel series. When traveling without load the locomotive can go at a speed of five kilometers an hour when the series is used, and when the parallel multiple is used, at a speed of from nine to 10 kilometers an hour.

"The tow pole is worked by a one-horse electric motor, specially provided for the purpose. At the upper end of the tow pole is a funnel through which the towing rope is led, and then wound around a drum. To work this drum there is another electric motor provided, which has a drawing power of more than 120 kilograms. An automatic coupling connects the drum with its shaft, so that, in case of any overburdening, the stability of the locomotive may not be endangered. The driver's place is fixed in front and contains all the controllers for the various motors, the switch for working the tow pole, and a switchboard for the gauges. The locomotive is also provided with the necessary accessories."

A New Form of Sealing Press.

In sealing electric and gas meters, service boxes, fare registers, freight and baggage cars, etc., a lead seal is frequently used which is attached to the fastenings and stamped by a sealing press of some sort. The H. C. K. Company of 45 Broadway, New York city, manufactures a new style of lead seal press, one important feature of which is that it fastens the lead seal to the wire in such a way that it is absolutely impossible to open the seal without cutting the wire. The zigzag-shaped dies

H. C. K. Lead Seal Press.



Lead Seals Applied to Wires.

in the press form the lead seal, as shown in the accompanying illustrations. The initials of the owner of the press can be sunk in the lower die. When several presses are required by one company they are usually numbered consecutively, and the number or figure is sunk in the upper die of the press. The initials and numbers will appear raised on each lead seal which has been closed by the H. C. K. press.

Central stations and railway companies have found it advantageous to number each press which is for use by one employe only, who is held responsible for his press and for all seals bearing his identification number. The importance of this system of meter, fare register and car sealing will be appreciated by superintendents and managers who may otherwise have difficulty in locating the employe who last applied the seal. The H. C. K. press is constructed of malleable iron and the dies are made of tempered steel. A large number of central stations, railway companies and exporters are now using the H. C. K. lead seal presses, seals and wires with satisfactory and profitable results.

Indiana Independent Telephone Association.

The [illegible] meeting of the Indiana Independent Telephone Association [illegible] was held at the [illegible] Indianapolis [illegible] highly [illegible] and [illegible] and the attendance large.

After the reading of the minutes and report of Charles S. Norton, secretary-treasurer, President George W. Beers of Fort Wayne delivered the annual address. Mr. Beers [illegible] upon its progress and [illegible] and emphasized the necessity of [illegible] between the various companies [illegible].

Much interest was centered in the reports of the vice-presidents from the 11 districts [illegible] which make up the state association.

Theodore Thorward of South Bend, vice-president of the first district, reported conditions in the seven counties of his district to be excellent. He said there were seven Bell exchanges with 3,198 telephones in operation in his district against 50 exchanges and 17,295 telephones in operation by the Independents.

William L. Moellering of Fort Wayne, vice-president of the second district, reported great progress and said the Independent telephones in use predominate so largely in his district that the Bell competition was scarcely perceptible.

Walter S. Uhl of Logansport, vice-president of the third district, reported 12,092 Independent telephones in use as compared to 4,103 by the Bell companies. He said 2,000 telephones had been installed by the Independents during the last seven months and that great interest was manifested in the district meetings.

W. D. Curll of Petersburg, vice-president of the ninth district, reported that the companies in his district were constantly increasing facilities in order to take care of the growing business. He said a number of companies had merged with the Central Home Telephone Company of Louisville, and this would result in vast improvements and extensions. Mr. Curll explained the Evansville situation and said that the defeat of the Independents in Evansville was only temporary, and that the people of Evansville are favorable to the granting of a franchise to the Citizens' Telephone Company, which already has more contracts for business telephones in that city than the Cumberland after 30 years of service.

Reports in a similar strain were made by J. A. Brown, vice-president of the fourth district; O. P. Friberg of the fifth district; Earl Talbot of the sixth district; A. L. Mendenhall of the seventh district; A. C. Lindemuth of the eighth district, and C. D. Knoefel of the tenth district.

The evening session was devoted to a smoker. Refreshments were served, after which a number of speeches were made on subjects relating to the telephone business and the conditions of Independent telephony throughout the state and country in general. This session was largely attended.

The first hour of the Friday morning session was devoted to committee reports. The committee on constitution recommended that article 8 be amended so as to provide for the selection of a larger number of delegates from each company and district association to the annual meeting of the state association. The committee on "uniform methods of accounting" reported progress and asked for further time, and the committee on "rates" reported present rates inadequate and far from being commensurate to the increasing and widening of the service and increased cost of the service now being given. The committee recommended a uniform effort to gradually educate the people up to the fact that the larger the plant the greater the cost of service, to say nothing of the increased cost of material for extensions and the high-priced skilled labor required. The committee recommended the cutting out of all free service.

The announcement that Col. J. D. Powers of Louisville would read a paper on "Independent Telephone Securities" served to bring out a large attendance, since the subject is one of much concern in Indiana at present. Col. Powers was unable to be present and his paper was read by Mr. A. L. Tetu of Indianapolis. The paper aroused an interesting discussion.

By a rising vote a petition was ordered sent to the mayor and board of public works of Indianapolis requesting that the franchise of the Indianapolis Telephone Company be so modified as will enable that company to continue to enlarge and extend its system without financial embarrassment, which is likely to result under present franchise rates and conditions. The petition declares that the Indianapolis Telephone Company's exchange system is the essential terminal for the present toll-line company and is vital to the usefulness of Independent toll-line business and the 400 connecting companies in the state.

Likewise a petition was ordered sent to the Common Council of Evansville requesting a grant to the Citizens' Telephone Company of a franchise and thus open the gates of that city and give its people telephonic connection with the great body of Independent telephones throughout Indiana, Illinois, Kentucky and the entire Mississippi Valley.

[illegible]

Indiana Telephone Items.

The Cumberland Telephone [illegible] Company, operating at Jeffersonville, [illegible] tall cities, and [illegible] Jeffersonville can now call 12,000 other [illegible] Louisville, for the [illegible].

Theodore Thorward, president of the South Bend Home Telephone Company, [illegible] a number of Independent telephone [illegible] northern Indiana. This has been [illegible] comment in Indianapolis, [illegible] believed that those in control of the Indianapolis company and the New Long-distance company had hoped to control the entire Indiana field. According to word received from South Bend, Mr. Thorward has made arrangements to take over Independent telephone properties at Fort Wayne, Warsaw, Goshen, Elkhart, Columbia City, Flora and Plymouth, Ind., and Sturgis, Mich.

A strictly rural telephone service is the purpose of the new Hamilton County Telephone Company. The plan is to have exchanges in the small towns which have not yet been served by telephone companies, with the main headquarters in Noblesville and at Sheridan. Six new exchanges will be put in, those at Hortonville and Eagletown to be ready for operation by the first of the month. Fletcher Jessup of Hortonville is president.

The validity of the Central Union Telephone Company's franchise is to be examined by the Indianapolis city authorities. The claim of the company that its franchise is perpetual and limitless is not pleasing to the present administration.

It is announced that arrangements have been made between representatives of the Bell and Independent telephone interests, which, if ratified, will effect a combination of the two companies in Jennings and Bartholomew counties. The Bell company has been asking for a franchise to open a city exchange in addition to the long-distance board it now operates, and the Citizens' company has been bringing pressure to bear to defeat it. O. M. May of Columbus, manager of the Bell, and C. S. Norton of Indianapolis and W. H. G. Butler, manager of the Columbus Independent exchange, appeared before the council at North Vernon to effect an agreement. At Columbus the Bell will close up its city exchange, transferring the city business to the Citizens' company there, and trunk to the Independent exchange for toll business. S.

Telephone News from the Northwest.

The Minnesota Central Telephone Company will install a central-energy system for its exchange in New Ulm, Minn.

The Northwestern Telephone Exchange Company has shipped considerable material to Thief River Falls, Minn., and states that it will install a local exchange there. The City Council objects to a second exchange, but the Northwestern is understood to claim rights of installing an exchange under an old franchise.

H. Hennes has sold his interests in the Le Roy (Minn.) Telephone Company, and will take charge of the People's Telephone Company of Spring Valley, Minn.

The employes who signed a declaration against a strike of linemen of the Northwestern Telephone Exchange Company at St. Cloud, Minn., have been persuaded to walk out.

The Farmers' Telephone Company of Dunnell, Minn., has been incorporated with a capital of $10,000.

The secretary of state of South Dakota has recorded over 60 new telephone companies in the state in the last 10 months. Many of these are rural companies.

The Citizens' Telephone Exchange Company of Montevideo, Minn., has amended its articles of incorporation, increasing its capital stock to $50,000.

The Citizens' Telephone Company of Centerville, S. D., has been incorporated with $50,000 capital stock.

Judge Lochren of the Federal District Court has issued an injunction against the striking telephone linemen in Minneapolis, restraining them from inter

fering with the companies in any manner whatever. This is a result of a clash between union and non-union men in Minneapolis. The order was issued on the application of the Tri-State Telephone Company.

The Northwestern Telephone Exchange Company will erect a handsome new building in Crookston, Minn., to accommodate its local exchange.

The Southwestern branch of the Iowa Independent Telephone Association met at Council Bluffs on May 12th. F. C. Musson of Atlantic was elected delegate to the convention to be held at Chicago in June. H. A. Kinney of Woodbine was elected president and J. F. Glenn of Denison secretary-treasurer. R.

Southeastern Telephone Developments.

A compromise ordinance has been under consideration in Birmingham, Ala., to secure for the People's Telephone Company the same rates as the Bell. It means a reduction for the Bell and an increase for the People's company. The measure is said to be unlikely to pass.

The City Council of Montgomery, Ala., has declined to grant a franchise to C. B. Stark of St. Louis to operate another telephone system in that city. The question had been under consideration for some time and the committee having the issue in hand had made a prolonged examination of the workings of a double service in other towns.

The secretary of state of North Carolina has filed a complaint with the state corporation commission against the Bell Telephone Company for alleged overcharge for long-distance service in the state. The secretary of state asks that the commission set a rate of five cents per minute for the first five minutes and a half that amount for over five minutes' conversation. He also seeks to have rents placed at $1.50 per month for residences and $2 per month for places of business—a considerable reduction on the present schedules.

The Renan Telephone Company has been quartered in Level Run, Va., with W. C. Harvey president. The capital stock is $5,000.

The Schocho Telephone Company has been chartered at Logan, Ky., with $2,500 capital stock. L.

Plans for the Chicago Telephone Convention.

From the headquarters of the National-Interstate Telephone Association in Cleveland announcement is made that an exceptionally interesting programme is being prepared for the convention to be held in the Auditorium Hotel, Chicago, June 26th to 28th. There will be some valuable papers by experienced men, and the Question Box will be given special attention. Besides, matters of importance to the rapidly growing Independent telephone movement will come up for discussion and settlement. The standing committees will submit reports which will be of interest to all telephone men.

An informal banquet will be given at the hotel on the evening of June 27th. This is only one of the entertainment features. The manufacturers and supply men, who are co-operating with the association, will have large exhibits of the latest devices and appliances. The men are also planning pleasant diversions for the delegates between meetings.

Reduced rates under the certificate plan have been secured on all railroads. Full-fare tickets, with a certificate signed by the agent, should be purchased to Chicago by the delegates. The certificates, upon being deposited at the convention headquarters, will entitle the holder to a return ticket for one-third regular fare. The association will give prizes for the best photographs of Independent plants exhibited at the convention.

Manufacturers to Ask Telephone Franchise in Chicago.

Prominent business men, members of the Illinois Manufacturers' Association, appear as incorporators of the Manufacturers' Telephone Company, incorporated a few days ago in Illinois. The company is backed by the Manufacturers' association and will, it is understood, apply to the city of Chicago for a franchise to operate a telephone system. The city, it is said, will be offered a hand in the management of the company and will get some of the profits. Rates from 25 to 30 per cent. lower than the lowest offered by the existing company in the recent negotiations with the city are promised.

The Manufacturers' association has been waging war for five years against the Chicago Telephone Company, demanding lower rates and better service, and the new company it is fostering will take a prominent part in that campaign.

The New England Telephone and Telegraph Company has agreed to install gratuitously a telephone system in Mechanics' Hall, Boston, for use during the reception to the president of the American Medical Association on the evening of June 6th. The system will permit of communication with all parts of the hall from a point behind the stage.

Telephones and Telegraphs in the United States in 1902.

A report on the telephone and telegraph systems and the municipal electric fire-alarm and police-patrol systems of the United States has just been published by the Bureau of the Census. The report does not consider the period since 1902, nevertheless it is of interest as showing the growth and development up to and including 1902. The statistics were collected and compiled under the supervision of Mr. W. M. Steuart, chief statistician for manufactures, and the text was prepared by Mr. Thomas Commerford Martin of New York city, expert special agent.

The statistics of the telegraph and telephone industries of the United States were first shown in the census of 1880. At that time telegraphy had been growing steadily for nearly 40 years and telephony was in the formative stages of development. Since then, however, telephony has progressed to such an extent that it has surpassed telegraphy in physical and financial magnitude.

In 1902 the telephone systems operated more than three-fourths of the wire mileage reported for both telephones and telegraphs, gave employment to seven-tenths of the wage-earners, paid more than two-thirds of the wages, received more than two-thirds of the total revenue and paid more than two-thirds of the total expenses.

Telephones.

The telephone systems are divided into three classes as follows:

1. Commercial systems, including all systems operated by individuals, firms or corporations, primarily for revenue.

2. Mutual systems, including all systems operated through a mutual arrangement among persons deriving benefit from the service, primarily for the benefit of the owners, revenue being incidental to the operation of the line.

3. Independent farmer or rural lines, including all lines having no regular exchange or central office.

In 1902 there were 3,157 commercial systems, 994 mutual systems and 4,985 independent rural lines. For the commercial systems the mileage was 4,779,571, and the number of telephones 2,225,981; for the mutual systems the mileage was 70,915, and the number of telephones 89,316; and for the independent lines the mileage was 49,965, and the number of telephones 55,747.

In connection with the commercial and rural systems there were 10,361 public exchanges. The pay stations numbered 80,870, of which 32,477 were automatic.

The number of salaried employes engaged in the telephone service was 14,124, and the average number of wage-earners 64,628. The amount paid in salaries was $9,885,886 and in wages $26,369,735.

Although there were only 44 Bell systems in 1904, they reported about seven-tenths of the wire mileage for all telephone systems, more than one-half of all the telephones, and three-fifths of the messages or talks during the year. They employed over seven-tenths of the wage-earners and paid almost four-fifths of the wages.

The report shows that on the average there was one telephone to every 34 persons, that each person talked 65 times a year, and that each telephone was used 2,190 times.

In 1900 there were 1,157 incorporated urban centers with 4,000 or more inhabitants. Of these 1,002 were provided in 1902 with telephone systems of some description. San Francisco, with one telephone to nine persons, was the best telephoned city in the United States in 1902; while Cleveland ranked second, with one telephone for every 16 persons; and Boston was third, with one telephone for every 19 inhabitants.

The average revenue per telephone amounted to $37.50 and the average per message to 1.7 cents; while the average operating expense was $24.56 per telephone and 1.1 cents per message.

Reports were received for one system in Alaska, one in the Philippines, and seven in Hawaii. For these nine systems there was an aggregate of 5,518 miles of wire, 2,891 telephones and 3,887,925 messages.

The introduction of the telephone in the United States was followed by its adoption almost immediately in all the countries of Europe and more slowly in other parts of the world. But while in the United States the development of the telephone has been left to private enterprise, in Europe the telephone, along with the telegraph, has remained almost exclusively subject to government control.

In the report a table is given showing the telephone statistics as of January 1, 1905, for the United States and Europe. The number of telephones for the United States was 3,400,000 and the number for Europe 1,485,784.

Telegraph Versus Telephone.

The effect of the telephone in reducing or checking the amount of telegraph business is produced in two ways—by substituting the long-distance telephone call for the telegraph message between two widely separated points, and by obviating to a very large extent the necessity for using the telegraph within city limits.

The rates of the two systems for medium distances do not differ greatly, and for very long distances they are overwhelmingly in favor of the telegraph, if the message be taken as a unit; but if the number of words exchanged be taken into account as well as the time required for getting into communication the telegraph is at a disadvantage in case of a large amount of traffic.

Frequently the brief message will suffice and the written telegram serves as a record; but where a swift interchange is required the telephone seems to have thoroughly established its superiority for social matters and for business. The public employs the telegraph at the rate of only a little more than once a year per capita, whereas the number of telephone messages is already 65 per capita.

Telegraphs.

The telegraph systems are divided into two general classes—the commercial land telegraph and the ocean cable systems, including all systems organized primarily for the transmission of messages for the general public; and the railway telegraphs, including all wires owned and operated in connection with railway systems.

The commercial telegraph systems of the country owned and operated 1,318,350 miles of wire in 1902. In addition there were 16,677 nautical miles of submarine cable. The 25 systems had an investment or capitalization of stocks and bonds, of $162,946,525; a total revenue of $40,930,038; and total assets of $195,503,775. A sum amounting to $15,039,673 was paid in salaries and wages to 829 salaried employes and 26,798 wage-earners.

The railway telegraph systems were reported by 684 companies. They employed 30,336 operators and dispatchers, to whom $20,040,730 was paid in wages. The number of messages sent during the year for railroad business only was 201,743,756 and the number of commercial messages was 4,474,593.

The report contains an interesting chapter on the employment of the telegraph and telephone by the government. It shows the statistics for the telegraph and telephone service of the Signal Corps in the United States, in the Philippines and in Alaska, and discusses the use of telegraphy and telephony in the work of the Weather Bureau and the life-saving service.

Electric Fire-alarm Systems.

Electric fire-alarm systems were installed as early as 1852, and by 1902 there were 764 such systems in operation. There are, however, a great many communities which still retain the inadequate method of notifying the people of the occurrence of a fire by the ringing of a bell or by the blowing of a steam whistle, the number of strokes or blasts indicating roughly the location of the fire.

The practice of putting the fire-alarm wires underground has increased rapidly during late years, and more than one-fourth of the 39,635 miles of such wire was underground in 1902. There were 37,832 signaling and annunciating boxes and 1,900 special telephones for use in connection with the fire-alarm service. During the year 1902, 85,070 fire alarms were turned in through these boxes and telephones. Of these alarms 12,794 were credited to New York, 9,491 to Massachusetts, and 9,027 to Illinois.

Electric Police-patrol Systems.

The combination of the telegraph and telephone as an auxiliary to the police force was first introduced in 1880. In 1902 the police-patrol systems were distributed in 32 states and the District of Columbia. There were, in 1902, 148 police-patrol systems, with 26,350 miles of wire. The signaling boxes numbered 9,476; and the telephone boxes 1,170. Over these instruments 40,626,505 police calls were received or sent. This gives an average per box or station of 3,816 messages during the year, or a daily average of more than 10 calls.

The use of the telephone predominated, the number of telephonic messages being 23,393,812, as compared with 17,232,693 of all other kinds.

In the rural districts the use of the telephone has greatly lessened the labor of sheriffs and constables in connection with the suppression of the "tramp nuisance."

Bell Output for April.

The American Telephone and Telegraph Company reports for April as follows: Gross output, 206,557 instruments, against 174,207 for the corresponding month in 1905 and 102,907 in 1904; returned, 65,357 instruments, against 44,981 in 1905 and 42,335 in 1904; net output, 141,200 instruments, against 129,226 in 1905 and 60,572 in 1904; outstanding April 30th, 6,187,280 instruments, against 4,910,962 in 1905 and 4,032,667 in 1904. The April figures for gross and net output break all records. The previous high records were 193,272 gross last October and 134,395 net last November. The April net output was larger than the net output of any full year prior to 1897.

The Home Telephone Company has purchased for $52,000 a site in Detroit, Mich., for its new exchange building. An eight-story building will be erected. It will be 100 feet square. The company will expend more than $2,000,000 within the city, it is said, in installing its plant.

CORRESPONDENCE.

Great Britain.

London, May 9. There is so much to relate this week concerning power supply and "electric power companies" here that I am afraid my notes must largely consist of the one subject, contrary to custom. In the first place, we have the electric power scheme of the London County Council with us in real earnest, for we are again floundering in a jumble of estimates and tables which are given in that detail which only promoters of electric power schemes know how to produce. But we are able to gather an excellent idea as to the raison d'etre, at any rate in the minds of the council, for the scheme. Put more or less in a nut hell, it is thus: A comparatively large power house already exists at Greenwich, primarily for tramway supply, but which can well be requisitioned for the additional purpose of supplying in bulk to ordinary electric power consumers. Then it is proposed to construct a new generating station to be worked in parallel with the one at Greenwich.

This latter station (Battersea) will be equipped with eight 10,000-kilowatt turbo generator sets, the total capital cost of the station alone being put at $6,000,000. The station would be built in quarters as the demand arises. In all there will be 32 boilers in four rows of eight each. Mr. Rider, the electrical engineer to the London County Council, being convinced that a station divided into eight working units is the most economical division. All through the estimates are higher than those proposed by Mr. Merz last year and also those which he will put before the committee this year.

A further point in the case for the opposition is that by placing the cost of the Greenwich generating station upon the undertaking (it having been tendered for some years ago when turbines were in such a state that the council did not adopt them) a distinct handicap is put upon it compared with what could now be done by a new company starting on fresh ground and with present-day plant. Much is made by the council of the fact that its existing ducts for the tramway cables will obviate considerable breaking up of the streets, but against this the opposition contends that it is next to impossible to "draw in" 0.35 square-inch cables, which are suggested, and that if they have to be laid solid this so-called advantage disappears.

Again, the frequency adopted is 25 cycles, at which but very few of the existing London suppliers, who are the potential customers, generate, and doubt has been expressed as to how these will fare if they wish to take a supplementary supply from the council. While on the one hand the council's engineers contend that it is a perfectly simple matter to change from 25 cycles to any other periodicity required, their opponents deny it and promise to produce a witness who will state that he has tried it and it has failed as a commercial problem.

It is a long time since engineering matters of this description have been fought in the Parliamentary committee rooms, and the proceedings should prove valuable from this viewpoint alone. The end of the case seems very far off, however, for, having existed a week, the committee has not yet disposed of two witnesses. And there are many others.

Another electric power scheme of great interest and which, fortunately, is going forward practically without opposition, is one that proposes to generate electricity by means of gas engines driven by the waste gases from the blast furnaces which abound in the district. The area in question is on the northwest of England, adjoining the Scottish boundary, and contracts have been entered into with several of the large iron mines for the utilization of their waste gases. I do not know that such an idea has ever been put into effect upon so large a scale before and the interest in it is very great.

Yet another matter concerning electric power companies, which is worthy of record, shows the difficulties that have to be encountered here when private enterprise seeks to do anything in which municipalities can have a hand. Several of the earlier power companies had very restricted powers given to them, owing to the uncompromising attitude of the local authorities. Later ones have fared somewhat better, and stirred by this success one or two of the pioneers in this field applied for extended powers, and with the late government in authority their prospects of getting what they asked were very great. But since their bills were deposited the general election came and with it a complete change in the constitution of the government, which, municipally, is now so strong that any opposition on the part of private enterprise is fatal to their schemes. Thus it comes about that the companies in question have been very glad to make terms once again with the local authorities, and in spite of their desires they remain where they were five years ago. It is an open secret that the restricted powers granted five years ago have been the cause of the poor show made by most of the pioneer companies up to date, and the sooner this state of affairs is remedied the better for all.

The Edinburgh Town Council has decided, upon the suggestion of Lord Kelvin, to entertain the American and other foreign visitors in July.

While the attempt to float a company to run [illegible]

[illegible]

Halfpenny tramways [illegible] fail to become [illegible] dropping out of favor, a [illegible]

Dominion of Canada.

Winnipeg, Man., May 19.—The Winnipeg Street Railway Company is now [illegible] to continue its double track on Portage Avenue. The track will be extended into St. Charles. The company and the City Council have [illegible] the question of running Sunday cars and [illegible] to have a majority vote in the [illegible] June. The citizens are clamoring for Sunday cars, and it is not necessary to get legislative authority to run them. The proposed electric street railway belt line in Fort Rouge will be built this year.

The council of Peterboro, Ont., has decided to fix the assessment of the Canadian General Electric Company at $150,000, and in return the company agrees to erect additional buildings to cost $500,000 and employ 2,000 men.

The Winnipeg Street Railway, through Manager Phillips, has notified the City Council that the company will extend its lines to the new City Park, about three miles.

The contract for the masts to carry the British Columbia Electric Company's high-potential wires over the second narrows to make connection with North Vancouver has been let to Ironsides, Rannie & Campbell of Vancouver. The masts will carry the wires 150 feet above high-water mark. The line is now being built and the contract for the sub-station and car barn for North Vancouver will be let in a few days.

The Toronto Electric Railway Company is building some 60-foot cars for the York Radial electric road, costing $8,000 each. Two have already been received. They will run between Sunnyside and Port Credit.

The London (Ont.) Street Railway Company has a large number of men putting up poles and wires for the new Edward Street belt line in South London.

The Toronto Street Railway Company has decided to build two more large car barns and will enlarge its car-building shops and repair shops. The advent of Niagara power and of the radial railways has already led to the erection of some very costly buildings, but a great deal more must be undertaken before the power schemes or the radial-lines system can be fully developed.

The Winnipeg-Selkirk and Lake Manitoba Railway, which has been running by steam since it was built, by permission of the government, is now being electrified.

The recent action of the legislative committee in limiting franchises to 30 years has affected the Great Western Power Company of Brandon, Man. The council of Brandon has now made it 25 years, when the city can take over the electric-light plant and the gas plant.

Strathcona, Alb., is in the market for poles, wire, cross-arms, transformers, arc lamps and regulators. A. J. McLean is the town engineer.

The Manitoba Legislature has given the council of Portage la Prairie, Man., power to borrow $50,000 to construct an electric-light system. Mayor E. Brown will give information.

Citizens of Owen Sound, Ont., have passed a by-law to expend $45,000 for the extension of the electric-light plant, and a like amount to extend the gas plant.

The electric-light plant owned by the town of Indian Head, Sask., and costing $28,000, is now in active operation. The long rows of lights give the town the appearance of an up-to-date city. The lights were turned on a few nights ago for the first time.

The City Council of Calgary, Alb., has authorized the expenditure of $30,000 to double the capacity of the municipal lighting plant.

Fort William, Ont., has instructed Superintendent Jones to proceed with the architect on the building of a new electric-light sub-station, at a cost of $10,000. Electric-light wires will be placed underground.

H.

New England.

Boston, May 19.—Allan Hollis of Concord, N. H., has been appointed receiver for the Exeter, Hampton and Amesbury Street Railway Company on a petition of the holders of the company's bonds, amounting to $225,000. The company is a subsidiary of the New Hampshire Traction Company and operates 18 miles of electric railway. Its summer business is heavy, but the winter traffic is small.

The directors of the Engineering Specialty Company have voted to move the company's manufacturing plant from Meriden to Stamford, Conn. The company will erect a brick building 140 by 150 [illegible]

[illegible]

[illegible] bought [illegible] St. Johnsbury, Vt.

On May 22d the [illegible] New Bedford and Onset Street Railway [illegible] on the proposition to purchase [illegible] ton and Buzzards Bay Street Railway [illegible] which is not operating its railway [illegible] sell it. The directors of the two [illegible] already made a contract for the transfer [illegible] chase price being New Bedford and Onset company's stock, amounting to $[illegible]. The [illegible] and Buzzards Bay company [illegible] ness of $150,000. Its road is 30 miles long and cost between $500,000 and $600,000.

The Owens Manufacturing Company of Boston has been incorporated under the laws of Massachusetts. It has a capital of $[illegible] to do electrical work and plumbing. George W. Fairchild, Everett F. Sweet and Charles H. Coolidge were the incorporators.

The Boston Common Council has adopted a resolution protesting against the erection of any more elevated-railway structures in the city by the Boston Elevated Railway Company.

Melvin F. Underwood has been appointed commissioner of electric lines and lights in Somerville, Mass., by the mayor of that city.

The Massachusetts Electric Companies have refused to grant their employes' demands for higher wages and a working day of nine hours. President Sullivan notified the men that if the corporation acceded to their demands it must either increase the fare unit to six cents or stop paying dividends. Representatives of the employes and President Sullivan will hold another conference. The men threaten to strike if the corporation does not comply with their demands.

B.

New York.

New York city, May 19.—The New York Electrical Society, at its meeting on May 23d, will consider problems relating to city transportation. Two papers are expected—one by Max E. Schmidt, on "The Moving-platform Railway in City Transportation," and the other by F. H. Behr, on "The Monorail Solution of the Rapid-transit Problem." Mr. Schmidt's paper will embody a short historical sketch of the evolution of the moving-platform railway and the apparatus used, including a description of the improvements made since the system was used at the Chicago World's Fair. Mr. Behr will discuss the principles and construction of the monorail system, of which he is the inventor.

The Illuminating Engineering Society, at its meeting on May 11th, discussed street lighting. A paper outlining a method of street lighting by incandescent lamps was prepared by W. Underwood and V. R. Lansingh. In their absence it was read by H. Luritzen. The paper was devoted principally to a description of the lighting on Broadway, Los Angeles, Cal. W. F. Wilcox of Harrison, N. J., read a paper on high-efficiency incandescent lamps for street lighting. "Lighting Streets by the Incandescent Mantle Burner," was the subject of a paper by F. V. Westermaier. Some interesting points were brought out in the discussion of the papers. Besides the authors, the following gentlemen took part in the discussion: J. T. Cowling, W. T. Morrison, J. W. Cowles, T. J. Lytle, W. D'A. Ryan, John Campbell, L. B. Marks, E. L. Elliott and H. Smith. On June 8th the next meeting will be held, when the subject will be "Physiological Effects of Light." Dr. Louis Bell will present a paper on the subject.

In reference to the earnings of the New York city traction companies for the first three months of this year, an official of the Interborough company says that the essential fact is that the nine months ended March 31, 1906, show for the entire Metropolitan system a decrease in the deficit as compared with the nine months ended March

31, 1905, of $370,881. This decrease has been continued during April and May, and will make the net reduction of the deficit by June 30th about $500,000 for the fiscal year.

Lewis Cass Ledyard has been appointed by Mayor McClellan to be a member of the Rapid Transit Commission, to succeed John Claflin, resigned. The appointment was made by authority of the Elsberg bill, signed by Governor Higgins, giving the mayor power to fill vacancies instead of making the board self-perpetuating.

At a meeting of Yonkers citizens on Thursday night, George S. Rice, chief engineer of the Rapid Transit Commission, predicted that the system would be in Getty Square, at Yonkers, and at Coney Island within five years. He said $400,000,000 will be spent in subway construction within six years. Mr. Rice said that two years ago August Belmont had an agreement drawn and ready to sign with the New York Central Railroad providing that the subway should connect with the Putnam branch to Yonkers at Kingsbridge, but before the time for signing the scheme fell through. As a result the subway will now run direct by way of Van Cortlandt Park.

Jesse C. Pierrez, doing business as the People's Electrical Supply Company at 230 Pearl Street, has filed a petition in bankruptcy, with liabilities at $4,585 and nominal assets $4,974. He was formerly in the rubber-goods business from 1899 to 1905, and started this business on December 1, 1905.

William Freeman, dealer in incandescent-light supplies at 60 East Houston Street, has also filed a petition in bankruptcy, with liabilities $2,315 and nominal assets $1,300. He began business in June, 1903, and used the style of the Sunlight Electric Company.

The Coney Island and Brooklyn Railroad Company, the only rival of the Brooklyn Rapid Transit Company, intends to apply for a franchise along streets leading to Bay Ridge and Fort Hamilton. It is expected that the full plans will be made public within a week. Persons who live in the territory south of Prospect Park are heartily in favor of it.

Governor Higgins has signed the bill of Senator Stevens, amending the law fixing the price of electrical current sold in the city of New York by providing that the price for two street lamps attached to a single pole shall be $65 a lamp a year.

C. I. C.

Southeastern States.

Charlotte, N. C., May 19.—The town of Shelbyville, Ky., has granted a 99-year right-of-way to the Louisville and Eastern electric railway, the road to be completed within one year. A line to Eminence is also to be constructed.

The power plant of the Anderson (S. C.) Power Company, destroyed last week, was ignited by lightning, the transformer house being entirely destroyed and the coils on the dynamos being burned. The loss is about $10,000.

Estimates by the Geological Survey place the available waterpower in the Appalachian Reserve and affected territory at 1,000,000 horsepower, which will be greatly protected by the establishment of the proposed national park.

Nesbitt Shoals in Spartanburg County, S. C. Gaffney Shoals in Cherokee County, and Palmer Shoals in Cleveland County, N. C., have been purchased by E. L. Jennings, president of the Colonial Trust Company of Pittsburg, and Lownes Kennedy, vice-president and treasurer of the Colonial company, for approximately $100,000. The three electrical developments will be carried out by the new owners, it is understood. The properties were bought from the Electric Manufacturing and Power Company of Spartanburg.

The Lexington-Winchester interurban electric railway in Kentucky has secured the necessary rights-of-way and will probably begin work on the new line this summer.

Preliminary details have been completed for the organization of the Paris-Mount Sterling (Ky.) interurban electric railway, to connect the two towns named.

The properties of the Bay Shore Terminal (electric) in Norfolk, Va., have been sold to E. B. Smith & Co. for $765,000. However, a litigation has been started, and the F. D. Zell interests have secured a supersedas from the Supreme Court of the United States holding up the sale to the Smith interests, provided a bond of $200,000, to cover damages to the Smith interests, should the lower-court decision in the case in former litigation be confirmed. The purchasing interests are said to be the same that have merged the Portsmouth and Norfolk companies, known as the Norfolk and Portsmouth Traction Company.

The Standard Electric Supply Company has been organized at Charlotte, N. C., and has bought out the stock of the Standard Electric Company.

Frank Head, representing Head & Co., bankers of Louisville, has purchased the entire issue of $250,000 bonds, of the Oconee Water, Light and Power Company of Walhalla, S. C. The company supplies electric power to five towns in South Carolina. The sale was made by Mayor James Thompson and associates.

The extensive new electric plant of the Virginia Passenger and Power Company on the Appomattox River, near Petersburg, will start soon. The four-mile canal has been widened, the flumes completed and the power house finished some time ago. J. E. Harvill, superintendent at Petersburg, states that the machinery will be installed by June 15th.

L.

Ohio.

Cleveland, May 19.—Negotiations are well under way for the absorption of the Canton-Akron line by the Northern Ohio Traction and Light Company. The Canton-Akron company is controlled by the Tucker-Anthony syndicate of Boston. In all it has 85 miles of track. The Northern Ohio Traction and Light Company owns the lines connecting Cleveland and Akron and Barberton, with lines running to Kent and Ravenna as well as the local lines at Akron and the lighting plant there.

Electric-railway men over the state are greatly interested in the long-haul business between Toledo and Dayton. If that proves a success, then there will be an incentive to form larger systems of the roads which have good beds and heavy rails. Since the reduction of steam road fares to two cents a mile there is not much of an inducement in the fare offered by the electric roads, as it will average well up with the two cents a mile. But the fact that cars may be secured often during the day and night and that they are operated upon a more uniform speed than railroad trains still remains a factor to pull business. There are many lines in Ohio which may be united into long and extensive systems for operating purposes, and if the Dayton-Toledo line proves a success it is safe to say that most of the companies are willing to enter into an arrangement that will guarantee a share of the long-haul business along with the good short-haul traffic they already command.

The stockholders of the Columbus, Buckeye Lake and Newark Traction Company have consented to the sale of the property to the Columbus, Newark and Zanesville Traction Company in exchange for $2,500,000 of the common and $500,000 of the six per cent. prefered stock of the purchasing company. W. Kelsey Schoepf stated that in addition to the Columbus and Newark line the purchasing company would own the Newark and Zanesville road and the property of the Zanesville Railway, Light and Power Company. These properties together with the lines between Columbus and Springfield, Springfield and Dayton, Dayton and Richmond, Ind., and Dayton and Muncie, Ind., will be leased to the Indiana, Columbus and Eastern, which will thus control an excellent cross-state system, and as soon as the new line between Dayton and Lima is completed it will have a route traversing the state in the other direction. The offices will be moved to Cincinnati. The members of the syndicate present at the meeting were W. Kelsey Schoepf, John W. Warrington, George H. Warrington, J. B. Foraker, Jr., Hugh McGowan, Frank A. Durbin and Marshall Morgan.

It is now claimed that stockholders of the Eastern Ohio Traction Company have come to an understanding by which an assessment will be paid in and the company reorganized. This will avoid a sale of the property.

Stockholders of the Toledo and Western at Cleveland have given an option on their holdings to an agent of a syndicate which is endeavoring to consolidate all the lines between Toledo and Elkhart, Ind. The death of President Luther Allen, the moving spirit of the company, has proved a blow. Judge Carlos M. Stone was elected to fill his place.

The capital stock of the Wadsworth and Western Traction Company has been increased from $1,000 to $500,000. This is owned by the Northern Ohio Traction and Light Company and it is said that the object is to secure a route toward the south with the idea of reaching Cincinnati in connection with other lines. Surveyors have already run off a line to Mansfield. With a line to Marion, a through line from Cleveland to Cincinnati would be opened.

The New York syndicate which has been arranging for a lease of the properties of the Cincinnati Gas and Electric Company is said to be about ready to close the deal. A. S. White of New York and other members of the syndicate were in Cincinnati a few days ago in conference with the officers of the company.

The Shelby Traction Company has been granted a franchise to build and operate lines on unimproved streets for a period of 25 years in consideration of the payment of $150 a year. The Plymouth-Shelby and the Mansfield, Shelby and Shiloh lines will come into the town over this franchise.

The municipal gas plant at Hamilton has been closed, as it was said to be losing $65 a day for the town.

The Cleveland and Southwestern Traction Company has acquired a tract of land at Elyria and will build new car barns.

P. D. Metzger, representing H. T. Yaryan of Toledo, it is reported, will ask for an electric-light and heating franchise in Cleveland.

Stockholders of the Sandusky, Fremont and Southern will in a short time take action to increase the capital stock from $10,000 to $500,000 or $1,000,000, and a bond issue will be authorized to complete the line from Fremont to Sandusky. The capital stock will be placed in the treasury of the Lake Shore Electric Railway Company, and the bonds will be guaranteed by that company, it is said.

The Hunkin Bros. Construction Company of Cleveland has secured the contract for building a plant for the Crouse-Tremaine Carbon Company of Fostoria. Besides the office building, the six manufacturing buildings will contain 500,000 square feet of floor space.

The Northwestern Ohio Electric Railroad Company of Defiance has been incorporated by E. C. Bell and others. The capital stock is $100,000.

Articles of incorporation have been issued to the Chicago, New Washington and Bucyrus Railway Company, with a capital stock of $500,000, to build an electric road from Chicago to Bucyrus. A. W. Thomas, E. L. Williams, W. H. Foxall, H. E. McCabe and others are interested.

O. M C.

Michigan.

Grand Rapids, May 19.—The Child-Hulswit Company of this city has purchased the Fort Dodge Light and Power Company of Fort Dodge, Iowa. Harry E. Morton, formerly manager of the Boone (Iowa) gas company, will assume active management of the business.

The expense per arc lamp for lighting the streets of Grand Rapids during the last municipal year are given as $35.14. This is a reduction of $5.22 from the cost of the year 1904-05. The figures include everything except interest and depreciation. General Manager Samuel Freshney has been at the head of the Board of Public Works just seven months. During the last year the cost of distribution and maintenance of the lighting system was but 2.10 cents per kilowatt-hour. These figures came out during the discussion of a proposition of the Grand Rapids-Muskegon Power Company to furnish current for the city at a rate of one cent per kilowatt-hour at the city lighting plant. Mr. Freshney is of the opinion that this is too high a rate for the city to pay.

The M. B. Wheeler Company of this city is reported to have given up for the present the project for developing the power of White River, and will develop three properties which it now has on the Manistee River. A project was considered by the city of Muskegon to secure lighting current from the Wheeler company at one cent per kilowatt-hour, the city buying and distributing the current for both city and commercial lighting and power purposes. The Muskegon Traction and Lighting Company is now lighting the city at 12½ cents per kilowatt. The Muskegon-Grand Rapids Power Company has a franchise into Muskegon and the Wheeler company also has a franchise.

Power is being generated on the Shiawassee River for lighting Bancroft, Morrice, Perry and Vernon. Bancroft is now being wired to receive the service.

The annual meeting of the Grand Rapids, Grand Haven and Muskegon Railway Company was held in this city last week, and officers were elected. John D. Hawks of Detroit was made president and W. K. Morley of Grand Rapids general manager.

The Grand Rapids, Holland and Chicago Railway is fitting up new offices in this city, and a new waiting room and baggage room at 75 Market Street.

Construction work on the Toledo, Ann Arbor and Detroit electric railway is at a standstill and the Fidelity Construction Company has moved its engine and equipment to Baltimore, Md., where the company has a contract on the Baltimore and Washington electric line. Since the Patrick Hirsch Company, which had power to build and equip the line, went into the hands of a receiver, its creditors have attached about everything on the grounds.

The Kalamazoo, Lake Shore and Chicago Traction Company is preparing to build a spur to connect with the track of the Michigan United Railway in the city of Kalamazoo that the cars of the two lines may connect.

Grand Blanc will subscribe $6,000 to $10,000 and offer a free right-of-way as an inducement to the Flint, Fenton and Saginaw electric railway to pass through the village.

The Houghton County Street Railway Company is now running express cars over its lines on a regular schedule, with express agents at all of its stations.

General Manager Benjamin S. Hanchett of the Grand Rapids Railway Company of this city is having built at the Cincinnati car works a special car for the use of visitors in inspecting the Grand Rapids Railway Company's lines and those of the connecting interurban roads. The car is 23 feet long, mounted on single truck provided with two 40-horsepower motors and will have a maximum speed of 30 miles an hour. The interior finish will be mahogany, and 12 leather upholstered chairs will be provided. A cooking compartment will be provided for the preparation of light lunches, and an observation platform at the rear. The car will be leased for theater or small trolley parties.

Ramona Theater and Athletic Park opened up the season Sunday with a specially strong list of attractions. All is under the control of the Grand Rapids Railway Company.

L. W. B.

Indiana.

Indianapolis, May 19. The Decatur and Ohio Traction Company has been incorporated and purposes to build an electric railway from Bluffton through Decatur to the Indiana-Ohio state line, about 24 miles. The directors include Harry R. Moltz of Decatur, J. R. Tudor of Van Wert and S. N. Young of Toledo.

Official announcement is made that the traction interests represented in Indiana and Ohio by Hugh J. McGowan and W. Kelsey Schoepf of Cincinnati will construct a new line between Dayton, Ohio, and Richmond, Ind., by way of Brookville, Ohio. It is also announced that the gap between Middletown and Newcastle, in this state, will be closed, and that a new line between Newcastle and Greenfield will be built.

The Board of Public Works of Lafayette has granted the Lafayette Street Railway Company (part of the Fort Wayne and Wabash Valley Traction Company) an 80-year franchise on two streets. The interurban company secures a franchise for 50 years to operate its cars in the city of Lafayette. This grant assures the Logansport and Lafayette interurban.

The commissioners of Green County have ordered an election in 10 townships to vote on subsidies for the proposed Indianapolis, Vincennes and Evansville electric railway. Two routes through five townships have been surveyed. The tier of townships that shows the best results in the election will get the road. Gilbert H. Hendren of Bloomfield is one of the promoters.

It is reported that George C. McCullough and Horace R. Stillwell, acting for the Philadelphia syndicate, have bought the Calumet car line, and thus gain an entrance into Chicago by the Indiana interurban lines. It is now said that the Indiana Union Traction system will rush the completion of of its proposed line from Logansport to Hammond.

The Louisville and Eastern Railway, bought recently by C. Edgar Elliott, F. M. Fauvre and Harry B. Gates of Indianapolis, has filed for record with the county clerk at Frankfort, Ky., a mortgage for $2,000,000, the bonds of the company being guaranteed by the Old Colony Trust Company. It is provided in the mortgage that not more than $450,000 shall be spent for the extension of the road from Shelbyville, Ky., to Frankfort, a distance of 21 miles. Work on the extension is expected to begin as soon as the rights-of-way are secured.

William G. Irwin, manager of the Indianapolis, Columbus and Southern Traction Company, has contracted for the excavation on the 20 miles of the company's extension to Seymour, which forms one link in the Indianapolis-Louisville line, now under construction. The Irwins already run cars from Indianapolis to Columbus, 42 miles, and the extension will give them a little over half the through distance. The remainder of the line is being constructed by the Indianapolis and Louisville Traction Company. Each company will run local cars over its own lines, and a traffic agreement has been made.

The South Bend and Southern Michigan interurban line, connecting South Bend and St. Joseph, Mich., will be formally opened to traffic May 20th.

Operators in the Indiana oil belt are employing electric motors for pumping wells, with excellent satisfaction.

The Indianapolis Board of Public Works will receive bids until June 4th for a new incandescent auxiliary light contract. S. S.

Northwestern States.

Minneapolis, May 19.—R. D. Sprague of Caledonia, Minn., owner of a waterpower on the Root River at Hokah, Minn., contemplates developing electrical power to be transmitted to Hokah, Spring Grove and Caledonia. It has a capacity of 400 to 600 horsepower.

F. L. White, owner of the electric-light plant at Traer, Iowa, proposes to add an engine and dynamo to the equipment, and in the fall a new boiler.

The Great Northern Development Company of Duluth, Minn., has ratified the contracts for the development of 50,000 horsepower on the Mississippi River, between St. Cloud and Minneapolis. The first installation for electric power will be about half of the total amount.

The contract for a new light and power plant at the state university, Lincoln, Neb., has been let to Olson & Lawrence at $3,000.

F. X. Schaefer has applied to the council of Muscatine, Iowa, for a franchise for an electric-light plant.

The City Council at Luverne, Minn., has voted to completely remodel the electric-light system, discarding the old arc lamps for incandescents and enclosed arcs.

A franchise has been granted to N. Newbanks of Pierre and F. Fischer of Fort Pierre to construct a steet-car system at Pierre, S. D.

The Mondovi (Wis.) electric-light plant will be closed and current for light and power will hereafter be supplied from Eau Galle.

It is reported that Chicago interests are negotiating for the purchase of the LaCrosse (Wis.) Gas and Electric Company's system. W. D. Woods of Chicago has been carrying on the negotiations, it is said.

The Chippewa Valley Electric Railroad Company of Eau Claire, Wis., will expend [illegible] in the development of more [illegible] and in remodeling its system, which [illegible] practically rebuilt. R.

Illinois.

Peoria, May 19. At Beardstown [illegible] are making an effort to have [illegible] which is building an electric line between [illegible] and Lewistown, extend the line to [illegible] city [illegible] would give them direct [illegible] Peoria.

Emil G. Schmidt of Springfield [illegible] Peoria this week. He is general manager of the Springfield gas plant and the electric-light plant [illegible] is also interested in the street railway [illegible]. He was accompanied by D. H. Walbridge of New York.

The Peoria Gas and Electric Company has been granted a permit to extend its gas mains and electric lines into the township outside the city limits.

The permit for erection of the power house of the Illinois Traction Company was granted this week and calls for an estimated cost of $25,000, exclusive of the machinery.

The Central Union Telephone Company, having repaired the cable which crosses the river here, communication with up-river points has been restored.

F. J. McNulty, president of the International Brotherhood of Electrical Workers, which has headquarters in Springfield, has gone to New York. He will join the municipal-ownership committee of the National Civic Federation, which is going abroad to visit most of the successful municipal plants.

The National Improvement and Construction Company of Cairo has been incorporated with a capital of $2,500, to build and operate street railways. Peter Arlund, James H. Mulcahy and S. H. Yates are the incorporators.

The Gray National Telautograph Company of Richmond, Va., has been granted a permit to do business in Illinois. Capital in Virginia is $15,000,000, in Illinois $27,000. The offices are in Chicago. V. N.

Pacific Slope

Oakland, May 16.—The San Francisco, Oakland and San Jose Railway Company opened on May 16th a new double-track electric street railway extending about two miles from the electric power house near the Key Route mole to a junction with the Broadway lines of the Oakland Traction Company. This fills a long-felt want, enabling the Key Route commuters to journey from San Francisco by ferry and electric trains to a point within five blocks of the Oakland business center without change of cars or payment of an additional fare. The Key Route was already operating in connection with its San Francisco ferry system electric trains to Berkeley Station via Lorin, Golden Gate and Ashby, and, on another line, to the Piedmont district.

The Allis-Chalmers Company is now thoroughly down to business at 906 Broadway, Oakland, the temporary offices. It reports good deliveries of freight and a big demand for the new stock of induction motors. This company has closed a contract with the Trinity-Bonanza King Mining Company for a complete electric equipment for its new waterpower plant, which is to be installed soon. Deliveries are to be made at Marysville, Cal. The three-phase generator will supply sufficient electric power at 6,600 volts for motors aggregating 800 horsepower in capacity. Power will be transmitted six miles. The Westinghouse and General Electric companies are also receiving lots of freight at their new Oakland warehouses.

The council of Falls City, Ore., has passed an ordinance granting a franchise to the Luckiamute Valley Water and Electric Manufacturing Company for an electric-light and power plant and manufacturing company in that city.

An ordinance has been passed granting M. F. Kincaid and associates of Seattle a 50-year power, light and heat franchise in Olympia, Wash.

It is reported that Mayor Waterhouse of Pasadena is in favor of purchasing the Pasadena plant of the Edison company and that Manager Selig of the Edison company has said that any proposition made by the city would be considered. This would give Pasadena two plants—one private and one owned by the city.

Work has been begun in replacing the mule-car line with an electric system on the University line at Tucson, Ariz., and as soon as completed work will be started on the road to Elysian Grove.

The California Street Cable Company of San Francisco, whose power plant at California and Hyde streets was destroyed, is making rapid preparations to rebuild.

M. F. Donohue, formerly connected with the Kansas City, Pittsburg and Gulf Railway, acting for Eastern capital, has secured a franchise from the city of Gresham, Ore., for lighting that city for 25 years. Power will be developed from Badger Creek. The same company has secured controlling rights in many of the streams flowing from Mount Hood and is in a position to furnish all light and power needs of the entire district from Mount Hood to the city limits. A.

PERSONAL

[illegible]

[illegible] all the [illegible]

[illegible]

[illegible] week.

[illegible]

[illegible] the Mi[illegible] in the company.

Henry J. Stone of the [illegible] Company, Chicago, and R. [illegible] White of the American Steel Wire Company, were [illegible] Chicago Credit Men's Association at the [illegible] meeting and dinner held recently. The association was incorporated last December and now has a membership of 478.

W. N. Zurfluh, superintendent of the Home Light, Power and Heating Company of Springfield, Ohio, has resigned to go to Dayton, where he will be in charge of the new Arcade Building electric-light, heat and refrigerator plant. He was with the Springfield company when the plant was built and since has built up a large business.

Charles Frederick Thompson, secretary and treasurer of the Brattleboro Gas and Electric Light Company, died in Brattleboro, Vt., on May 11th. He was born in Seymour, Conn., in 1831, and came to the light company in 1892. He was the first president of the Brattleboro and Whitehall Railroad Company and was prominent in church work.

Prof. William Ostwald has resigned the professorship of chemistry at the University of Leipsic as a result of his displeasure at the lack of support accorded to his chemical researches. He will establish a private laboratory. Dr. Ostwald, it will be remembered, lectured at Harvard a few months ago under the arrangement for the exchange of professors between American and German universities.

Charles D. Livermore, chief operator in the Western Union Telegraph Company's Portland (Me.) office, died May 16th of blood poisoning. He was manager of the Western Union office in Portland for 36 years, but was put in charge of the operating room four years ago. He served in the Union Army during the Civil War. He was well known to old telegraphers in all parts of the country.

Mrs. R. E. Tutt, well known in California as a central-station manager, has gone to the Philippine Islands with her daughter to spend several months. Mrs. Tutt took to electrical work 11 years ago. She then lived in Butte, Mont., but went to Southern California, where her father and brother were mining engineers. Seeing an opportunity she got a franchise and built an electric-light plant in San Pedro. Later she built a larger system and extended the lighting to Long Beach. She also laid a submarine cable to carry current to Terminal Island. At present she is installing two large power plants near Prescott, Ariz., for the Arizona Power Company and the Prescott Power Company. She has an interest in both companies.

H. C. Baker, formerly in charge of the Atlanta office territory of the Crocker-Wheeler Company, in which capacity he became favorably known as an electrical engineer throughout the southern industrial field, has started for San Francisco, where he will take charge of the Pacific Coast territory of the Crocker-Wheeler Company. The offices at Fremont and Howard streets, San Francisco, were completely destroyed by the recent fire, and temporary offices have been established at 2611 Broadway. Mr. Baker will enter an active field of electrical development in which the company is already conspicuously established by its installation of 4,000-kilovolt-ampere alternating-current generators in the plant of the California Gas and Electric Corporation. These machines, the largest gas-engine-driven alternators in the world, escaped damage in the recent disaster.

ELECTRIC LIGHTING.

Incorporators of the Elgin (Ill.) Merchants' Light Company will ask for a franchise at once. The company proposes to provide electric power as well as light, and will extend its wires in all directions within the city limits. Wires will be laid underground wherever specified by the council. At present the capital stock of the company is only

$2,500. This will be increased materially within a short time.

J. Mahaney and others will put in an electric-light plant in Minnewaukon, N. B.

The Augusta (Ark.) Power, Light and Water Company has been incorporated with a capital of $50,000.

The City Council of Fremont, Neb., has decided to rebuild the light and water system at a cost of $80,000.

The village of West Milwaukee, Wis., recently incorporated, proposes to establish electric lighting. George Breu is village president.

The Parsons Electric Light and Power Company of Parsons, Kan., is improving and extending its lines at an expense of about $35,000.

B. R. C. Brown, president of the Roaring Fork Electric Light and Power Company, Aspen, Colo., is going to build another big plant to be situated a few miles below Aspen.

Another effort for the establishment of an adequate electric-light plant in Tecumseh, Neb., is to be made by the Commercial Club. The committee will take the matter of a special bond election up with the council at the regular meeting on June 5th.

The Mankato Gas and Electric Company of Mankato, Minn., is planning extensive alterations and improvements. The company has hope of interesting a large percentage of the merchants in electric signs and has secured the services of an experienced solicitor, who will solicit business of this kind and design signs for prospective patrons.

The Union Central Light and Ice Company of Hubbard City, Texas, has been chartered, capitalized at $25,000. The company will generate current for light and power for commercial use, and will manufacture artificial ice, carbonated drinks, mineral waters, etc. W. A. Bass is president and manager of the company. With him are associated J. F. Waller and J. M. Carrol.

John A. Masters of El Reno, Okla., has purchased a controlling interest in the Shenandoah (Iowa) Electric Light Company and will take active charge of the plant. A reorganization of the company took place following the purchase and Mr. Masters was chosen president as well as one of the board of directors. W. C. Crose was made secretary and George Bogart, whose interests largely passed into the hands of Mr. Masters, was made treasurer.

Submarine incandescent electric lamps were used recently at Union Lake, near Millville, N. J., in the search for the body of Richard, the nine-year-old son of Daniel C. Lewis, president of the Millville Traction Company. The boy and Thomas P. Clark were drowned while canoeing. The lamps were connected to long lines of insulated cable and lowered into the water so as to enable the search to go on at night. The lake is comparatively small, and the traction company ordered all its linemen to assist in the work, so that the whole bottom of the lake might be illuminated.

A feature to be introduced at the senior ball of the University of Illinois on June 11th is a scheme of electrical decorations to be executed by H. E. Page. A part of the scheme is to have special lighting effects for five of the different dances. For instance, there will be a 1906 dance, during which a cherry and gray lighting effect will be produced. During the playing of "Moonlight" there will be a moonlight scene, and, besides these, there will be three other appropriate effects, all involving a lighting scene. For the benefit of the spectators a colored-light effect is to be produced during one of the first dances. Mr. Page is a practical electrician, having had charge of several similar schemes. He is a member of the class of 1906 in electrical engineering and was for several years with the Kewanee (Ill.) Light and Power Company.

ELECTRIC RAILWAYS

The Memphis and Horn Lake Railroad Company, now in process of organization, proposes to build an interurban electric railway from Memphis, Tenn., to Horn Lake, Miss., on the Mississippi-Tennessee state line, a distance of about 15 miles.

The Suffolk (Va.) Light and Ice Company's plant has been purchased by the Norfolk and Portsmouth Traction Company for $50,000. The traction company will operate local trolleys; also an interurban line between Suffolk and Norfolk. The contract for lighting the streets of Suffolk is included in the transfer.

Work which has been delayed on the South Side elevated-railway extension by the strike of the structural steel workers, which was called off recently, will be pushed with all possible haste, and it is expected that express service will be in operation on the third track by September 1st. The company has purchased 150 new cars, which will increase the carrying capacity of the road 25 per cent. Some of the cars have already been delivered. There is plenty of material on hand to keep the bridgemen busy for weeks, and it is probable that the men will be worked in two shifts to expedite erection work.

The Commercial Club of Biloxi, Miss., has decided to urge the Gulfport and Mississippi Coast Traction Company to build an electric belt railway around the city and establish, in connection with the new line, a freight traffic between Biloxi and and Gulfport, to make a connection with the Gulf and Ship Island and Illinois Central railroads.

Articles of incorporation for the Paris and Mt. Sterling (Ky.) Railway have been filed. The incorporators are John T. Collins and W. A. Thomason of North Middletown. D. C. Talbot, Henry A. Power, R. J. Neely of Paris and others. This is the initiatory step taken toward building the line from Mt. Sterling to Paris via Sideview and North Middletown.

A charter was granted to a company which will construct a new interurban electric railway through Southern Kansas and Missouri. The title of the company is the Southern Kansas Railway, Light and Power Company and the capital stock $4,000,000. R. C. Rawlins, C. K. Rosenthal and others of Chanute, Kan., are interested. The headquarters of the company is to be at Chanute.

The Chehalis (Wash.) City Council has voted unanimously to grant a 35-year franchise to the Centralia-Chehalis Electric Railway and Power Company. This is a company organized last fall by W. U. Canon and others to build an electric railway between Chehalis and Centralia. Representatives of the company recently appeared before the council, urging the immediate granting of the franchise and representing that if the same passed early the construction of the line was practically assured, with extensions to Portland and Tacoma.

POWER TRANSMISSION

The Coal Creek Power Company has been organized at Henryetta, I. T., with a capital stock of $10,000. It is proposed to build a large power plant. The incorporators are J. W. Stewart, W. N. Martin and William Stockleberg.

The legal battle for the control of waterpower rights valued at over $1,000,000 was begun in the Circuit Court in Joliet on May 21st, when the suit of the Sanitary District of Chicago against the Gaylord-Monroe syndicate to condemn property held by the latter was commenced. Each side claims the right of eminent domain.

The most prominent of the proposed waterpower companies in Japan is the Ujikawa Electric Power Company, with a capital of $10,000,000 and a development of 40,000 horsepower. This company will furnish the city of Kyoto and vicinity with electric power. Among others is one for supplying Nagoya, where the power will be used by the Miye Cotton Spinning Company, Nagoya Electric Light Company, Nagoya Electric Tramway Company, and the Atsuta Arsenal. It is also the intention of the Hanshin Electric Railway Company of Osaka, which connects that city with Kobe, to use waterpower for generating the electricity required by its lines.

PUBLICATIONS.

A small bulletin issued by the Stanley-G. I. Electric Manufacturing Company gives descriptive matter concerning hanger boards and pendent push-button switches, etc.

In an illustrated bulletin about the application of storage batteries to lighting and power plants the Electric Storage Battery Company describes a number of fine residential plants in which Chloride accumulators are used in connection with the generating plants to give 24-hour service.

The Selling Magazine, a monthly publication intended to show "how most economically and satisfactorily to market machinery, tools, equipment and supplies," has made its appearance. It is published in New York (Postal Telegraph Building) by Emerson P. Harris, well known in class journalism, and the first number has a bright, clean-cut, up-to-date appearance.

The new features of the C-W core-type transformers, described in bulletin 65 of the Crocker-Wheeler Company of Ampere, N. J., just issued, will interest everyone who follows the development of American electrical manufacture. One of these 667-kilowatt 35,000-volt transformers was subjected recently to a test of 60,000 volts from primary to ground. This pressure was applied to the transformer after it was removed from the case and not immersed in oil.

Two new bulletins from the Cooper Hewitt Electric Company describe respectively the new type C alternating-current lamp (indoor form) and the types K and H direct-current lamp, also for indoor illumination. The type C lamp is a combination of the principles of the direct-current lamp and the mercury converter. The details of its construction are fully set forth in the bulletin. The bulletin on the direct-current type is likewise complete in the descriptive matter, and the two are an important addition to the literature on Cooper Hewitt apparatus.

The Manhattan Electrical Supply Company is now located at 17 Park Place (through to 14 Murray Street) in New York, where it has a thoroughly complete and roomy supply house. To remind its numerous friends of the change the company is mailing a unique folder which says that the company is now "Only 45 minutes from Broadway." The outside of the folder bears a picture of downtown New York, with familiar buildings and streets, and showing the location of the company's headquarters. On the inside is a map giving more accurately the same information.

"The City Unburnable" is the suggestive title of an interesting pamphlet issued by the National Fireproofing Company, with principal offices in Pittsburg, Pa. The pamphlet, which, by the way, is especially attractive from an artistic viewpoint, is devoted chiefly to a description of the new Fire Underwriters' Laboratories in Chicago, which was described at some length in the Western Electrician of November 4, 1905. This building is fireproof throughout, and is a model of its kind. The materials used in its construction were the product of the National Fireproofing Company.

SOCIETIES AND SCHOOLS.

Members of the executive committee of the American Street and Interurban Railway Association met in Columbus, Ohio, a few days ago to formulate plans for the annual meeting to be held in Columbus in October. They were entertained by the convention committee of the Board of Trade at the Chittenden Hotel. In the evening the committeemen gathered about a circular table for dinner. Around the centerpiece a tiny electric railway was constructed. Operated by electricity, a small car ran out on the track and stopped in front of each man as his time came to speak. W. Caryl Ely, J. H. McGraw, B. V. Swenson, George Kegan, H. W. Blake, J. R. Elliott, E. H. Baker, C. K. King, C. C. Peirce, F. W. Brooks, Richard McClintock and D. B. Dean were present. The local men were H. C. Pirrung, J. Y. Bassell, Frank Davis, E. K. Stewart, G. T. Adams, H. M. Daugherty and Edwin Sharp.

TELEGRAPH.

Secretary Taft has been urging before the House committee on interstate and foreign commerce the military necessity of a government cable to Guantanamo, Cuba, Porto Rico and the Isthmus of Panama. The total cost, he said, of a cable to touch Cuba, Porto Rico and Panama is estimated at $1,300,000. It could be laid by converting the army transport Sumner into a cable ship at nominal cost.

A cable concession was recently granted by Colombia, S. A., to Francisco J. Fernandez. Coast merchants are now compelled to send their cable messages overland a distance of 1,500 miles to Buenaventura on the Pacific side, causing great delay. The concession will allow of the laying of a cable which will avoid this repetition. The concession includes also the exclusive privilege of erecting wireless-telegraph stations within the jurisdiction of Colombia. In that respect Savanilla, the seaport of Barranquilla, offers unusual advantages for the erection and successful operation of a wireless station. Stations are already established in Colon, Bocas del Toro, Port Limon, Bluefields, and many other ports of the West Indies.

MISCELLANEOUS.

An electric magnet capable of unloading a carload of pig iron in three hours, with only one man in the crane, is installed at the Buckeye Engine Works, Salem, Ohio. To unload this amount by hand required the services of six men for six hours.

Speaking at the Royal Institution, London, recently, Mr. C. A. Parsons caused some surprise by announcing that a combination of the reciprocating engine and the steam turbine would soon be tried in a cargo boat of moderate speed. The reciprocating engine would use the steam down to the atmospheric pressure, and the turbine would use the expansion down to the condenser. There would be a saving, he estimated, in the cost of coal of from 15 to 20 per cent.

The meteorologic service in Belgium will shortly begin a series of aerial experiments, to be continued at regular monthly periods. G. W. Roosevelt, United States consul, writes that these experiments will consist of flying testing balloons, provided with instruments for registering atmospheric pressure and the temperature and moisture of the air. As the balloons will not be large, varying from three to six feet in diameter, and capable of carrying only a few pounds in weight, the success of the experiments will in part largely depend upon the co-operation of the public, as the service must rely upon the good-will of persons finding the balloons after they have fallen to earth

to recover the instruments. Directions will be attached to each balloon and the finder will be paid for returning it.

TRADE NEWS

The Jackson Electrical Supply Company of Muscatine, Iowa, has been incorporated.

The Standard Electric Supply Company of Bisbee, Ariz., has sold its business to the Bisbee Plumbing Company.

Announcement is made by Dodge & Day, engineers of Philadelphia, of the removal of their offices to suite 597 Drexel Building.

The Fort Wayne Electric Works has established temporary offices at 67 Blake Block, Oakland, Cal., but will occupy rooms 403-5 Atlas Building, San Francisco, as soon as the building is ready for occupancy. The company has replaced its stock which was destroyed by fire.

The Navy Department, through the Bureau of Yards and Docks, is inviting sealed proposals until June 2d for furnishing two motor-generating sets at the New York navy yard. Specifications can be seen at the bureau or will be furnished by the commandant of the yard named.

Sealed proposals for the erection of a power house, installation of boiler plant, generating machinery, main switchboard, steam-laundry equipment, refrigeration plant, power-house piping, etc., will be received until June 28th by the constructing officer, United States Soldiers' Home, Washington, D. C.

Bids for the installation of machinery to constitute the new electric-lighting plant near the capitol, Washington, D. C., will be opened at the offices of J. G. White & Co., New York city, on June 2d. The bids call for engines, electrical generators and other necessary machinery. The company mentioned will have charge of installing the plant.

Sealed proposals will be received at the office of the United States Reclamation Service, 876 Federal Building, Chicago, until July 7th for manufacturing and furnishing complete 10 or more motor-driven centrifugal pumps of five-second-feet capacity, to be used on the Garden City project at Deerfield, Kan. Particulars may be obtained by application to the chief engineer of the Reclamation Service, Washington, D. C., or to O. H. Ensign, electrical engineer, 321 Merchants Trust Building, Los Angeles, Cal., or to C. E. Gordon, engineer, Garden City, Kan. E. A. Hitchcock, secretary.

The increased imports during 1905 at Kobe, Japan, through which port machinery is imported for the industrial centers in and about Osaka, is stated by a newspaper sent by Consul-general Miller of Yokohama to be astonishing, the total amounting to $5,059,000, over three times the value imported in 1904. Of all machines, lathe machines made the highest increase, amounting to $1,240,000 in round figures. [illegible] and wood work, [illegible] locomotives and [illegible] various descriptions [illegible] $250,000 on the [illegible] for 1904.

The American [illegible] of Pittsburg, Pa., has appointed [illegible] Liberty Street, N. Y., [illegible] agent [illegible] fitting in the metropolitan district. [illegible] company believes that it has [illegible] in selecting Mr. Calpin for the [illegible] tion is an important one in view of the [illegible] growth of the company's business [illegible].

The Bureau of Supplies and [illegible] Navy Department is inviting sealed proposals [illegible] June 12th for furnishing western [illegible] the following supplies: Schedule [illegible] schedule 552, motors. Blank proposals can be obtained upon application to the Navy Pay Office, San Francisco, or to the bureau at Washington. On June 5th the bureau will open bids for furnishing various eastern yards with supplies as follows: Schedule 556, incandescent lamps, miscellaneous electrical supplies; schedule 558, meters. Proposal blanks are obtainable at the Navy Pay Office in New York or upon application to the bureau.

A decision from the Board of United States General Appraisers on May 12th partially sustained claims filed by Hugo Reisinger of New York regarding the rates of duty to apply to unfinished carbons for electric-lighting and battery carbons. Collector Stranahan assessed duty on all the merchandise at the rate of 90 cents per 100 sticks, which, in the case of the battery carbons, was equivalent to a customs tax of 1,100 per cent. ad valorem. The board, therefore, holds that the collector erred in his assessment on the battery carbons, the proper rate of duty being 35 per cent by similitude to "carbon not decorated." The assessment on electric-lighting carbons was affirmed.

BUSINESS.

Final transfer of the Pensacola (Fla.) Electric Terminal Railway Company to Stone & Webster of Boston has been completed, and the new owners are now in charge.

In addition to the office recently established at 906 Broadway, Oakland, Cal., the Allis-Chalmers Company has opened another in the Atlas Building, 602 Mission Street, "New" San Francisco.

The Newton (Iowa) and Northwestern Railroad Company has awarded a contract for the construction of a large power plant at Fraser. It is said the company will equip its lines with trolleys this season.

The Bloomington and Normal Railway and Light Company of Bloomington, Ill., is making active preparations toward the remodeling of its power plant, which will be located on the site of the old [illegible]

Will [illegible]

[illegible] 270 Fifth Avenue, Chicago.

The installation of electric power [illegible] certain classes of service [illegible] chines be totally enclosed [illegible] be protected to exclude flying [illegible] where electric machines [illegible] service the Northern Electrical Manufacturing Company, Madison, Wis., applies [illegible] tecting covers which not only afford the required protection against dust or other matter, but are readily removed, thus making it easy to [illegible] running parts. This insures the satisfactory operation of Northern protected and dustproof machines in all classes of service. The company also frequently applies direct-current motors for operation in wet locations where provision has to be made not only for the exclusion of moisture but water [illegible]

The H. W. Johns-Manville Company of New York is now placing upon the market and installing sectional tile pipe conduit, which provides a conduit for pipes running underground, which insulates and protects the pipes, and which can be installed for a reasonable cost. This is known as the "J-M" Portland sectional conduit, and consists of tile pipe made in top and bottom sections. This division is made by cutting half through the shell of the pipe before it is baked and then breaking afterwards so that the joint is much like that made in replacing pieces of a broken plate, the use of neat hydraulic cement making it possible to put these sections together when desired, making practically a perfect looking piece again. As the top and bottom sections are numbered to correspond, the same sections can always be mated, and thus a perfect joint is secured.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 15, 1906.

820,396. Rod-rolling Mill. Fred H. Daniels, Worcester, Mass. Application filed August 1, 1902.

The mill rolls are operated by a series of motors. The motors are connected directly to the spindles of the rolls and are also operatively connected to a generator supplying current through suitable switching devices.

820,407. Electric Railway. John A. Garey, Tarkio, Mo., assignor of one-fourth to George G. Garey, Indianapolis, Ind. Application filed May 23, 1905.

A pair of sills carry a third rail supported by one of the sills, a plow being disposed between the sills and a vertical spindle journaled in the plow. Rocker arms extend from the spindle, a current-collecting wheel being carried by the arms and engaging the third rail. Means at the upper end of the spindle rock it to permit adjustment of the current-collector from side to side of the space between the sills.

820,411. Railway Signaling System. Henry W. Griffin, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed January 18, 1905.

A signal device constructed to usually give a danger indication has an operating mechanism for moving it from danger indication to safety indication, means for at times holding it in its safety indication and an electric circuit for the holding means usually closed. A motive-power circuit normally disabled and energized by the action of a train on a track-circuit, and another track-circuit for controlling the motive-power circuit and the circuit of the holding means are the remaining features.

820,412. Railway Signal System. Henry W. Griffin, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed January 31, 1905.

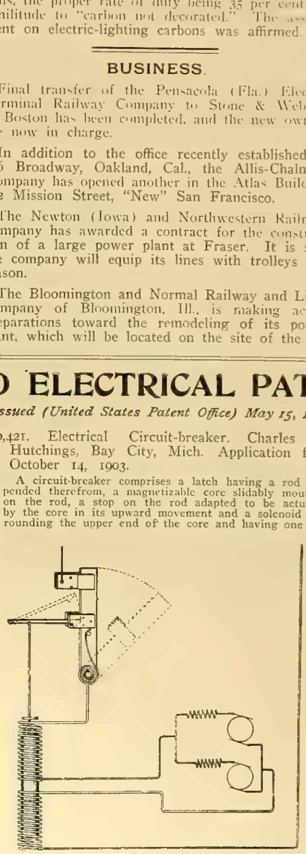
A clearing relay with neutral and polarized contacts at each signal affects the clearing of a signal, a polarized circuit controlling and operating the clearing relays; the circuit is opened or closed or the flow of current therein reversed by track relays to affect the next clearing relay in advance.

820,414. Lamp Pendant. Herbert W. Hanwell, Northampton, England. Application filed December 9, 1904.

Mechanical features in a lamp pendant are set forth in the patent.

820,421. Electrical Circuit-breaker. Charles F. Hutchings, Bay City, Mich. Application filed October 14, 1903.

A circuit-breaker comprises a latch having a rod suspended therefrom, a magnetizable core slidably mounted on the rod, a stop on the rod adapted to be actuated by the core in its upward movement and a solenoid surrounding the upper end of the core and having one end



NO. 820,421.—CIRCUIT-BREAKER.

electrically connected to the circuit-breaker and having its other end connected to the electrical device to be protected. A second solenoid surrounds the other end of the core and is connected to one end of the device, whereby current is carried through the circuit-breaker, first solenoid, device to be protected, second solenoid and thence back to the source of current. (See cut.)

820,423. Trolley for Overhead-trolley Systems. Ezra F. Landis, La Salle, N. Y. Application filed February 20, 1905.

A trolley pole has a trolley head with a trolley wheel revolubly mounted in the head, and retainer-arms lying lengthwise within the head and above the trolley wheel and pivotally supported at their front ends.

820,429. Apparatus for Ascertaining the Level of Liquids. Charles May, London, England. Application filed July 25, 1904.

Apparatus for ascertaining the level of liquids consists of a series of insulated rods of different lengths, a corresponding series of terminals, each connected to one of the rods, a switch free to move over the terminals, an indicator and an induction coil. To the secondary winding of the coil is connected the switch and the indicator, the primary winding being in circuit with a source of electricity. (See cut on next page.)

820,440. Trolley Pole. Robert P. Rever, Newark, N. J., assignor of one-half to Everett Irving Rever, Newark, N. J. Application filed February 18, 1905.

In the mechanical construction of the pole are two hinged joints, which are held normally straight by a pair of leaf springs at each joint.

820,463. Attachment for Telephone Receivers. Casper Zimmerman, Aberdeen, S. D. Application filed November 4, 1905.

A head-piece attachment for holding the receiver to the ear is described.

820,464. Self-acting Electrical Rope-straining Device. Otto Adam, Dresden, Germany. Application filed February 16, 1905.

Means operated by a motor for taking up the slack in electric cables are described.

820,481. Trolley. Jacob R. Deily, Philadelphia, Pa. Application filed September 5, 1905.

Two grooved trolley wheels are pivoted to a frame on the end of the pole. The pivotal connections are so arranged that a straight line connecting the axes of the wheels intersects the pivot of the frame.

820,482. Apparatus for Treating Liquids. Léon Dion, New York, N. Y., assignor to the American Electro-Hermatic Company, New York, N. Y. Application filed May 24, 1904.

Positive and negative electrodes are situated in a contracted chamber of the vessel containing the liquid to be treated. The material separated by the elec-

trolytic action descends into another compartment of the vessel.

820,488. Electric Railway. John A. Garey, Tarkio, Mo., assignor of one-fourth to George G. Garey, Indianapolis, Ind. Application filed May 25, 1905.

Third-rail supports include hollow crosstics arranged at intervals and means for forcing accumulations of dirt and foreign matter into the crosstics.

820,489. Ballast Device for Nernst Lamps. Ludwig Glaser, Berlin, Germany. Application filed June 8, 1905.

Ballast for second class conductors comprises a resistance having a high temperature coefficient, a second resistance operatively related thereto and automatic means for connecting the second resistance in shunt with the first resistance after the latter has attained a suitable temperature. (See cut.)

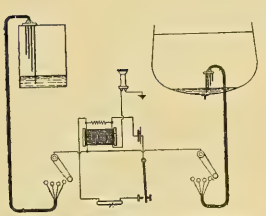
820,491. Electric Switch. David E. Gray, New York, N. Y. Application filed February 21, 1905.

An insulating base, a main contact, a switch arm pivotally carried thereby, a pair of contact members projecting above the surface of the base and adapted to be engaged by the switch arm, and another contact movable in the base with means for connecting the pair of contacts automatically when engaged by the switch arm are specified.

820,496. Automatic Circuit-breaker. Dag Hoyem, Brooklyn, N. Y. Application filed October 24, 1904.

Combined with a toggle for holding the switch closed are a pivoted frame, a spring mounted thereon and connected with the toggle, a detent for holding the frame in ineffective position and means connected with the toggle for assisting to swing the frame into effective position.

820,498. Elevator-control System. John D. Ihlder, New York, N. Y., assignor to the Otis Elevator Company, East Orange, N. J. Application filed February 16, 1905.



NO. 820,429.—APPARATUS FOR DENOTING LEVEL OF LIQUIDS.

Associated with a car and its motor are motor-controlling means connected to reduce the speed of the motor at any predetermined point in the traverse of the car and automatic means operating with the motor-controlling means for proportioning the reduction of speed to the load whether the car is ascending or descending.

820,499. Electric Elevator-control System. John D. Ihlder, New York, N. Y., assignor to the Otis Elevator Company, East Orange, N. J. Application filed March 13, 1905. Renewed November 24, 1905.

The essential features of the system are motor-controlling means, means comprising a floor controller, a single switch connected thereto and electric circuits and connections to gradually and automatically stop the car at the limits of its travel. At the several floor levels, by the operation of the switch while the car is in motion and at a sufficient time before the car reaches a desired floor level, it is also gradually and automatically stopped.

820,504. Controller for Electric Motors. Alvaro S. Krotz, Springfield, Ohio. Application filed November 4, 1904.

In a controller for electric vehicles are a speed drum having electrical contacts adapted to control the speed to the motor, a ratchet wheel on the speed drum, a brake lever, a ratchet pawl and means for causing the pawl to engage the ratchet wheel upon the operation of the brake lever, whereby movement of the speed drum only toward "off" position will be permitted.

820,521. Electrical Protective Device. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed June 22, 1903.

A graphite stick is placed in co-operative relation with a tube containing mercury and having its lower end resting upon the graphite stick. Circuit connections are controlled by the mercury.

820,535. Electric Igniter for Explosive Engines. George J. Weber, Kansas City, Mo. Application filed February 16, 1903.

Details are described.

820,555. Recovery of Copper from Solutions Containing It. Benvenuto Comba, Turin, Italy, assignor to Edward Casper, London, England. Application filed September 14, 1903.

The patentee describes a method of recovering copper from solutions which consists in placing the solution in a suitable vessel, immersing a cathode superimposing a liquid of less specific gravity upon the surface of the copper solution and supporting an anode in the supernatant liquid and connecting it electrically with the cathode. Heat is then artificially applied to the supernatant liquid.

820,569. Target Apparatus. George M. Haas, New York, N. Y., assignor to the Automatic Target Machine Company. Application filed July 7, 1905.

A dummy pistol is mounted on a stand and electrical connections from it to the target indicate the apparent "hits."

820,574. Electric Furnace. James E. Hewes, Plattsburg, N. Y., assignor of one-half to Charles H. Boone, Baltimore, Md. Application filed July 18, 1905.

A trough-like hearth for the materials to be smelted is provided with side flanges. Two electrodes are arranged at an angle to each other, one of the electrodes being in alinement with the length of the hearth.

820,584. Trolley-pole Controller. Joseph F. Mackin, Columbus, Ohio. Application filed August 21, 1905.

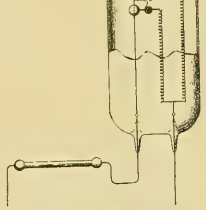
A tube is supported near the base of the pole, a cylinder surrounding the outer end of the tube. A piston in the cylinder on the tube is connected with the pole. A spring acting on the piston tends to raise the pole, and means admit fluid pressure to the cylinder through the tube to depress the pole.

820,604. Electric Coupling. Otto Schaller, Steglitz, near Berlin, Germany, assignor to the firm of Julius Pintsch, Berlin, Germany. Application filed June 1, 1905.

A coupling for electric conductors for railway and other cars consists of two similar single-pole coupling members having bayonet clutches, each member constituting a hermetically sealed chamber having a projecting contact piece normally devoid of current and means within each chamber for circuiting-in the contact piece when the coupling members are in engagement.

820,636. Electric Ignition Apparatus. Gustave E. Franquist, New York, N. Y. Application filed June 24, 1905.

Circuit-controlling means for hydrocarbon motors include a shaft having a stud and a projection, a primary timer, carrying a rotating secondary switch disposed upon the stud and engaging the projection, and spring means for retaining the timer in position.



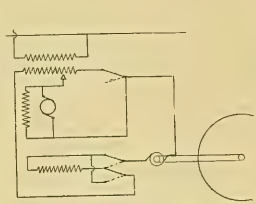
NO. 820,489.—BALLAST FOR NERNST LAMPS.

820,641. Protector for Insulators. John L. Gleason, Boston, Mass. Application filed February 17, 1904.

A molding box presenting a body portion constructed to extend across the angle of two adjacent sides of a room has one side cut away to fit around the molding in which wires are placed, the body portion having integral therewith at each end a flange to fit the angle of the room and affording beneath sufficient room to accommodate any splicing in the wires.

820,649. Electric Machine and System. Frederick W. Knopfe, St. Louis, Mo. Application filed August 25, 1904.

Combined with a conductor carrying an alternating electric current are a transformer located in the circuit capable of regulating the alternating current and a machine capable of being operated as a motor by the alternating current to store mechanical energy and of alternatively being operated by the mechanical energy so stored to generate electrical energy which is added to the electrical energy from the transformer to operate a motor intermittently. (See cut.)



NO. 820,649.—INTERCHANGEABLE MOTOR AND GENERATOR SYSTEM.

820,652. Telegraphic System. Jacob W. Lattig, West Bethlehem, and Charles L. Goodrum, Philadelphia, Pa., and Edward E. Clement, Washington, D. C. Application filed June 9, 1903.

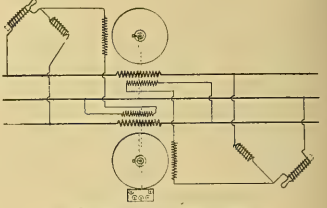
A system of telegraphic communication adapted to railway work embodies a continuous conductor which is kept in touch with the train apparatus by a traveling contact. Occupants of the train are enabled by the apparatus to talk over the telephonic circuit while the train is in motion.

820,713. Credit-system Apparatus. Jacob O. Greenwald, Milwaukee, Wis. Original application filed September 21, 1905. Divided and this application filed February 2, 1906.

A magnetic check-punching device comprises a solenoid, the core, a spring-retracted punch member in the path of the core and adapted to be struck and moved thereby and punch pins carried by the punch member.

820,755. Energy Meter for Three-phase Plants Unsymmetrically Loaded. Riccardo Arno, Milan, Italy. Application filed September 20, 1902.

In a meter for three-phase systems are two three-phase reactance devices, each connected to the three mains of the system, and each having one of its reactive coils arranged to act as a volt-measuring coil. Two ampere-measuring coils are connected in the corresponding mains and each is arranged to interact with its corresponding volt-measuring coil. (See cut.)



NO. 820,755.—THREE-PHASE METER.

820,756. Alternating-current Meter. Riccardo Arno, Milan, Italy. Application filed February 10, 1904.

Combined with the volt coil and ampere coil are two compensating coils coacting to produce a common compensating flux substantially in phase with the voltage of the system, the compensating coils being connected in branch circuits. Means are supplied for substantially equalizing the impedances of the branch circuits.

820,781. Suspended Electric Dental Motor. John F. Hammond, Brewster, N. Y. Application filed April 27, 1905.

An electric translating device has an arm supported to swing in a vertical plane, a member having a swinging connection with the arm and carrying the device, means for counterbalancing the arm and electric device in their several positions and leads connected with the translating device.

820,797. Spark-igniting Plug. Robert B. Kuhn, Canton, Ohio. Application filed May 10, 1905.

An insulation tube with a cone-shaped inner end contains a stem having a head on the inner end with a concave side adapted to fit and bear against the cone-shaped tube end.

820,803. Two-division Telephone System. John H. Lendi, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed October 27, 1902.

A telephone line contains two line-signal-controlling electromagnets in series in the metallic line, one only of the electromagnets being responsive to current over the metallic circuit. There is a separate signal for each electromagnet.

820,823. Electrical Fire-alarm Apparatus. James P. Robertson, North Sydney, near Sydney, New South Wales, Australia. Application filed July 17, 1903.

Automatic alarm apparatus contains alarm signal transmitting means comprising automatic driving means, and ringing and signaling circuits. A ringing contact, a signaling contact, a common movable contact member adapted to coact with both the contacts, means operated by the signaling mechanism for causing the contact member to contact with the contacts alternately during the operation of the apparatus and means for bringing the mechanism to rest with the contact member out of contact with both the contacts complete the apparatus.

820,877. Controller for Electric Circuits. Sam H. Kanmacher, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 22, 1904.

In combination with a switch having a number of operative positions on one side of its off position are an electroresponsive device adapted and arranged to move the switch to an operative position, a lost-motion connection between the device and the switch whereby the movement of the switch may be continued manually to another operative position without moving the device and means connected directly to the switch for holding the switch normally in off position.

820,890. Alternating-current Motor. Adolph W. Schramm, Philadelphia, Pa., assignor to the Electro Dental Manufacturing Company, Philadelphia, Pa. Application filed May 20, 1905.

An alternating-current motor having main and corrective field windings is provided with means for varying the speed of the motor, the means including a device for varying, through a number of steps, the current flow in the corrective field circuit, and for varying the number of turns of the main field winding in circuit.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on May 21, 1906:

403,515. Railway Signal. T. A. Casey, New York, N. Y.
403,517. Electromagnet and Armature. F. W. Cole, Newton, Mass.
403,541. Electrical Converter. H. Lemp, Lynn, Mass.
403,576. Magnetic Separator. G. Conkling, Glens Falls, N. Y.
403,619. Switch Instrument for Railroad Signals. G. C. Steenbergh, Syracuse, N. Y.
403,624. Magnetic-ore Separator. W. R. Thomas, Catasauqua, Pa.
403,626. Telegraph Sounder. F. L. Van Epps, Hudson, Mich.
403,630. Dynamo-electric Machine. T. L. Willson, Brooklyn, N. Y.
403,671. Arc Lamp. D. Houghton, Skowhegan, Me.
403,691. Electrical Switch for Elevators. W. E. Nickerson, Cambridge, Mass.
403,767. Process of Electric Soldering, Brazing and Welding. E. Thomson, Lynn, Mass.
403,768. Method of Electric Welding and Brazing. E. Thomson, Lynn, Mass.
403,752. Method of Operating Electric Furnaces. J. C. Hobbs, Lockport, N. Y.
403,754. Electric Railway. R. M. Hunter, Philadelphia, Pa.
403,776. Individual Call and Switch. E. Pope, Quebec, Canada.
403,786. Electric Railway. F. M. Speed, San Francisco, Cal.
403,800. Slotted Conduit for Electric Conductors. C. J. Vandepoele, Chicago, Ill.
403,801. Electric Railway. C. J. Vandepoele, Lynn, Mass.
403,802. Galvanic Battery. J. C. Vetter, New York, N. Y.
403,825. Underground Conduit for Electrical Conductors. C. B. Cole, Detroit, Mich.
403,836. Dynamo-electric Machine. A. I. Gravier, Paris, France.
403,868. Galvanic Battery. D. J. Arnold, Omaha, Neb.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Electrical Development in Philadelphia.

By Frank H. Taylor.

PHILADELPHIA of today, awake to the possibilities of a great future, has been recreated in the space beginning with the coming of the modern electrician, with his wires and batteries, proposing unheard-of things.

A marvel of the Centennial Exhibition, now 30 years behind us, and which drew great crowds of evening visitors, was the burst of electrically lighted gas jets in the principal buildings, and although as he [illegible] imagined [illegible] an old tower, [illegible] by the magic of electric force, and [illegible] than 30 years

Electric Lighting.

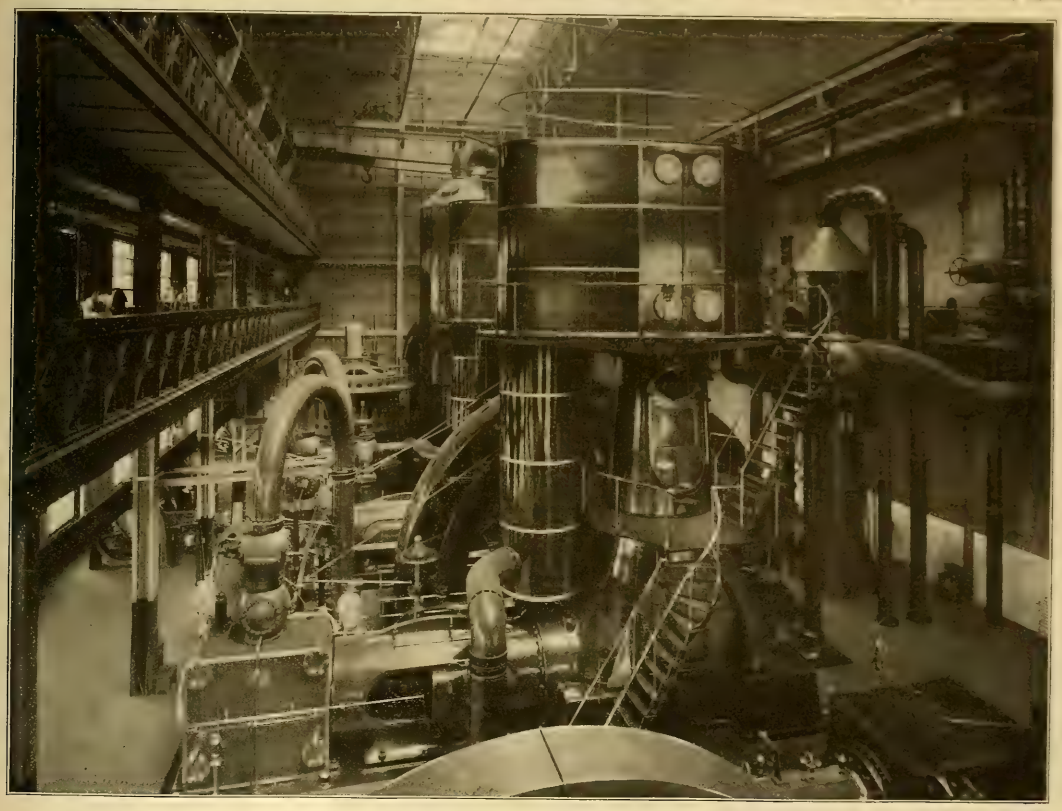
Considering [illegible] in this article the [illegible] industry, it is to be remarked that the Philadelphia Electric Company is the logical result of the merging of a series of detached companies formerly doing business in different sections of the city. It was essential to the proper handling of a problem which involved the lighting of the streets and structures of a municipality covering 129 square miles of territory.

The present plant includes one main generating plant and 13 sectional generating and sub-stations. These are connected by tie lines having a voltage of 5,500.

The co-ordination of the several plants and varied systems was equivalent to the reconstruction of the whole, but it permits the instant distribution of power and light to any district required, through the exigencies of breakdowns or other forms of interference.

The main generating station of the company has attracted great attention. Its location, upon the banks of the Schuylkill River, and in touch with both rail and water freightage, was determined with a view to the greatly increased business of the future. The present massive building, with its vast stack and powerful machinery, represents but the first section of a plant for which the ground has been reserved, and which, when completed, will be, perhaps, the greatest electric station in the world. Its site is at the western extreme of Christ [illegible] upon [illegible] All the arrangements for the [illegible] are in line with the most advanced engineering experience.

The company held the contract for city lighting,



INTERIOR OF MAIN GENERATING PLANT OF PHILADELPHIA ELECTRIC COMPANY.

external illumination, searchlights and prismatic fountains or electric rapid transit had no part in the great Exposition of 1876, here and there, among the countless exhibits, were the germs of electric destiny, modestly asserting their claims upon skeptical capital and ingrained prejudice against the new and strange. The arc light and the Bell telephone had their public beginnings here.

Within a few weeks Philadelphia has celebrated, in a series of dignified ceremonials, the bi-centennial of the birth of Benjamin Franklin, the greatest all-round citizen who ever lived within her borders. Almost the first glimmer of knowledge the world of Europe gained of the existence, in the British colonies in America, of the Quaker port of Philadelphia, was caused by Franklin's electric experiments and advanced conclusions upon the nature and powers of the electrical fluid. As I write, all of his treasured electrical devices, together with many personal belongings, are gathered upon public exhibition. Representatives of the nations are here to do honor to his memory.

Perhaps, as the great philosopher dreamed, under the shade of his garden tree in old High Street,

it maintains about 15,000 arc lights, and supplies some 17,000 other users of electricity with either light or power.

The transformation of the formerly dark and lonely downtown shopping streets into avenues sparkling with the brilliancy of hundreds of beautiful show-windows and open stores, has made them now popular promenades, crowded until late at night with gay throngs as at an exposition. This is true, also, of the busy shopping highways in the factory districts. A distinguished foreign diplomat remarked, not long since, that Philadelphia is probably the best lighted city in the world. While this may have been a superficial impression, our profusion of lighting is generally remarked by strangers.

While the use of electric signs here is not as noticeable as in some western cities, the illuminations undertaken by the company upon occasions of important public celebrations, notably the electri effects upon the City Hall, have seldom been sur passed.

The executive department of the Philadelphi Electric Company has been long housed in a build-

ing at Tenth and Sansom streets. This has been found inadequate through the growth of the business. The company has, therefore, purchased the famous old Assembly Building, sacred to the memory of the most fashionable and exclusive of society events of generations ago. This building is now being demolished, and in its place will soon arise a modern office building of seven floors, having a frontage upon Chestnut Street of 32 feet and upon Tenth Street, back to Sansom Street, of 232 feet. This is now and must always continue to be the busiest part of the city.

In the planning of the structure, which will be of Colonial brick faced with Indiana limestone, a number of interesting features have been decided upon. The basement will contain the elevator systems, enclosed in glass and operated by electricity. This, with other heavy mechanisms, shown here, will constitute a permanent exhibition. A dark room, 32 by 32 feet in dimensions, will be used for special electric demonstrations. The ground floor will be devoted to a showroom and to offices of the commercial department. The executive and other offices and departments will fill the floors above. Ice water from electrically driven refrigerators will be piped to all parts of the building. Upon the top floor an assembly room will afford convenience for the frequent meetings of the solicitors, district managers and other officers or representatives. Upon this floor, too, will be the reference library. The new building is the especial care of Mr. Joseph B. McCall, the president of the Philadelphia Electric Company, and directly in charge of his assistant, Mr. Walter M. Johnson. The builder is Mr. John Wiggins.

The U. G. I.

The streets of this, the first American city to employ fixed lights in its highways, at a public charge, were long feebly lighted by oil lamps, the business sections echoing only to the cautious footfall of the roundsman and the private watch

Philadelphia was the first city in America, also, to adopt gas lighting. Its several original companies had long before been absorbed by the city, and the gas office, upon Seventeenth Street, was a perennial bone of political contention and the haven, with the various gas works, of the insistent ward

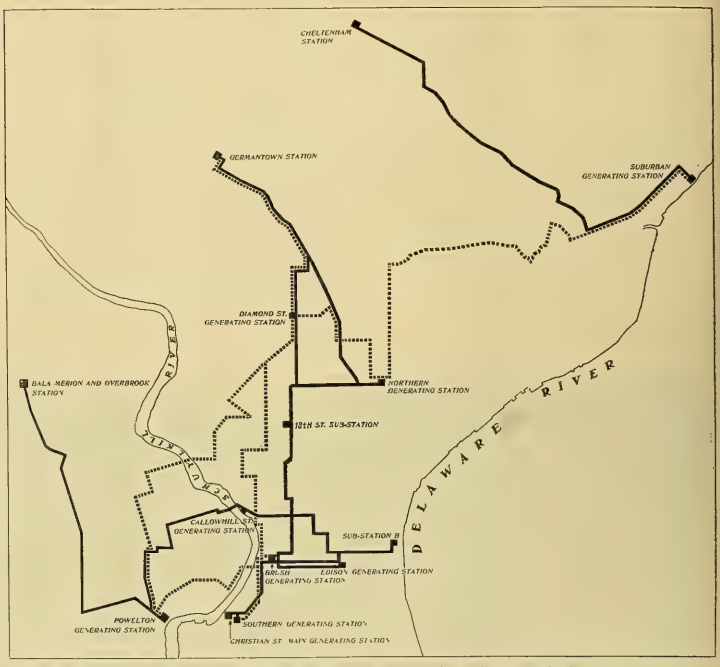
MAIN GENERATING STATION (CHRISTIAN STREET) OF PHILADELPHIA ELECTRIC COMPANY.

worker of the time. When, not long ago, the business of supplying the city with gas was taken over by the United Gas Improvement Company as an incident of its vast business, a new political movement was born, the stress of which is still with us. But this is another story.

The United Gas Improvement Company, popularly dubbed "the U. G. I.," was chartered in 1882. The company owns or operates gas works in 30 cities or towns besides Philadelphia, which is its largest customer. The operations of the company also include electric-lighting plants, power plants for electric railways and the manufacture of the Lowe water-gas apparatus. In 1899 the U. G. I. erected a stately 12-floor building upon the northwest corner of Broad and Arch streets, all of which is devoted to the vast and growing business which it undertakes. The company has developed a large local business with domestic consumers by the introduction of gas ranges for cooking, these being especially popular in summer.

The Problem of Transit

The half million of people who welcomed the



Solid Lines Indicate Incandescent Circuits. Broken Lines Indicate Arc Circuits.

MAP SHOWING GENERATING AND SUB STATIONS OF PHILADELPHIA ELECTRIC COMPANY.

world to Philadelphia in the Centennial year lived mainly between the rivers Delaware and Schuylkill, huddled in plain brick houses, in streets arranged upon the gridiron planned by William Penn for his "greene country towne." Athwart this crowded and monotonous design were streaked to and fro the tracks of the horse-car lines, a corporation for every distinct line, whose cars, in speed, dimensions and comfort, were of the type now to be found only upon the cross town lines of imperial New York city.

A few unprofitable tentacles of the street-car systems of that time extended outward into unpromising and muddy suburbs. Single fares were eight cents.

When President Morton of the Market Street line invited the writer, with a few other journalists of that day, to ride down Market Street from West Philadelphia to the Delaware River upon his steam street car, it was generally said in the papers that the era of suburban development was at hand. This was in 1877, and we were yet to endure the era of the cable.

It was not until 10 years later, when the Union Traction Company was formed, that the congestion of the old brick town, between the rivers, began to have real relief in the rush of families to accessible new suburbs. This outward pressure toward the semi-country has now cordoned Philadelphia with a semicircle of new residential districts extending for many miles, composed of two and three-story houses, having grassy spaces, concrete sidewalks, bricked streetways, porches and a general interior fitting-up (which includes electricity very often), sanitary conveniences, embellishments and appliances formerly enjoyed only by the very rich. The majority of these homes are owned by the occupants.

In two progressive wards of the city, the Twenty-seventh and Forty-first, at present there are under construction about 4,000 such homes. Nearly all of these houses and their attendant business centers are within 30 or 40 minutes' ride by electric cars from the City Hall. The number of rail lines, sufficient in themselves heretofore, is being reinforced by many transverse railways, with a pass system, which takes the passenger to or fro, for a single fare, over two lines, this pass privilege being limited to the suburbs and to certain routes. Exchange tickets are very generally bought, and the fare is now practically four cents.

With all of the effort which the Rapid Transit company has been able, seemingly, to put forth thus

OLD EDISON DIRECT-CURRENT GENERATING STATION OF PHILADELPHIA ELECTRIC COMPANY

far, the natural growth of the population, now some 40,000 annually, and the lure toward new and handsome suburbs, have resulted in outgrowing the transit facilities. The clamor for relief is great and constant. Fifty thousand people, probably, find use the steam railroad local trains, but these are an insignificant fraction of the whole. At the present writing the situation is in this shape. The Rapid Transit Company controls 554 miles of track, not

portion of the city lies to the north and south of it, and the travel is [illegible] peded, especially [illegible] of half a dozen [illegible] run. There are [illegible] the city limit. [illegible] one may ride over 18 different [illegible]

At Eighth and Market [illegible] topping point in the city [illegible]

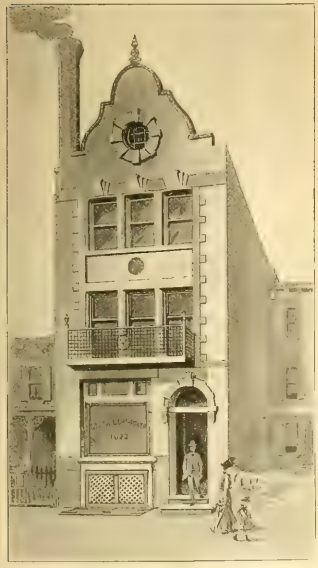
ENTRANCE TO PHILADELPHIA SUBWAY, SHOWING PORTAL EXTENDING OVER TO MARKET STREET.

including the additions since the last report. It operates about 3,300 cars. The standard adopted, which is rapidly replacing the old cars, many of them inherited from the subsidiary companies, is the 38-foot Brill semi-convertible double-truck design.

The electric power required to move these cars, which carry considerable more than 1,000,000 passengers per diem, is derived from a series of widely separated generating and sub-stations, with underground high-tension cables. The length of the distribution cables is more than 1,000 miles, feed taps being placed at intervals of from 500 to 1,000 feet.

All of the cars in this city have been run upon the street surface until within a few months, when a short section of the Market Street subway was opened.

As nearly every important street in the older



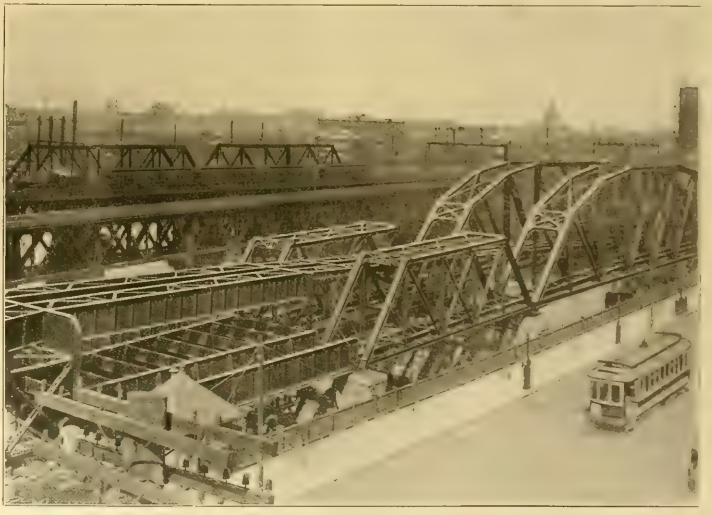
EIGHTEENTH STREET SUB-STATION OF THE PHILADELPHIA ELECTRIC COMPANY.

although [illegible]

Within the [illegible] years the [illegible] and plans [illegible] the [illegible] system, the [illegible] Sixty-third and Market streets [illegible] to the west side of the Schuylkill River. The [illegible] way, [illegible] to [illegible] Hall. The company [illegible] to the Delaware River, a [illegible] subways are to extend [illegible] and are [illegible] that the Camden [illegible] connected electric [illegible] connected with Philadelphia by a sub-Delaware [illegible] tunnel. A great generating station is to be built upon Delaware Avenue.

The outlays of the Philadelphia Rapid Transit Company for betterments have been large and constant. The greater part of the railway system has been, or is being, reconstructed. The new rails, of the "Trilby" pattern, weigh 127 pounds a yard and are set in place by the most approved and durable methods.

The present system of building track in Phila-



FOUR TRACK BRIDGE OVER SCHUYLKILL RIVER, PHILADELPHIA, SHOWING LOCAL AND EXPRESS TRACKS AND INCLINE LEADING TO ELEVATED STRUCTURE.

cities has been called upon to study problems more difficult in the nine years since it was formed.

Under the conditions of its contracts with the numerous subsidiary companies taken over from the Union Traction Company, it is obliged to pave the entire street surface of all streets upon which it operates. This item is a large factor in the 40 per cent. of total earnings which the operative expenses entail.

This item of maintenance of way, about 13 per cent., is about double that of New York city and much larger than in most cities. The fixed charges,

delphia is said to be superior to anything of the kind attempted elsewhere. Briefly, the rails, set upon pedestals, bolted and braced, are soldered together by the fusion of zinc, and the track space below the final paving is solidly concreted.

Among the side investments of the Rapid Transit Company projected for the encouragement of excursion traffic the most important is beautiful Willow Grove and its spectacular million-dollar electric fountain, high-class concerts and varied amusements. This is mentioned simply as an evidence of the tendency of the local carrying companies

of the cities to provide enjoyments for the masses which, although created entirely as sources of revenue, still are free to all and contribute greatly toward making summer life in the city enjoyable and healthful.

The urban system of electric railways in this city connects, either directly or by ferry, with 18 trolley lines, extending into the surrounding country. Two of these, converging upon Trenton, N. J., form part of a new route to New York.

Under the new law in New Jersey, its electric lines may carry freights, and this right is certain to be extended to the lines in Pennsylvania. As in the West, the city and country are becoming intimately related, to the incalculable advantage of both.

Telephone Service.

The Bell Telephone Company, which enjoyed the undisputed possession of this field of business for a long time, now shares it with the Keystone Telephone Company. Both are well housed in substantial office buildings, the former being at Seventeenth and Filbert streets, and the latter upon Second Street, above Walnut Street. Each company is alert to develop further business. In thousands of business concerns both telephones are a necessity. This competition has greatly increased the use of telephones by the general public. Philadelphia is now practically upon a message-rate basis, this having been conceded to be the fairest method

VIEW IN PHILADELPHIA SUBWAY AT TWENTY-THIRD STREET, LOOKING TOWARD PORTAL AND SHOWING CONCRETE BULKHEADS.

yet devised. Telephone cables are now carried almost entirely in conduits.

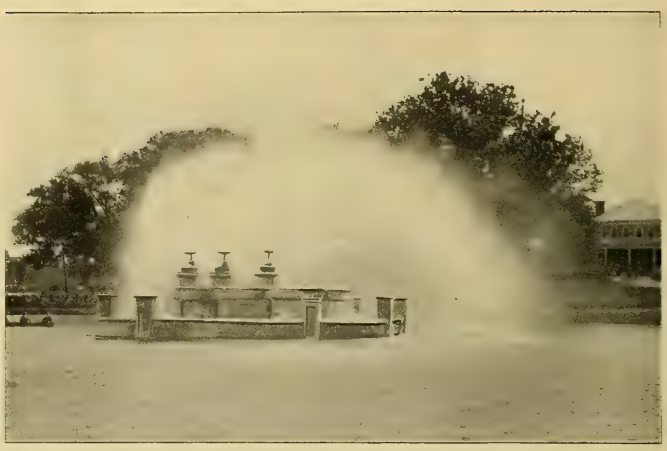
The Bell Telephone Company controls the Delaware and Atlantic Telegraph and Telephone Company, the two corporations covering the city and 15 counties over a large expanse of neighboring territory. Much has been done in the line of private exchanges, which are now in use in a large number of public, commercial and manufacturing buildings. At present the company is doing a large business in intercommunicating residence service, in which over 1,000 installations have been made. Philadelphia had 140,269 Bell telephones upon April 1st of this year. It is expected that the 1906 increase will reach 75,000 telephones.

A feature of the telephone service in Philadelphia which is especially interesting is seen in the inquiry bureaus, by which any subscriber or user of a pay telephone may obtain, at once, any item of important news in advance of its publication in the papers, the location of a fire, election returns, baseball scores, and the like, being instances. Sermons preached in the churches may be heard by the patients in the hospitals.

Ninety-five per cent. of the local service is now supplied from the underground system. The cables are lead-covered, and the larger ones carry 440 pairs of copper wires. The old-style terminal pole has been replaced by junction boxes, from which short lines are run from house to house at the rear. This forms a practically storm-proof service.

The new Lombard central office of the Bell Telephone Company represents the latest development in this class of stations, of which there are many. The building is a four-story brick and granite structure in Colonial design. The multiple switchboard is divided into 59 positions. This station is visited daily by many people, to whom the details of the installation and work are fully explained.

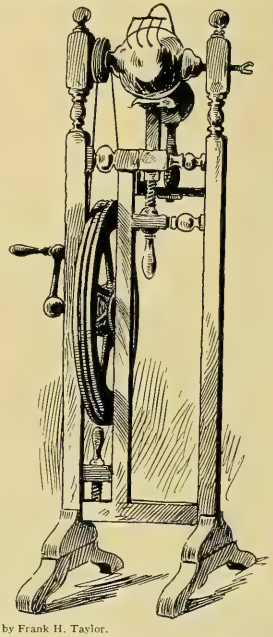
In the Bell service all operators are schooled one month before engaging in actual practice. Of those who undertake this preliminary schooling but one in five finally secures engagement. These successful operatives have much subsequent consideration. Each station is provided with rest and lunch rooms. The former is supplied with the comforts of a club and with abundant literature. In the latter coffee, tea and milk are furnished at the charge of the company. The employes who come into direct contact with the public are also thoroughly instructed in their duties by experts. This also applies to the construction work and all other departments.



ELECTRIC FOUNTAIN IN WILLOW GROVE PARK, NEAR PHILADELPHIA.

Conclusion.

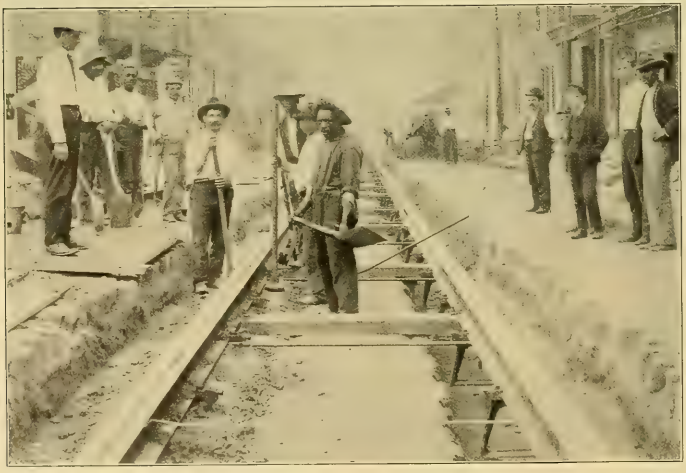
Probably in no other American city are the great utilities, based upon the use of electricity, as constantly in the public mind or more closely subjected to scrutiny and criticism. But it is not in an antagonistic or destructive mood that the citizens consider the electrical powers-that-be. Their important part in the daily life of the community is recognized, and the changes they have wrought upon the face of the town are conceded.



Sketch by Frank H. Taylor.
FRANKLIN'S ELECTRIC GENERATOR IN COLLECTION OF FRANKLIN INSTITUTE, PHILADELPHIA.

The present attitude of the public and the corporation officials who run cars and supply light, power and communication, is of concession and a disposition to work together for the common weal.

In view of the large visitation of electricians to Philadelphia this summer, it may not be amiss to conclude this article with a reference to a few of the many electrical devices and others made by or under the direction of Benjamin Franklin, which



STREET-RAILWAY TRACK LAYING IN PHILADELPHIA.

may be seen, conveniently, in their present places of deposit.

At the rooms of the American Philosophical Society is preserved Franklin's first electric generator, also his model for an improved stove and a chair of ingenious design. At Independence Hall Museum may be seen the famous lightning-rod which Franklin persuaded Robert Morris to place upon his house; also an air pump made for him in London.

At Franklin Institute are preserved Franklin's dress sword and a large electric generator, one of similar build also being shown at the Philadelphia Library. It is especially fitting that these relics should be treasured in a city which proudly claims to be the birthplace of electrical science in America.

Latest Developments in Chicago Edison and Commonwealth Electric Companies' Sub-station System.

Included in the system of the Chicago Edison Company there are at the present time 21 sub-stations and in that of the allied Commonwealth Electric Company are 10. Twenty of these distribute direct current only, and more than half of them are located in or very near the downtown business district, supplying the direct-current network. Three of the stations distribute direct current and have also a subsidiary steam plant. Two distribute alternating current and have in addition a subsidiary steam plant. The remaining stations, to the number of six, distribute alternating current only.

The sub-stations have been erected from time to time as an outgrowth of the service requirements, and there is discernible a gradual change in the de-

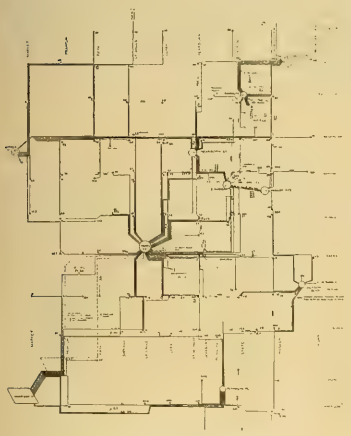


FIG. 1. LAYOUT OF LOW-TENSION FEEDERS IN DOWNTOWN DISTRICT, CHICAGO.

sign of these stations from the earlier ones installed to those which have been put in service within the last year or two. What was once standard practice in the details of the work has given way to new ideas which, for the present at least, are deemed standard. The object of the present article is to describe a few of the Edison companies' latest sub-stations in Chicago, which are typical of the latest methods in sub-station construction. The descriptions are confined to those sub-stations which supply direct current, as the alternating-current sub-stations are merely transformer installations which vary little from one another in the details of their design.

As a basis of the description, five sub-stations have been selected as indicative of the latest practice, and they are known as Plymouth Place Sub-station, Jackson Boulevard Sub-station, White City Sub-station, East Madison Street Sub-station and West Twenty-second Street Sub-station. They exemplify three classifications which may be used for convenience sake, e. g., stations having rotaries only, as East Madison, Jackson Boulevard and White City, stations having rotaries and storage batteries, as Plymouth Place, and stations having motor-generators, rotaries and batteries, as West Twenty-second Street.

Inspection of Fig. 1 shows the layout of the underground direct-current feeder system between South Water Street and Harrison Street and as far west as Harrison Street generating station. This does not include mains, laterals and service connections. This diagram shows the relation of three of the [illegible] district to the [illegible] low-tension feeder [illegible]

These preliminary [illegible] idea of the importance of the [illegible] to the rest of the [illegible] and [illegible] scriptive matter relates to the [illegible] lected as above mentioned.

Plymouth Place Sub-station.

Plymouth Place Sub-station [illegible] ing (Fig. 2) which can be easily [illegible] into an

FIG. 2. EXTERIOR OF PLYMOUTH PLACE SUB-STATION, CHICAGO.

office building in case the company should desire to use it for this purpose at some future time. The building is three stories in height, with basement. The rotary-converter apparatus is located on the main floor and the high-tension work and direct-current buses in the basement beneath. On the second and third floors are installed the storage batteries.

At present there are installed two 1,000-kilowatt rotary converters of the General Electric Company's latest design. One of these converters is rated at 300 volts and the other at 250 volts, the higher pressure being necessary for the charging of the batteries. The switchboard, which is located on the main floor, is simply a control board, the direct-current buses not being mounted behind it, as is the usual custom, but in the basement beneath. The board contains two rotary panels, three station panels, one battery panel and one future-battery panel.

The rotary panels contain the instruments and also the control switches for both the 9,000-volt oil switches and motor-operated circuit-breakers on the direct-current side of the rotaries. They also contain the starting switches. The station panels carry the control switches for the line and tie oil switches; also the direct and alternating-current indicating instruments. The batteries are located in the floors above, and the battery buses in passing

FIG. 3. VIEW SHOWING SEPARATION OF DIRECT-CURRENT BUS BARS IN PLYMOUTH PLACE SUB-STATION.

[illegible]

FIG. 4. HIGH-TENSION BUS-BAR CHAMBER IN PLYMOUTH PLACE SUB-STATION.

ment is a copper neutral, which takes up the neutrals of the transformers, system, etc.

The high-tension lines come into the station on the opposite side from the low-tension lines. The lines enter from the underground conduits and pass directly through oil switches to the high-tension buses, of which there are three sets. These buses are contained in concrete compartments, as shown in Fig. 4. One 9,000-volt three-phase line comes in and passes through a line oil switch to bus No. 2, and from bus No. 1 through an oil switch to the transformer of one of the rotaries. The other line passes in like manner to bus No. 2, and to the other rotary. Bus No. 1 is connected through an oil switch to a tie bus, and there is likewise a connection from bus No. 2 to the tie bus. In this way no rotary is dependent for its current upon any particular set of high-tension feeders, and any combination may be made, no matter to what length the number of units in the sub-station be multiplied.

Potential transformers for instruments are also located in the high-tension compartment, and are protected by soapstone covers. The oil switches, of which there are three to a unit, as above explained, are located on the first floor, the lines passing vertically from the switches to the bus-bars below.

Artificial cooling of the transformers is necessary, and is accomplished by motor-driven blowers, which are located in a separate room of the basement. Air from the street passes through a series of fine screens, which eliminate the principal portion of the

dirt, and is taken up by the blowers and discharged into a duct. From this duct the transformers and regulators are supplied with air under a pressure of about one ounce. The blowers are installed in duplicate, to insure against interruption of service. The heat from the transformers is used in winter to heat the building, and has been found entirely sufficient for this purpose, except during the very coldest days. Later on this installation will be augmented by the addition of a 2,000-kilowatt rotary, which will take the place of the 1,000-kilowatt rotary No. 2 of the lower voltage. The station has been designed throughout so as to permit of the installation of three 2,000-kilowatt machines when this capacity becomes necessary.

The remaining apparatus in this station consists of the battery installation, located, as before mentioned, on the second floor. At present the battery occupies the second floor only, but additions will ultimately be made which will be located on the third floor. There are now in service 150 cells, having an aggregate capacity of 1,000 kilowatt-hours. They are of the Electric Storage Battery Company's make. In a separate room on the second floor are located the end-cell switches for the

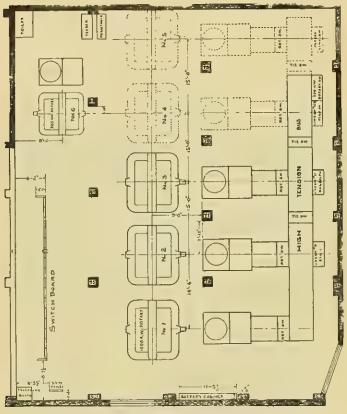


FIG. 5. PLAN OF JACKSON BOULEVARD SUB STATION.

regulation of the battery pressure. They are mounted near the ceiling.

JACKSON BOULEVARD SUB-STATION.

Jackson Boulevard Sub-station is located in the basement of the Railway Exchange Building, at the corner of Jackson Boulevard and Michigan Avenue. Fig. 5 is a plan of the station, showing in dotted lines future units to be installed. It not only furnishes direct current to the downtown network but also furnishes a limited supply to the system of the Illinois Tunnel Company. The high-tension leads to this station come from the underground system and pass to separate buses in compartments beneath the floor. There are three separate sets of buses, two supplied by lines coming from the west side of the building, and one coming from a line from the east side. Current from the buses passes through tie switches to the transformers supplying the rotaries.

There are four rotary converters in the sub-station, as shown in Fig. 6. Three of these are of 1,000 kilowatts capacity each, supplying direct current at 250 volts. The fourth rotary, barely discernible in the picture, is of 500 kilowatts capacity and supplies current to the tunnel system. Each rotary is supplied with a hand-operated circuit-breaker and speed-limit and reverse-current devices. There is room in the station for the installation later of two more 1,000-kilowatt units. Transformers for the rotaries are artificially cooled, the air entering the ducts from the Michigan Avenue side of the building. The heat derived from the transformers is more than enough to heat this compartment of the building.

A 12-panel switchboard (Fig. 7) is located directly in front of the rotaries and consists of four machine panels, two house panels and six feeder panels. The buses at the rear of the board are mounted vertically, the later scheme of horizontal buses not being carried out in this instance. Two starting boxes are so connected that they can be used for any of the machines. Fig. 8 is a general wiring plan of rotary unit No. 2, and shows in detail the connections from the high-tension 9,000-volt cables entering the station, on through the transformers and rotaries to the direct-current buses, the connections for the instruments being also shown. The connections for the other two 1,000-kilowatt rotaries are identical and those for the 500-kilowatt unit in general the same.

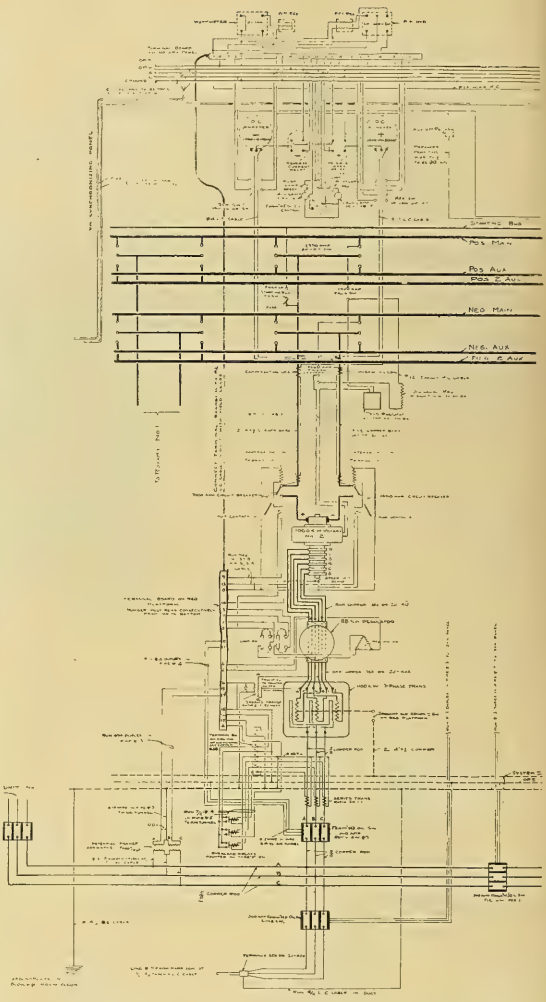


FIG. 8. GENERAL WIRING PLAN OF ROTARY NO. 2 IN JACKSON BOULEVARD SUB-STATION.

WHITE CITY SUB-STATION.

Three 1,000-kilowatt rotary-converter units are at present installed in the White City Sub-station (see Fig. 9). They are used to convert the 9,000-volt high-tension alternating current to direct current for distribution on the three-wire system to the amusement park which gives the station its name. In addition to these machines, there is one small one at 300 kilowatts capacity that is used to take care of part of the load of the Calumet electric-railway system. In his station there is also a 90-kilowatt induction-motor-generator set, which may be used for starting the rotaries from the direct-current end, as well as supplying the minimum load. This station is also one of the features of the White City, being opened to visitors at night. Therefore

Fig. 6. View of the Rotary Converters in Jackson Boulevard Sub-station.

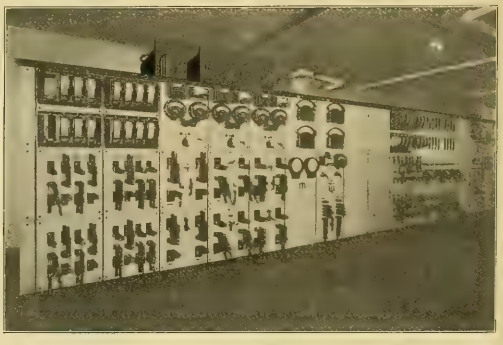


Fig. 7. The Twelve-panel Switchboard in Jackson Boulevard Sub-station.

particular pains has been taken to make it attractive.

In the southwest corner of the building, next to the plank walk, there is an entrance with large illuminated electric signs, which show the way to the exhibit room (Fig. 11). The entrance to the exhibit room proper is of the colonial style and set off artistically with various designs in electric arcs. Inside this room there are exhibited various types of artistic lighting fixtures, cooking apparatus, flatirons and a complete dining room equipment. Large windows are located between this room and the interior of the sub station, through which the apparatus may be viewed while in operation.

Taking up in detail the electrical equipment of this station, the switchboard, perhaps, offers one of the most interesting features. On this board

Fig. 9. Interior of White City Sub-station.

Fig. 10. 60-each, 2200-A. H. Bus and Feeder Switches in West Twenty-second Street Sub-station.

SUB-STATIONS OF CHICAGO EDISON AND COMMONWEALTH ELECTRIC COMPANIES.

there are three rotary panels, one station panel, three wattmeter panels and five feeder panels; also one future rotary panel, and a motor-generator panel. Fig. 12 is a view in the rear of the switchboard. The 300-kilowatt rotary for the railway load is provided with a small independent switchboard.

Two separate sets of buses are mounted on the rear of the main board, and the output from these buses at times of heavy load is measured by two 8,000-ampere wattmeters. During times of light load, however, instruments of such large capacity are inaccurate, and the current is passed through two small 600-ampere wattmeters, which measure the output at times of minimum load. When the heavy load begins to come on the 600-ampere wattmeters are each cut out by means of a 6,000 ampere switch, in which operation the coils of the 8,000-ampere wattmeters are cut in, and the larger instruments then measure the output.

Taking up the high-tension equipment, the lines entering the station and carrying the 9,000-volt three-phase current enter the transformers by way of six type H3 oil switches. Two of these are line switches, three rotary switches and one a tie switch. After passing through the switches the current enters the 1,100-kilowatt transformers, which are located, with the regulators, just back of the rotaries, and as close to them as possible, in accordance with the usual practice in the Chicago Edison sub-stations. The oil switches are controlled from the main switchboard, the controlling current being derived from 60 (type E5) cells of batteries made by the Electric Storage Battery Company, mounted in a cabinet on the north wall of the station.

The motor-generator, before mentioned, and supplying starting and light-load current, consists of a 250-volt direct-current generator mounted on the same shaft with an induction motor of 100 horsepower.

Two blower sets furnish air for transformer ventilation, and are driven each by a 15-horsepower 230-volt motor. These blower sets are installed in duplicate, to provide for cases of emergency.

The building in which the apparatus is located is strictly fireproof, and is composed of brick with cement floors and iron roof trusses, and all precautions are taken to protect the building from fire, not only within itself but from surrounding buildings. The lighting of the interior of the substation is accomplished by a large number of meridian lamps, mounted on the under side of the

FIG. 11. EXHIBIT ROOM IN WHITE CITY SUB STATION.

through a concrete chamber on the curb wall. They enter the sub-basement from above instead of being brought up through the floor, as in the other stations, on account of the sub-station being located so far below the level of the street. After entering the sub basement, however, they pass down below the floor level. The direct-current feeders also leave the station in the same manner. Concrete compartments enclose the motor-operated oil switches and the high-tension buses. There are five of these switches two line switches, two rotary switches and one tie switch.

The switchboard is made up of four rotary panels, now equipped, two future rotary panels, one station panel, six feeder panels and two future feeder panels, all panels having been installed at the beginning to take care of the ultimate output of this station. The feeder panels on this board, as also on

lators in a duct, which passes beneath the floor. An exhaust fan, driven by a 15-horse-power motor, exhausts the heated air from the sub-station compartment of the building.

The sub-station occupies nearly one-third of the entire sub-basement, and the only way in which the apparatus could be brought into this sub-basement was by lowering the machine parts through openings under the sidewalk.

A point which may be mentioned here is the painting of the interior of the sub-stations, the same scheme being followed out in all of the companies' stations. The ceilings of the rooms are of a light cream color with yellow walls and green dado some five feet up from the floor. The machines are all painted a dark green, which is the standard color, and are numbered with station numbers. Another feature also of the sub-stations is a private telephone line from each station to the load dispatcher's office, which is located in the companies' main-office building at 130 Adams Street.

To insure satisfaction to customers in the matter of voltage regulation, all the sub-stations are provided with a potential panel indicator carrying a 30-point voltmeter switch. Each of these points is connected either to the various feeder ends or to the station buses. By this means it is possible for the operator to ascertain the pressure at the ends of the feeder lines at all times, and keep it practically constant.

Between East Madison Street sub-station and the storage-battery station on Wabash Avenue a tie line is connected, to insure continuity of service. In case of a shutdown of the rotary station for any cause this tie line is able to supply the necessary energy required by the station feeders. The Wabash Avenue sub-station is a battery installation with two sets of 1,000-kilowatt batteries, and this tying in is also done between it and the other downtown sub-stations.

East Madison Street Sub-station.

In features of general design East Madison Street sub-station does not vary greatly from the Jackson Boulevard sub-station. It is located in the sub-basement of the Chicago Savings Bank Building, on East Madison Street, between Dearborn and State streets. There are installed in this station at the present time two 1,000-kilowatt rotaries, and two more are to be installed in the near future. The station is laid out for an ultimate capacity of six 1,000-kilowatt units.

Beginning with the high-tension apparatus, the 9,000-volt three-phase cables enter the building from both the State Street and Madison Street sides

West Twenty-second Street Sub-station.

At West Twenty-second Street sub-station is exemplified the type in which the rotary converter, the motor-generator and the storage battery are all installed. The equipment of the station consists of two motor-generators, one of 500 kilowatts and the other of 1,000 kilowatts capacity, two rotary converters of 500 kilowatts capacity each, and one storage battery, located on the second floor, and having a capacity of 2,200 ampere-hours at a one-hour discharge rate. Fig. 13 is a view of the exterior of this sub-station, and, as will be seen, is of plain but pleasing design.

This station, especially in regard to the high ten-

sion system, is particularly important to the service. The two motor generators are used simply as frequency changers. The 9,000-volt three-phase lines from Fisk Street Station enter this sub-station, and after passing through the oil switches and the buses go direct to the motors of the motor-generator sets. In these sets the frequency is changed to 60 cycles, 2,200 volts (star connection). These 60-cycle circuits all run out underground to points north, west and south of the sub-station, where they connect to

FIG. 12. REAR OF SWITCHBOARD IN WHITE CITY SUB-STATION, CHICAGO.

the overhead system. The pressure is regulated by a means of potential voltmeter panel. There are two separate switchboards in the sub-station, one for direct current and the other for the control of the high-tension 60-cycle current. There is still another smaller board which controls the 25-cycle alternating current entering the station.

The 60-cycle board is simply a control board for the operation of the switches. It contains two generator panels, three feeder panels and one future feeder panel. None of the high-tension work approaches this board, which controls the switches by a system of remote control.

On the direct-current side of the station the switchboard is provided with two rotary panels, a booster panel, a battery panel, two station panels and three feeder panels. It will be remembered that at Plymouth Place a high-voltage rotary was installed to charge the batteries, but in this instance the necessary voltage is obtained through the use of a 1,600-ampere booster which is located in the feeder-regulator gallery above the switchboards. It is for this booster that the booster panel on the direct-current board was installed. The booster also serves as a balancing set in addition to charging the batteries. As in the other installations, the

FIG. 13. EXTERIOR OF WEST TWENTY-SECOND STREET SUB-STATION, CHICAGO.

field rheostats are mounted above the board and are operated by solenoids.

The rotary converters in this station are of the standard type and require no particular description.

In the basement are the 60-cycle 2,200-volt buses and also the 9,000-volt 25-cycle buses. The latter installation is characterized by the installation of the buses in compartments of asbestos lumber. The oil switches are enclosed in concrete compartments, there being one for each rotary and each motor-generator and one tie switch.

The 60-cycle 2,200-volt buses are entirely open and erected on an iron framework, as shown in Fig. 10. This framework also carries the K2 oil switches, as shown in the picture. Fig. 14 is a sectional elevation of a portion of the 60-cycle bus and feeder switches. The 60-cycle circuits are all connected to a transfer board for transferring the regulator to the various circuits in cases of emergency. This is also another of the engineering features to provide for continuity of service.

Programme and Arrangements for Atlantic City Convention.

The twenty-ninth convention of the National Electric Light Association will be held on Young's Pier, Atlantic City, N. J., on June 5th, 6th, 7th and 8th. The officers of the association, from President Blood and Vice-president Williams down, and not forgetting the efficient assistant secretary, Miss Harriet Billings, have worked hard for the success of the convention, which is assured. There is no doubt that the meeting will attract a very large attendance—perhaps the largest in the history of the association. An excellent business programme has been arranged. It is as follows:

TUESDAY, JUNE 5TH.

First Session, Beginning at 10 a. m.

Address of welcome by his excellency the governor of the state of New Jersey, or his honor the mayor of Atlantic City.

President's Address.—W. H. Blood, Jr., Boston, Mass.

Announcements.

Report of Committee on Progress.—T. Commerford Martin, New York.

"Magnetite Arcs and Mercury Rectifiers."—W. S. Barstow, Portland, Ore.

"Flaming Arcs."—Louis B. Marks, New York.

TUESDAY, JUNE 5TH.

Second Session, Beginning at 2 p. m.

Report of Steam-turbine Committee.—W. C. L. Eglin, chairman, Philadelphia.

"Fuel Economy."—J. H. Hallberg, New York.

"Mechanical Refrigeration."—John Myer, Philadelphia.

"Electric Heating."—James I. Ayer, Cambridge, Mass.

"Line Construction for Overhead Light and Power Service."—Paul Spencer, Philadelphia.

WEDNESDAY, JUNE 6TH.

Third Session, 10 a. m.

"Business-getting Methods."—F. W. Freeauff, Denver, Colo.

"How to Make a Small Electric Plant Pay."—D. F. McGee, Red Oak, Iowa.

"Some Methods Used in Securing and Retaining Business."—Mathias Turner, Cleveland, Ohio; N. T. Wilcox, Lowell, Mass.; George N. Tidd, Marion, Ind.; R. S. Wallace, Peoria, Ill.; George B. Tripp, Colorado Springs, Colo.; Leon H. Scherck, Birmingham, Ala.

"Free Installation of Electric Signs."—John F. Gilchrist, Chicago.

WEDNESDAY, JUNE 6TH.

Fourth Session, 2 p. m.

"Profitable Co-operation."—J. Robert Crouse, Cleveland, Ohio.

Report of committee to co-operate with lamp manufacturers on advertising.—Paul Spencer, chairman, Philadelphia.

"Grounding Secondary Alternating-current Services."—Sidney Hosmer, Boston.

Report on Protection from Lightning During 1905.—Alex Dow, chairman, Detroit, Mich.

Report of Committee on the Fire Hazard of Electricity.—H. C. Wirt, chairman, Schenectady, N. Y.

THURSDAY, JUNE 7TH.

Fifth Session, 10 a. m.

"Maintenance and Calibration of Service Meters."—William Bradshaw, Pittsburg, Pa.

"Comparison of Direct-current and Induction-motor Load."—L. E. Bogen, Milwaukee, Wis.

"Alternating-current Systems of Distribution and their Automatic Regulation."—C. W. Stone, Schenectady, N. Y.

"Alternating-current Elevators"—W. Noble Dickinson, Jr., New York.

"Modern Switchboard Practice with Particular Reference to Automatic Devices."—E. M. Hewlett, Schenectady, N. Y.

"Control of Motors on Electric-light and Power Circuits."—H. D. James, Pittsburg, Pa.

THURSDAY, JUNE 7TH.

Sixth Session, 8:30 p. m.

"The Meaning and Proper Treatment of the Agitation for Municipal Ownership of Public Utilities."—Everett W. Burdett, Boston.

FRIDAY, JUNE 8TH.

Seventh Session, 10 a. m.

"New Illuminants."—Prof. H. E. Clifford, Boston.

"Higher Efficiency Incandescent Lamps in Central-station Service: Their Value and Effect and the Policy Therefor."—F. W. Willcox, Harrison, N. J.

"The Edison System of Southern California."—R. H. Ballard, Los Angeles, Cal.

"Design and Manufacture of Hydro-electric Installations as a Whole."—E. F. Cassel, Milwaukee, Wis.

"Question Box" and "Wrinkles."—Paul Lüpke, Trenton, N. J.

FRIDAY, JUNE 8TH.

Executive Session for Class A and B Members Only, 2 p. m.

Report of executive committee.

Report of secretary and treasurer.

"Laws of Different States Governing Theft of Current."—E. H. Davis, Williamsport, Pa.

"Methods of Current Theft."—C. T. Murdock, Terre Haute, Ind.

"Sliding-scale Method of Public Regulation."—W. H. Gardiner, Jr., Boston.

Report of Committee on Rates and Costs.—C. L. Edgar, chairman, Boston.

Report of Committee on Standard Rules for Electrical Construction and Operation.—E. H. Davis, chairman, Williamsport, Pa.

Report of Committee on Public Policy.—Arthur Williams, chairman, New York.

Report of Committee on Relations Between Manufacturers and Central-station Companies.—Henry L. Doherty, chairman, New York.

Election of officers.

Especially noticeable is the large proportion of papers devoted to business rather than technical subjects. Indeed, the meeting may be styled a "business" convention.

OTHER ARRANGEMENTS.

Under the rules of the Atlantic City Hotel Men's Association, no single hotel can be considered as

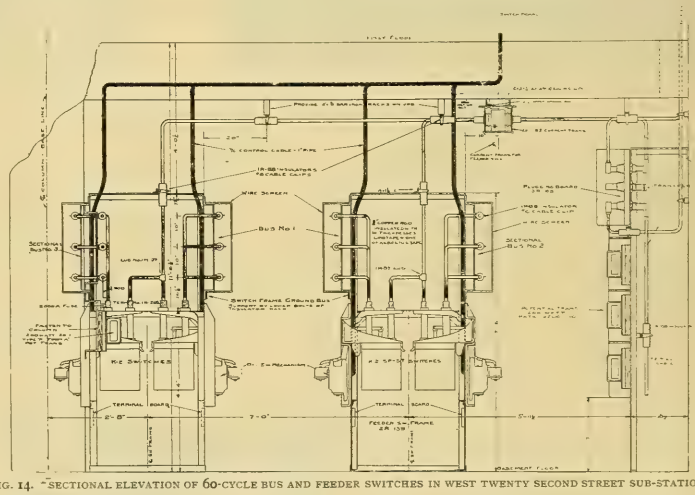


FIG. 14. SECTIONAL ELEVATION OF 60-CYCLE BUS AND FEEDER SWITCHES IN WEST TWENTY SECOND STREET SUB-STATION.

Wm. H. Blood, Jr., President

Arthur Williams, First Vice President

Dudley Farrand, Second Vice President

W. C. L. Eyre, Secretary and Treasurer

OFFICERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

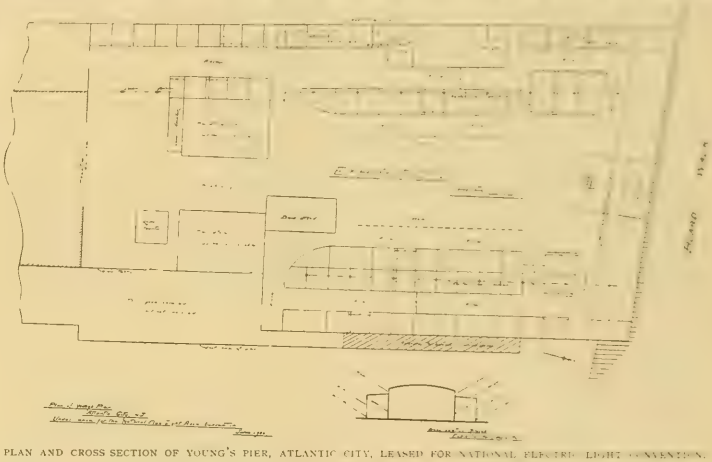
the association's headquarters. This will make little difference, however, as the association has contracted for the use of Young's Pier during convention week. The secretary's headquarters for the registration of members, securing badges and general information, will be at the front of the pier, adjacent to the entrance. The meetings will be held in the small auditorium, at about the middle of the pier. The front, with the exception of the spaces occupied by the exhibits of the associate members, can be used as a music hall and sun parlor by the ladies of the association. Arrangements have been made for a thousand rocking chairs and for morning, afternoon and evening concerts. It is expected that this, with other features, will make the convention unusually attractive.

Special prices have been obtained from 35 of the largest hotels, of which 13 are on the ocean front. The inclusive rates for one person, on the American plan, vary from $2 to $4 daily without bath, and from $3 to $6 with bath; for two persons, from $4 to $8 without bath, and from $6 to $10—in some instances slightly higher—with bath.

The large rooms at the end of Young's Pier, adjoining the Board Walk, has been leased as an exhibition hall for associate members. There will be between 10,000 and 12,000 square feet of space available for this purpose. This auditorium will be open to the public upon the payment of 10 cents—convention members, wearing their badges, entering free—a feature, it is thought, which will add greatly to the value of the exhibition. The accompanying plan shows the relative location of the Board Walk and exhibition hall and the various exhibit spaces. A moderate rental, to pay for the use of the pier, is charged for space, which is now practically all taken. If desired, exhibits may be shipped to Young's Pier, addressed to the exhibitor, in charge of the Eldredge Express and Storage Warehouse Company, Atlantic City, N. J. Arrangements for current should be made with L. W. Byers, Atlantic Electric Light and Power Company, Atlantic City, N. J. A special convention rate of four cents a kilowatt-hour has been obtained through the courtesy of Mr. H. T. Hartman of Philadelphia.

Entertainment features will not be absent. Atlantic City is known for the variety of its entertainments. The programme will include the opening of the exhibition on Monday night, a large reception at the New Marlborough-Blenheim on Tuesday night, and a convention banquet will probably follow later in the week. The governor of the state, and many others prominently identified with the industry, are expected on some of these occasions. The ladies will be taken to Philadelphia for a day, going and returning by special train, and lunching at the new Bellevue-Stratford. The railroad between Philadelphia and Atlantic City is being "electrified." Efforts will be made to have at least part of the road in operation [illegible] delegates.

A rate of a fare and one-third, on the certificate plan, has been secured by Master of Transportation George F. Porter and his assistants for those attending the convention. There will be special trains from Boston and New York and from Chicago. In the West this train will run over the Pennsylvania lines, leaving Union Station, Chicago, at 2 p. m. on Sunday, June 3d, and arriving in Atlantic City the next afternoon. The train will go through Fort Wayne, Pittsburg, Harrisburg and Philadelphia. The train equipment will be first-class in every respect. Going tickets and certificates will be issued June 1st to 7th, and certificates when validated will be honored for return until June 12th. Stopovers at Washington, Baltimore and Philadelphia may be arranged. George F. Porter, 120 Liberty Street, New York, or Young's Pier, Atlantic City, may be consulted in relation to transportation arrangements, while for the West, Frank L. Perry or C. L. Kimball, 2 Sherman Street, Chicago, may be addressed.



PLAN AND CROSS SECTION OF YOUNG'S PIER, ATLANTIC CITY, LEASED FOR NATIONAL ELECTRIC LIGHT CONVENTION.

MAP OF OCEAN FRONT AT ATLANTIC CITY, SHOWING YOUNG'S PIER AND PROMINENT HOTELS.

Immediately after arriving and becoming settled at his hotel, the visitor is requested to go directly to Young's Pier, where, at the right of the entrance, members may register and receive their badges. This office will be open from one o'clock on Monday afternoon, June 4th, until 10 o'clock that evening, and through the following days and early evenings during which the convention con-

[illegible]

Martin, [illegible]

Municipal Ownership Defeated in Denver.

The recent [illegible] was [illegible]

close, is regarded as a triumph for the opponents of municipal ownership. Besides the electing of the usual city officers, at this election 20-year franchises were granted to the street-railway company and the Denver Gas and Electric Company. An amendment to the city charter was also adopted providing for the making of a 10-year contract by the city with the Denver Gas and Electric Company for street lighting at $60 per arc lamp per year. An amendment to the charter providing for the purchase of a street-lighting plant for operation by the city was defeated.

At present there is some agitation looking to a contest over the passage of the franchises, and there will probably be some litigation before the matter is definitely decided. However, the franchises, as passed, are now in effect, and the municipal ownership of a street-lighting plant was defeated.

Muncie, Ind., Quits the Lighting Business.

The Indiana correspondent of the Western Electrician writes that Muncie has decided that municipal ownership as applied to street lighting is a failure. The officials, it is said, came to this conclusion several years ago, but sentiment prevented them from making any change until now. The municipal plant was recently wrecked by the explosion of a large flywheel, and it is now the purpose to let a contract to a private corporation to light the city. The city plant will be abandoned, it is said.

The council of Dayton, Ohio, is said to have appropriated $115,000 for the purpose of providing a pumping station to be operated by electric power generated at the central pumping station. This work will be done in accordance with the plans submitted by the engineer of the waterworks.

Electrical Engineering and Railway Laboratories at Worcester Polytechnic Institute.

The board of trustees of the Worcester (Mass.) Polytechnic Institute has just awarded the contract for the erection of a new electrical engineering building. Upon completion, it is declared that this structure will house the largest and most complete electrical engineering and electric-railway engineering laboratories to be found in any college in the world. The building itself will cost about $125,-

ELECTRICAL ENGINEERING BUILDING OF WORCESTER POLYTECHNIC INSTITUTE.

000, and it is expected that its construction will have progressed to a point where the most of the laboratories will be available early in the next college year. The laboratories have been planned by the members of the electrical engineering department of the Institute, with Peabody & Stearns, Boston, as architects, and Prof. A. W. French of the civil engineering department of the Institute as consulting engineer and superintendent of construction. The perspective drawing gives an idea of the general appearance of the edifice, which will be constructed of selected red brick, with darker red brick and brown stone trimmings and a roof of light green slate. The building will be located at the northerly end of the campus, and facing upon Institute Park, from which the perspective view is taken.

On the lower or basement-floor plan there are shown in the easterly wing three recitation rooms and two offices. These rooms are so placed as to be readily available either for recitation or lecture work before small sections or for use as laboratories, as the growth and future demands of the department may require. It is proposed to use one of these rooms as a telephone laboratory at an early date, and a second room may be devoted to magnetic testing apparatus.

Under the east end of the general laboratory is space for a storage-battery room, and storage for heavier apparatus which may be deposited on this floor by the electric crane traveling over the general laboratory above. An entrance and vestibule at the east end of the building gives ready access to this part of the building. Ample accommodations for toilet, locker rooms and heating equipment are shown at the center of the building and under the main-entrance vestibule and stairway.

In the westerly wing, at the right and under the lecture hall, is located the standards laboratory, where standard reference instruments and apparatus will be found, and where the more exact work of calibration and standardization will be conducted. At the extreme westerly end, and under the lower portion of the lecture hall, will be located a large storage room, where heavy pieces may be lowered by the electric crane. A portion of this storage space may be used for a photometric laboratory.

Under the western vestibule is located a fireproof vault for the storage of records, lecture notes and manuscript, experimental data and the most valuable and delicate instruments of the department. The pit for the two railway tracks entering the general laboratory above appears in the basement plan.

Referring to the first-floor plan, it will be seen that there are three features of primary importance:

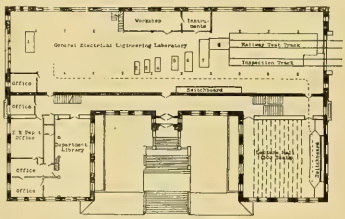
(A) The large general laboratory, having a length of 200 feet and width of 55 feet, containing, with the three galleries shown in the transverse section, a floor area of 19,400 square feet and volume of about 400,000 cubic feet (nearly 1,000,000 cubic feet for the entire building), constitutes what is undoubtedly the largest electrical engineering laboratory in the world. This laboratory is served by a 10-ton electric traveling crane, covering the entire central portion of the laboratory between the galleries.

(B) In the west wing of the building is located the lecture hall, which is capable of comfortably seating 300 persons. There is a difference in level of eight feet from front to back of the room, so that a good view of the demonstration table is obtainable from every seat. Back of the demonstration table is a switchboard, containing circuits reaching any equipment of the department, and the power units of the power laboratory. An overhead-trolley hoist will take equipment from the crane in the general laboratory to the demonstration table. Facilities for darkening the room and for the projection of lantern slides will be provided.

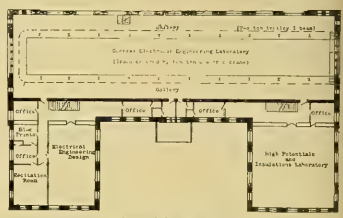
(C) In the east wing is located the department library and reading room, which will be attractively and conveniently fitted for its purpose, shelving extending the entire length of the side next to the offices, and upon the other wall spaces of the room will be shelf room for 3,000 volumes. Reading and study tables will occupy the center of the room, and periodical cases the spaces between the windows in the west side of the room. The room is conveniently located for use in connection with the recitation and electrical engineering design rooms, immediately above, the general laboratory opposite or the several laboratories in other parts of the building.

Most of the department offices are located upon the first floor and along the east end of the building. Upon the second or upper floor of the building, actually the third floor of the two wings, is located, in the west wing, the large high-potential and insulation laboratory, where are located the high-potential transformers, permitting the use of voltages of any desired frequency and potential up to 750,000 volts, for the study of the various problems of long-distance high-potential power transmission, and the dielectric and electrostatic phenomena of insulating and other material. The Worcester Polytechnic Institute is a pioneer among the colleges in the study of very high-potential phenomena, as well as a pioneer in the establishment of a chair of electric-railway engineering, and in the provision of extensive facilities for both of these lines of work.

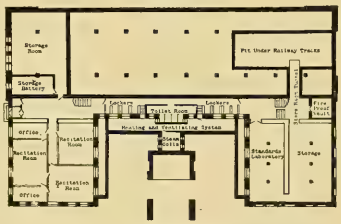
Referring again to the plan of the first floor of the general laboratory, it will be noticed that the arrangement is such that all of the heavier appa-



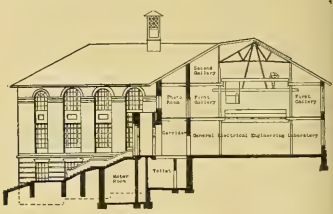
First-floor Plan.



Second-floor Plan.



Basement Plan.



Transverse Section.

ELECTRICAL ENGINEERING BUILDING OF WORCESTER POLYTECHNIC INSTITUTE.

ratus is located in the central aisle, under the traveling crane. Reference to the transverse section, through the center of the building, gives an idea of the location of galleries and traveling crane.

The galleries are designed to accommodate the lighter and accessory laboratory equipment, such as the switch signal, air-brake and controller apparatus for the electric-railway work, the arc-lighting apparatus, transformers and all other equipments not having heavy rotating or reciprocating parts. These galleries are served by two-ton trolley hoists, covering their entire length, the trolleys being arranged so that a load may be transferred from the traveling crane covering the main floor to the trolley hoists covering the galleries.

Ample and convenient space has been provided for workshop and instrument room on the main floor, as shown by the plan.

On the main-floor plan some of the larger stationary equipment is indicated by numbers. Nos. 2, 3, 4, 5 and 6 are generators of from 30 to 60 kilowatts capacity, each directly connected to induction motors receiving power from the service power plant, which is located in another building on the campus. These generators are 110-volt and 500-volt direct-current machines, and single, two and three-phase alternators. Number 7 is a 300-horsepower two-phase 60-cycle synchronous motor, driving a double-current generator, delivering 500 volts direct current, or 350 volts single-phase 25-cycle alternating current. This machine will supply power for railway experimental and testing purposes.

The location of the switchboard, from which all of these machines, as well as the main supply circuit and the laboratory distribution circuits, will be controlled, is shown on the first-floor plan.

Electric-railway Laboratory.

Two tracks, connecting with the tracks of the local railway company, and in that way with the suburban and interurban railways of New England, enter the building at the west end. Both of these tracks are covered by the traveling crane, and one, the inspection track, is for its entire length over a pit, from which work may be done on the trucks, brakes or motors. The second track enters to a testing plant, where the car under test is supported on 36-inch wheels, the rims of which are of the same section as the top of a 100-pound A. S. C. E. rail. These supporting wheels are carried to standard gauge on axles which revolve in bearings carried by pedestals, which can be moved to accommodate cars of any truck and wheel base, up to a maximum of 48 feet between front and rear wheels.

Generators mounted on the supporting pedestals and geared to the supporting axles will provide a load, as well as keep the rotation of the axles synchronous with one another. On each supporting axle will be mounted a flywheel, the weight of which is capable of variation to suit the weight of the particular car under test, so that in acceleration or retardation, the inertia due to the weight of a moving car will be faithfully imitated, and all of the actions of the equipment from the start, through acceleration, constant-speed running, coasting and braking to a stop may be studied while the car body itself remains stationary in the laboratory, the effects due to wind resistance and grades being obtained by means of varying the loads on the generators geared to the supporting axles.

No. 8 on the first-floor plan indicates the location of a traction dynamometer, which serves to keep the car stationary directly above the supporting wheels, and also to measure the drawbar pull.

As a part of the railway laboratory equipment, the Institute will own a double-truck four-motor car of the high-speed interurban type. Exteriorly this car will greatly resemble an ordinary interurban car, but instead of being equipped with seats for passengers, the interior will contain special recording apparatus for automatically registering speed, distance, voltage, current, etc., whether operating on the laboratory testing stand, or on lines of an electric railway. The car will also be fitted for making tests of bonds, feeder losses and other physical determinations of the track and electrical systems passed over.

As the testing stand will be arranged to accommodate any electric car, and the test car can operate on any standard-gauge track, the connection with this laboratory with any of the New England railways by means of the tracks of the Worcester local street railway should be of quite a practical advantage to these railways, as well as providing unexcelled facilities for instruction.

Besides the equipment of motors, controlling, lighting, heating and braking apparatus permanently mounted on the test car, various other types of such apparatus, as well as signaling apparatus and overhead and third-rail and track material, will form parts of the laboratory equipment, so that tests may be made on various systems under various conditions of service. A system of wires and pipes will enable the test car to be operated, while on the test stand, by any of the control or air-brake systems outside of the car, if desired.

The New Building of the Boston Edison Company.

The Edison Electric Illuminating Company of Boston, of which Mr. Charles L. Edgar is president, is erecting a very handsome 10-story office building at 33-39 Boylston Street, adjoining its Head Place property. The new building, together

THE NEW BUILDING OF THE BOSTON EDISON COMPANY.

with the existing one, will accommodate all the offices of the company except President Edgar's, which will still remain at 70 State Street. The first floor is to be fitted up as an exhibition room, equal, in general finish, to the foyer of a first-class hotel. On the third floor will be found the library, covering the entire area. In other respects (as to interior arrangement) the structure will be an ordinary office building of the first class.

As might be expected, especial attention will be paid to lighting effects. Mr. Edgar has appointed a commission of illuminating engineers to advise with the company and the architects, studying the problem as a whole. This commission consists of Dr. Louis Bell of Boston, L. B. Marks of New York and W. D'A. Ryan of Lynn. The details of the illumination are still to be worked out, but it is confidently expected that a plan will be adopted which will not only be commensurate with the dignity and importance of the building, but will serve as an excellent advertisement of the electric-lighting business as well.

The most noticeable feature of the building, architecturally speaking, will be the bronze window in front, 100 feet high and 25 feet wide. This unusually large window opening, effectively treated, has evidently great possibilities, both for admitting daylight and displaying electric-lighting effects at night. The window is being manufactured by the Gorham Manufacturing Company of New York, which declares that it will be one of the best pieces of work ever turned out of its shops.

The accompanying picture was reproduced from Edison Light, the house organ of the Edison Electric Illuminating Company.

Edison Storage Battery.

So much has been said about the new Edison storage battery that it is of interest to note that another patent was issued to Mr. Edison on May 22d (No. 821,032; application filed September 28, 1904) for an alkaline-electrolyte cell, with active materials containing iron and nickel. The battery contains a series of grids or plates which carry pockets for the iron composition. A similar set of grids carries the nickel composition. The latter grids are placed in pairs between the individual grids of the first series. The volume of active material carried by each grid is substantially the same.

The Idaho Light and Power Company has been granted a franchise for a light plant in Payette, Idaho.

Atlantic City in June.

A June convention in Atlantic City, a mixture of press and parley, [illegible] extravagance than at last June gathering, for the throng came to wrangle [illegible] from all sections of the country and [illegible] ded of hotel and cosmopolitan [illegible] Parisian like vanity and life.

There is but one Atlantic City, and [illegible] leading theatre are constantly [illegible] constantly used by an increasing [illegible]

Fifty years ago the beach at Atlantic City, on the desolate New Jersey coast, was dotted with a few small hotels and smaller cottages. A single-track railroad, then just completed, led across the dreary waste of the Jersey pine barrens. It builder and others who ventured to dream of a new road to Long Branch and Cape May were the subject of jibes from prudent investors. But Atlantic City, among its sand dunes and salt marshes, grew year by year. Its only patron was Philadelphia, but Philadelphians have a curious habit of returning often to places they decide to like. There was good bathing and fishing at Atlantic City and fine cruises from the Inlet, out among the billows, after the bluefish. Provision was made for a large excursion business, and the excursionists poured out of the hot city down to the sea for a few joyous hours beside the surf.

In the Centennial year a second railway was completed, and later the existing roads were absorbed with the system of the Pennsylvania Railroad. Later still, the Philadelphia and Reading Railway built a competing line, and both companies vied in luxurious trains and fast service. Today the fastest trains in the world run from Camden to Atlantic City.

In the course of time a rambling board walk was laid upon stilts along the sea front, and this was the germ of the present splendid promenade, famous the world over, which is soon to be extended to the length of 10 miles.

In the early '90's, Atlantic City, which had heretofore been content to enjoy four months of prosperity each year, began to set up as an all-the-year-around resort, and in this, as in all her enterprises, she has succeeded. Although originally built almost altogether of wood, great fires have not figured in her history. The city maintains one of the best fire departments in the world. All important buildings of recent construction have been built of brick, stone or concrete.

The assessed valuation of the realty of Atlantic City is now about $75,000,000. The midsummer population is often as high as 150,000 persons. There are, probably, six or seven hundred hotels and large boarding houses, and these are all cer-

MORNING SCENE ON THE BEACH, ATLANTIC CITY.

PROMENADERS ON THE BOARD WALK AT ATLANTIC CITY.

[illegible] from abroad.

Between meetings and rides [illegible] walking, concerts upon the piers, surf bathing, sun baths and meals, the convention visitor to Atlantic City, who has yet within him the love of life and its joys, is bound to find his days all too short and his flitting back to duty all too soon. F. H. I.

Maximum Voltage for Underground Cables.

The Bulletin de la Société Internationale des Electriciens for April contains an account of experiments made by Mr. de Marchena upon underground cables to determine the practical limit of pressures which may be safely employed. Two installations formed the subject of his experiments, the first being a high-tension tramway system at Nice, and the second a transmission line to convey power to Nice from a hydraulic installation, both of which have been in operation for a few years. From the successful results attained elsewhere at pressures of 5,500 volts, it was decided to try 11,000 volts on these lines. The cables employed were three-core, with eight millimeters of insulation between conductors and eight millimeters between conductors and lead covering, also insulation of 10 millimeters between conductors was tried. The first experiments, made in 1902, were unsuccessful, and extensions to the system were made with cables tested before shipment to 40,000 volts and with a minimum insulation of 10 millimeters. There are now 45 kilometers of cable giving satisfaction at 11,000 volts. The conclusions of the author are that cables carrying pressures up to 20,000 or 22,000 volts can be successfully made and maintained underground, but that from 20,000 to 40,000 volts they are liable to give trouble, and above 40,000 volts are considered to be impracticable for operation.

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CONTENTS OF THIS NUMBER.

Electrical Development in Philadelphia. By Frank H. Taylor. Illustrated 435, 436, 437, 438, 439
Latest Developments in Chicago Edison and Commonwealth Electric Companies' Sub-station System. Illustrated 439, 440, 441, 442
Programme and Arrangements for Atlantic City Convention of National Electric Light Association. Illustrated 442, 443
Municipal Ownership Defeated in Denver 443
Muncie, Ind., Quits the Lighting Business 443
Electrical Engineering and Railway Laboratories at Worcester Polytechnic Institute. Illustrated 444
The New Building of the Boston Edison Company. Illustrated 445
Edison Storage Battery 445
Atlantic City in June. Illustrated 445
Maximum Voltage for Underground Cables 445
Editorial 446
Annual Convention of American Institute of Electrical Engineers at Milwaukee 447, 448
Central Electric Railway Meeting 448
The Long-flame Arc Lamp 448
Lighting Statistics of Chicago 448
National Fire Protection Association 448
Central-station Industry of Massachusetts 449
Changes and Additions in the National Electrical Code.. 449
Book Table 450
Water Diversion of Drainage Canal 450
Chicago Street-railway Situation 450
New Permanent-magnet Switchboard Instruments. Illustrated 450
Single-phase Railway Equipment for Underground C... 450
The New Pagoda "Reflecting Arc." Illustrated 450
Electrical Equipment of Machine Tools in a Large Projectile Shop. Illustrated 451
Hygiene of Rural Electric Railway 451
Metallic Lamp Filaments. By J. Swinburne 452, 453
Notes on the Lighting of Churches. By Edwin R. Weeks. Illustrated 453
Economic Value of Niagara Power 453
Electrical Production of Fuel from Peat 454
Public Laboratory of Electricity in Belgium 454
Questions and Answers 454
Horsepower Required by Machine Tools 454
Starting of Polyphase Motors 454
Use of Thermo-electric Couple to Increase Temperatures 454
An Efficient Cinder Trap 454
Iron Wires Substituted for Copper in Telegraph Work.. 454
Brailey Syndicate Gets Federal Telephone Properties.... 455
New Companies 455
Indiana Telephone Items 455
Ohio Telephone Notes 455
Canadian Telephone Items 455
Telephone News from the Northwest 455
Southeastern Telephone Developments 455
Illinois Telephone Convention 455

DEPARTMENTS.

Correspondence 456, 457, 458
Great Britain 456
Dominion of Canada 456
New England 456
New York 456, 457
Southeastern States 457
Ohio 457
Indiana 457
Illinois 457, 458
Northwestern States 458
Pacific Slope 458
Personal 458, 459
Electric Lighting 459
Electric Railways 459
Publications 460
Miscellaneous 460
Trade News 460
Business 460
Illustrated Electrical Patent Record 461, 462

DATES AHEAD.

National Electric Light Association (annual convention), Atlantic City, N. J., June 5th to 8th, inclusive.

Canadian Electrical Association (annual convention), Clifton House, Niagara Falls, Ont., June 19th, 20th and 21st.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Hollenden Hotel, Cleveland, Ohio, July 18th to 20th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

READERS of the Western Electrician will hardly need to be reminded that the annual convention of the National Electric Light Association is at hand, and that all interested in electric lighting should make every effort to attend it. The meeting is held in Atlantic City this year, from June 5th to June 8th, inclusive, and the programme, given elsewhere in this issue, presents a list of papers which should prove valuable and helpful. It will be observed that, in larger proportion than ever before, the papers are of a business nature, paying much attention to the merchandising and salesmanship sides of the industry. In fact, the convention promises to be largely a business rather than a technical convention. This is characteristic of the natural settling-down development of the central-station business, influenced to a great extent by the "new-business" movement of the last year or so. But technical subjects are not neglected, and, altogether, the convention promises to be a very satisfactory one in every way. It will be reported in the next two issues of this journal.

IS IT true that the carbon-filament incandescent lamp is doomed? James Swinburne, the well-known consulting electrical engineer of London and past-president of the Institution of Electrical Engineers, says that it is probably so, and adds that the fact has been recognized for five years. His exact language is as follows: "At the beginning of this century it was quite realized that the carbon filament was probably doomed, although it would take a little time to replace it." This sentence occurs in an interesting article on "Metallic Lamp Filaments" in the London Times Engineering Supplement, which we reproduce elsewhere. In this country, it may be remarked, the replacing of the carbon filament in the ordinary vacuum incandescent electric lamp has hardly been begun, and certainly it has not proceeded very far in any country. Mr. Swinburne has something of a reputation as a humorist in England, and possibly in saying that it would take a little time to replace the carbon-filament lamp he did so with a twinkle in his eye. Still the subject of metallic filaments is one of great importance; it apparently means much to the electric-lighting industry. We reprint Mr. Swinburne's article in full; it is well worth reading.

SUB-STATION DESIGN is one of the most important features of modern electrical development, both in lighting and railway plants. The rapid growth of the number of these installations among the larger companies marks the reaching out of the service to an extent which was hardly dreamed of a few years ago. Features of new design of sub-stations in the railway field were considered in two articles contributed to the Western Electrician by Mr. Sydney W. Ashe, which appeared in the issues of September 30 and October 7, 1905. In the present issue, on the eve of the National Electric Light Association's convention, when consideration of central-station practice is particularly appropriate, an effort is made to describe in a somewhat similar manner the design, arrangement and utilization of the sub-stations of two of the most progressive electric-lighting companies in the country—the Chicago Edison and Commonwealth Electric companies.

It is well within the recollection of even the younger generation when there were no sub-stations in Chicago, and the electric-light and power business was carried on from the generating plants directly on a limited scale. To-day a glance at the map of the Edison and Commonwealth companies' system reveals the fact that there are a total of 31 sub-stations, including those for the distribution of direct current and the alternating-current transformer sub-stations.

The majority of the sub-stations are located within the downtown district, and supply the direct-current network. Owing to the high price of real estate in this quarter, these sub-stations are located for the most part in the basements of buildings not owned by the company. In the outlying districts the custom has been to erect buildings for sub-station apparatus.

Inasmuch as some of the older sub-stations have already been described in this journal, the present article is confined to the most recent of the installations, and embodies descriptions of five which have been installed within the last two or three years. The five selected embody rotary-converter, motor-generator and storage-battery equipments, and it is believed that they exemplify the most modern practice in sub-station design.

It may be that with the progress of the art, particularly in the electric-railway field, the sub-station will eventually be done away with, proving merely a stepping-stone in the march of development. But at the present time it is a very useful and important part of the system, and is to be studied carefully to obtain the highest efficiency and economy.

FREE ALCOHOL seems now to be an assured fact. The bill has passed both the House and the Senate, and it is believed that the President will sign it. Perhaps by the time these lines reach the eyes of the readers of the Western Electrician he will have already done so. What effect the new law will have on the lighting interests of the country remains to be determined. No doubt, in time, kerosene and gasoline will have to meet a formidable competitor. And if a satisfactory light, cheaper than that of the gasoline-mantle lamp, can be produced, will there not be introduced a new and serious competitor of the electric light in country towns? Many central-station men throughout the West and Northwest are asking themselves this question. Such comments as the following from the New York Times of May 25th give rise to some apprehension:

Out in the Northwest, where kerosene oil costs 18 cents a gallon and gasoline 22 cents, the passage by the Senate yesterday of the free-alcohol bill means something—as it does to the nation. According to the committee report of the House, denatured alcohol for light and fuel can be manufactured in that territory from corn at a cost of 14.2 cents a gallon. The alcohol can be made in Cuba from lowest-quality molasses and imported to eastern markets at a cost of about 9.4 cents a gallon. Tested in a lamp with a mantle, as is in common use in Germany, a gallon of this cheap alcohol furnishes an equally good light for twice as many hours as would a gallon of kerosene burned in the most approved pattern of kerosene lamp. Under the bill as it passed the House, and now with slight amendments the Senate, even if the methylated alcohol sold at nearly twice the price of kerosene, it will, after January 1st next, doubtless become a competitor of that illuminant.

So far as the electric light is concerned, we are in the position of the gentleman from Missouri in relation to the alcohol-mantle lamp; we will have "to be shown." In the first place, it will be some time before denatured alcohol will be produced in large quantities, and as there will undoubtedly be a demand for it as a fuel for automobile and other hydro-carbon engines, the price for it is likely, for several years at least, to be higher than is now apprehended. In fact, we are rather skeptical about the nine-cent and 14-cent alcohol, of which the Times speaks so confidently. The price will depend on many factors, which at this time no one can foretell with accuracy.

Then, again, what of the quality of the alcohol-mantle light? Is it as good as the gasoline lamp, with which we are familiar? Electricity has always had the very great advantage of providing the best artificial illuminant. This superiority will not be affected, in all probability, by alcohol. Germany, where pennies are certainly counted as closely as in the United States, has a flourishing electric-light industry. The alcohol lamp does not seem to have created any great havoc among the central stations of that country.

Further, it is likely that with flame-arc lamps and metallic-filament electric incandescent lamps the electric-lighting companies may be able to supply light more cheaply in the future—in other words, furnishing more light with a given amount of current. The general tendency is in the direction of slowly decreasing rates for electric light.

Still another point to be considered is the fire hazard of alcohol as an illuminant. This is a matter of no little importance. What will the underwriters have to say about the dangers of the alcohol-mantle lamp?

For these reasons, and remembering that acetylene, also held up as a bogey to the electric-light man, never made any serious headway against the central-station industry, we are disposed to view the advent of free alcohol with composure, although not with indifference. But, nevertheless, the electric-lighting companies, particularly in those rural or semi-rural communities where gasoline competition has been most keenly felt, should be forewarned in order to be forearmed against any possibilities that may be lurking in beneficent "free alcohol."

Annual Convention of American Institute of Electrical Engineers at Milwaukee.

Opening Exercises.

The twenty third annual convention of the American Institute of Electrical Engineers was called to order by President Wheeler at 11.30 a. m., Monday, May 28th, in the auditorium of the new Public Service Building, Sycamore and Third streets, Milwaukee. This meeting served as the dedication of this new office building of the Milwaukee Electric Railway and Lighting Company. At the time the meeting was called to order some 100 delegates were registered. Among these delegates were two past-presidents of the Institute, Mr. C. P. Steinmetz of Schenectady and Mr. C. F. Scott of Pittsburg, and the president elect, Dr. Samuel Sheldon. These gentlemen occupied the platform with President S. S. Wheeler throughout the session.

Mayor Becker was unable to be present, and City Attorney John T. Kelley was introduced by Mr. C. W. Burkett of the local committee to give the address of welcome. Mr. Kelley, after offering the freedom of the city to the convention, spoke briefly of the civilizing forces of the applications of electricity, and called attention to Milwaukee's great electrical company in an informal dedication of the Public Service Building.

President Wheeler's address was upon the subject "Engineering Art," and was a very excellent discourse on the duties of the engineer in general and of the electrical engineer in particular. Several extracts were read from the code of ethics of various professional societies, after which President Wheeler carefully outlined the various duties of the engineer to his clients, to his fellow professional men, to the public and to his representative society. The latter part of his address was an appeal for the support of the Institute by electrical engineers.

Following established precedent, President Wheeler at the close of his address introduced Dr. Samuel Sheldon of Brooklyn, president-elect of the Institute. Dr. Sheldon responded briefly, stating his appreciation of the honor of being selected for this office and of the duties falling to the president of this society.

Repulsion Induction Motor.

In the absence of the author of this paper, Mr. Maurice Milch, it was presented by Dr. Steinmetz, who merely called attention to the more important points of the motor.

Prof. D. C. Jackson, University of Wisconsin, in opening the discussion said that several years ago he came to the conclusion that single-phase distribution was better than polyphase distribution, and he looked for a satisfactory single-phase motor which would include certain characteristics of the repulsion motor and in other ways be like the induction motor. He still believed that single-phase distribution is now satisfactory for the smaller plants, and he congratulated Mr. Milch on his excellent paper.

Mr. Cole called attention to the large slip of this type of motor on full load, 15 per cent., and compared it with the slip of $2\frac{1}{2}$ to three per cent. for motors such as the Arnold motor. On account of this slip the motor is not adapted to cotton-mill work, but might do for elevators and machines. He also thought that the starting current might be very objectionable.

In closing the discussion Dr. Steinmetz said that high torque necessarily means large slip at full load, and hence the repulsion motor is not intended for limited constant-speed work. He does not believe it will enter this field, as suggested by Prof. Jackson. The repulsion induction motor is the only motor that will develop four times full-load torque on four times normal current at starting. It is a motor intermediate between the series motor and the induction motor. The same thing could be accomplished with a motor arranged to be controlled by hand and run as a series motor or as an induction motor, but this method of control would not serve for rapidly fluctuating loads.

Comparison of Two and Three-phase Motors.

Bradley McCormick of Cincinnati abstracted his paper on the above subject. Mr. A. S. McAllister, in opening the discussion, stated that the working component of the exciting current could be obtained in a much more simple manner and showed how it could be determined by knowing the volume of the iron and the volume of the air gap.

Dr. Steinmetz stated that the conclusions reached by Mr. McCormick do not agree with results obtained experimentally on a machine arranged to be connected single phase, two-phase [illegible]. In these experiments the [illegible] the same for the two and three-phase [illegible] slightly lower for the single-phase [illegible] maximum output for the [illegible] 35 to 40 per cent. of the [illegible] three phase.

Mr. C. F. Scott added to the [illegible] giving a brief history of the design [illegible] method similar to the method of [illegible] paper was used in the early design [illegible] motor.

Heat Tests of Alternators.

The first paper of the afternoon session was [illegible] of the above title by Sebastian Senstius. In closing the discussion of the paper Dr. Steinmetz spoke of the difficulties encountered in accurately determining the rise in temperature, due to the variation of the air temperature.

Direct-current Motor Design as Influenced by the Interpole.

Charles H. Bedell of Bayonne, N. J., read his paper, and the subject was a source of considerable discussion. H. F. T. Erben of Schenectady opened the discussion. After a short history of the development of the "commutating" pole at Schenectady he stated that its present use is due to the demands of high speeds and variable speeds. Experience with motors and generators from one-half horsepower capacity to 2,000 kilowatt machines shows that the commutating pole is an immense boon. Oscillograph curves show the flux distribution to be nearly uniform in the neighborhood of the brush and not as shown by Mr. Bedell. It is possible to secure excellent regulation with the inter-pole machine with brushes at the neutral point, and by a back shift a corresponding effect may be secured. The efficiency of a 500-kilowatt unit was given by Mr. Erben as 96.2 per cent.

In answer to a question regarding the use of the motor for railway work, Mr. Bedell cited experiments made by himself on a 10-horsepower motor. A 100 per cent. overload with nine per cent field excitation failed to produce sparking. He suggested that railway motors with three or four extra economical running points could be constructed by the use of the inter-pole.

President Wheeler said that it was largely a question of refinements versus simplicity. If a simpler motor or system would give good results, the more complicated inter-pole motor should not be used. He advocated the multiple-voltage system for speed control in machine shops.

Dr. Steinmetz called attention to the fact that at one time the design of direct-current machines was in relation to heating; then it became commutation. The use of the inter-pole has given an opportunity for the redesign of other parts of the machine so as again to reduce heating.

Protection from Lightning.

The meeting of Tuesday morning was held in one of the assembly rooms in the University Building, the auditorium of the Public Service Building proving too large for the uses of the convention. The meeting was called to order promptly by President Wheeler, and the three papers dealing with lightning protection were read before the discussion was opened.

"Experiences with Lightning and Static Strains on 33,000-volt Transmission Systems" was the subject of a paper presented by its author, Mr. Farley Osgood of the New Milford Power Company. This paper deals with observations made upon operating lines of the New Milford Power Company, with multi-gap series resistance type of lightning arresters and with the multi-gap arresters without series resistance, during the years 1904 and 1905. During 1904 the type of arrester with the resistance was used, and these arresters consisted of 64 gaps and 32 resistances of 250 ohms each between line and ground and 128 gaps and 64 resistances between lines. Considerable trouble was experienced in the neighborhood of the Waterbury sub-station, and in many cases the arresters were badly broken up, and bus-bar insulators were occasionally broken. During 19 electrical storms the service was interrupted 56 times.

In 1905 the arresters were replaced by multi-gap apparatus without series resistance, and the instantaneous relays of the circuit-breakers replaced with time-limit relays set for 6.5 seconds. The arresters had 672 gaps between line and ground. During especially severe storms these arresters held an arc until the cylinders were fused together. Four electrical storms occasioned seven interruptions to service, showing considerable improvement [illegible]

[illegible]

President [illegible] dent Wheeler [illegible]

Dr. Steinmetz [illegible] of the [illegible] The group of papers [illegible] portant to the [illegible] because of the long [illegible] high voltages [illegible] order to judge lightning [illegible] must be selected, [illegible] expect of such arresters [illegible] the main station [illegible] not be expected to [illegible] that can be done here is [illegible] as well as possible from [illegible] effects or voltage from the line.

Dr. Steinmetz emphasized the fact that the protection of lightning comes at the very beginning of the design of a system in the selection of a route for the transmission line itself. [illegible] should be located so as to be as free from lightning effects as far as possible, and [illegible] in the selection of the right-of-way. In the ordinary design of a transmission line the mechanical features are considered, but the electrical features stop with the selection of the insulator. The line should first avoid places particularly exposed to lightning, and then be specially protected at such points of danger as cannot be avoided.

It is true that danger points are not always recognized, but isolated hills and the west slopes near the summit level should be avoided. Examples of very poor locations were cited. In some cases poles of a system, following a straight-line right-of-way, were shattered by lightning before the lines were strung, and still the station apparatus is expected to protect the system from interruption.

For special protection of the line, the speaker proposed a grounded overhead conductor, erected high enough above the transmission line to afford a real protection. This conductor should never be a light wire or of poor quality, but it should possess high current-carrying capacity and be frequently grounded, though special care is not necessary in making these grounds. A steel cable, extending from pole top to pole top, with tension increased above that in the line wires, and which will serve as a mechanical support to the line as well as a protection, should be used. A light construction is rather a source of interruption than of protection.

In specially exposed places three grounded conductors should be used, one on either side of the line, in addition to the overhead conductor. It is even possible to obtain protection by stringing short-circuited parallel lines, such as wires loosely hung over trees, alongside of the transmission line.

Assuming that the line is not unduly exposed, and that these special protections are installed, the static problem for the station arresters is a simple one, though no amount of protection will keep all trouble out. The grounded wire acts as a series of short-circuited secondaries to the line, and disturbances passing along the line have their energy quickly dissipated by such short-circuited secondaries, though in the case of a direct stroke of lightning near the station some disturbance will probably reach the station.

A 33,000-volt line equipped with 672 1-32-inch gaps gives, according to one method of calculation over 9,000,000 volts as the breakdown voltage, while, as a matter of fact, 60,000 volts will break such an arrester down. This is explained by Dr. Steinmetz by the form of the electro-static gradient in the case of such an arrester. It is very steep in the neighborhood of the line, so steep as to break down the first gap in some cases, and the steepest point in the gradient is transferred to the second gap, and so on, until the entire arrester is broken down. This is also given as an explanation of the breaking down of immense gaps by lightning discharge

in the air, drops of water taking the place of the cylinder in the arrester. The brush discharge from a point or sphere is another example of the steep electrostatic gradient. The shape of the gradient can be modified by the use of shunt gaps and resistances.

Short-circuits on lines do not always cause surges in the lines, but they may cause surges.

Mr. P. H. Thomas was next called upon for discussion of lightning protection. Mr. Thomas believed that the most important subject in connection with the lightning arrester is the shunt gap. The question is to extinguish the arc due to dynamic current. The introduction of the shunt gap has a tendency to break this dynamic current, as experiments made at Niagara Falls show.

Mr. Thomas reproduced some curves, given at the Great Barrington convention, showing the relation of number of gaps to current the gaps will break, depending on the series inductance of the circuit. On small currents the shunt resistance of arresters is very effective, but a series resistance should be included to prevent the current from becoming too high in some cases.

Mr. Thomas commended papers of the nature of Mr. Osgood's for the practical information they contain for the guidance of the designing engineer. He believed 8,000 ohms for a series resistance, such as was used by Mr. Osgood in 1904, to be entirely too high.

In commenting on the second paper, that of Mr. Creighton, Mr. Thomas called attention to the necessity of taking great care in laboratory tests to approximate line conditions. He criticized some of the assumptions made by Mr. Creighton.

Mr. Creighton replied that he was justified in his assumptions and would furnish further proof at some future time.

The question was further discussed by Messrs. J. B. Taylor, C. W. Rice, P M. Lincoln, Dr. F. A. C. Perrine and C. F. Scott, after which the discussion was closed by Messrs. Osgood, Creighton and Wirt. The latter part of the discussion was devoted to clearing up questions which had arisen during the general discussion.

STANDARIZATION AND OTHER MATTERS.

As Mr. Morgan Brooks was not present at this meeting, his paper on "The Self-synchronizing of Alternators," scheduled to be read on Tuesday, was postponed until Wednesday.

A preliminary report of the standardization committee was submitted to the convention, in order to get the opinion of the members present on the general form of the report. There was considerable discussion, and many objections were offered to the report as presented, but it was finally voted to send this report to all members of the Institute and all others interested, asking for comments and criticism. Later the report would be again compiled by the committee and acted upon by the board of directors. There was some opposition to the granting of power to the board of directors to make this report official.

At three o'clock special cars of the Milwaukee Electric Railway and Lighting Company conveyed the delegates to West Allis, where they visited the works of the Allis-Chalmers Company. A luncheon was served by this company at its works.

An automobile ride about the city and luncheon at the Milwaukee Country Club was arranged for the visiting ladies by the local committee.

G. C. S.

[The remainder of the report will be given in the Western Electrician next week.]

Central Electric Railway Meeting.

The last meeting for the season of the Central Electric Railway Association was held at Dayton, Ohio, on May 24th. Most of the roads in Ohio, Indiana and Michigan were represented. E. L. Hamilton, secretary of the Railroad Y. M. C. A. at Chicago, made an address, in which he urged the electric-railway men to take up the work. He gave some facts concerning the work among the employes of the steam roads and said that the same could be accomplished with the electric-railway men. No action was taken for the present. The establishing of a bureau of information regarding accident swindlers was proposed by E. M. Hoover of New York. J. W. Brown, superintendent of the West Penn Railway Company, read a paper on the best manner of stimulating summer traffic. His suggestions were practical.

For some time the question of baggage has been under discussion by this association, but at this meeting action was taken that will definitely settle the question. Passengers will be allowed 150 pounds of baggage free instead of a charge of 25 cents a hundred as has heretofore been made. This will to a certain extent make the travel of commercial men easier.

The plan of forming an insurance company to carry the risks of electric-railway companies was approved, as the managers feel that they have been paying rather heavy rates to the regular fire companies, but the details of this matter will be worked out later on.

Special cars were run on all the roads reaching Dayton for the accommodation of the visitors. There will be no more meetings until fall.

The "Long-flame" Arc Lamp.

At a recent meeting of the British Institution of Electrical Engineers an interesting paper was read by Leonard Andrews upon the subject of "'Long-flame' Arc Lamps." Until recently, according to Mr. Andrews, it was established by tests that the best efficiency for arcs was for lengths not exceeding three or four millimeters, and Mrs. Ayrton showed that the extra energy for maintaining longer arcs was swallowed up in arc mist. This, however, applied to lamps with coaxial carbons. With down-feeding inclined carbons the arc can be efficiently maintained at from 10 to 15 millimeters, and such lamps are now coming into general use. The improvements in such lamps are—(a) the formation of a positive crater in such a position that none of the light is intercepted by the negative carbon; (b) the impregnation of the carbons with metallic salts. Of such lamps the Carbone and chemical carbon arc are very efficient, the candlepower per watt being 2.24 and 5.80 respectively, as against 1.54 and 0.77 for the ordinary open arc and enclosed arc.

Previous attempts to obtain an unobstructed positive crater by inclined carbons have been mainly at low pressures. In the Carbone lamp the voltage across the arc is from 80 to 90, and the long, steady arc is maintained across the carbon tips, the fully-exposed crater giving forth a maximum light. The arc is controlled by a closed magnetic circuit round the carbon points, and is formed by a ring with two solenoid cores arranged diametrically. Holes drilled in the ring midway between the cores increase the magnetic reluctance, and the resulting weak leakage field maintains the arc at the carbon tips. The positive crater has an area of 17.1 square millimeters, of which three square millimeters is soft core. A longer arc can be maintained when the positive carbon has a soft core with a given voltage. The maximum candlepower in Hefner units was 3,142.

Impregnation of carbons with calcium and other salts increases the efficiency owing to the high luminosity of the flame, the brilliancy of which is about one-third that of both craters, but irregularity in burning and the emission of poisonous fumes limit the usefulness of such lamps; moreover, the pure carbon yields a whiter light. Mr. Andrews showed by diagrams how the distribution of the lamps affects the illumination, and the conclusion is reached that considerable saving in energy is effected by the use of unobscured flame lamps placed 25 feet above the ground. The paper concluded with a brief reference to alternating-current arc lamps, which have a low efficiency owing to the light thrown upward, which for most purposes is wasted. The flickering becomes objectionable below 50 cycles per second, but this difficulty may be lessened by the use of down-feeding inclined carbons. Tests made by passing strips of bromide paper rapidly across the light showed that a downward-feeding carbon lamp at 50 cycles gives the same effect as an ordinary lamp at 100 cycles.

Considerable discussion was aroused by the paper, and some of it, as given in the London Times Engineering Supplement, is of interest.

Speaking from the viewpoint of a central-station engineer responsible for public lighting, E. E. Headley said that the Carbone lamp, as at present made, consumes about 850 watts, which is far too high for general use in small towns. He would like those who were responsible for the introduction of flame arc lamps to produce a trustworthy lamp with a consumption of between 250 and 300 watts, as he was sure that such a lamp would be largely adopted in small towns. It was also important that the lamp should have a greater length of burning. He had experienced no trouble from flickering with chemical flame arcs, nor had he noticed any ill effects or poisonous fumes.

W. H. Patchell referred to the success achieved by electric lighting in connection with the Charing Cross station. A test had been made as to the merits of gas and electric lighting for the new station, and after the demonstration of the Oriflamme lamp in comparison with gas there was no need to wait for the decision of the board to know what form the lighting of the station would take. On the basis of price for price they could give with the electric lamps 45,000 candlepower against 20,000 with the gas lamps. The following figures made a comparison between different types of lamp for the same candlepower per hour with current at 4.06 cents a unit: Oriflamme (350 watts), 0.812 cent; Weinert (350 watts), 1.12 cents; Excello (470 watts), 1.16 cents; Santoni (420 watts), 1.42 cents; 1,000-watt Carbone lamp, 2.03 cents; open arc (500 watts), 3.045 cents; Evelina arc (500 watts), 4.06 cents; enclosed midget arc (250 watts), 6.09 cents.

E. W. Cowan said that lamps were now being made of the magazine type which gave 300 hours.

W. M. Mordey said that the new lamps had made a timely entrance on the stage of electric lighting, for the ordinary arc lamp was being superseded by the improved gas lamps. Electrical engineers had not a little to thank the gas industry for, and he hoped that the competition of gas would continue to stimulate the progress of electric lighting. The flame arc lamp would keep the field for electric lighting, but it would be a mistake to rest on that achievement.

Prof. A. Swartz pointed out the fact that illuminating engineers appeared to be awakening to the fact that in arranging a scheme of illumination there were other factors to be considered in addition to the candlepower per watt. Questions of color, steadiness and suitable intrinsic brilliancy were beginning to receive attention. The point to be noted, and it was a deduction which the author came near to making, was that all strong light should be directed from above and at a considerable angle to the horizontal. The gas companies had familiarized the public with the placing of lights within the field of vision. They began with a radiant of low intrinsic brilliancy, and by now adopting a radiant of much higher intrinsic brilliancy fixed at the same height they had dazzled rather than illuminated the public.

Lighting Statistics of Chicago.

Statistics of artificial lighting in Chicago for the year 1905 have been completed by the Municipal Bureau of Statistics. The total cost of lighting the streets for the year is given as $960,048.65, and the total candlepower was 14,352,434. This includes all kinds of lights—gas, gasoline and electric. Of the arc light, 5,743 were operated by the city and a monthly average of 752 were rented. The rented arc lights cost the city $103 each. In comparison with this it is interesting to note the alleged cost of the municipally operated arc lights, which is given as $52.63. But in arriving at the cost of the municipal arc lamps only three items are considered in the published statistics, as follows:

Operation	$49.73
Replacement and betterment	2.41
Per cent. of office expense	0.49
Total	$52.63

Besides electric lights, both gas and gasoline were used in lighting the streets. The number of each kind, the cost, etc., was as follows:

	Monthly Average.	Cost.	Candlepower (Estimated).
Gas	24,727	$423,616.81	1,012,814
Gasoline	5,827	150,500.43	340,620
Rented electric lights	752	75,510.48	1,504,000
Municipal electric lights	5,743	302,219.85	11,486,000
Gas office lights		8,192.08	
Total 1905		$960,048.65	14,352,434
Total 1904		936,482.22	12,858,000

The number of electric-light stations and lamps in the city under jurisdiction of the Department of Electricity was as follows, for 1904 and 1905:

	No. of Stations.		No. of Arc Lamps Operated.		No. of Incandescent Lamps Equivalent to 16 Candlepower.	
	1905.	1904.	1905.	1904.	1905.	1904.
Commercial companies, central stations	30	59	19,045	17,627	1,404,719	1,208,321
Isolated plants	1,368	1,216	15,403	15,030	773,778	765,658
City plants, street lighting	4	3	5,743	5,107	.....	.....
City plants, isolated	12	12	69	31	5,286	4,180
Totals	1,414	1,310	40,260	37,795	2,273,703	2,068,159

The department made 34,250 inspections during the year and issued 13,753 permits for the installation of electric-light wires and apparatus. Electric motors having an aggregate capacity of 42,792 horsepower were inspected.

National Fire Protection Association.

The National Fire Protection Association held its tenth annual meeting in the Auditorium Hotel, Chicago, May 22d to 24th. The meeting was well attended and proved profitable to the members. The object of the association is to promote the science and improve the methods of fire protection, and to this end many valuable papers and committee reports were read and discussed.

Besides the consideration of fire-protection matters there were some interesting addresses. Uberto C. Crosby, first president and an honorary life member of the association, told of the organization in 1896, with 28 members, and traced the growth to the present day, with over 1,000 members, and C. A. Hexamer, president of the association, spoke of the San Francisco conflagration and drew from it some lessons for insurance engineers. The report of Secretary W. H. Merrill, Jr., was adopted

Officers were re-elected as follows: President, C. A. Hexamer, Philadelphia; vice-president, William A. Anderson, New York; secretary-treasurer, W. H. Merrill, Jr., Chicago. Members of the executive committee were re-elected, except that F. E. McKnight of Atlanta takes the place of F. J. McFadden. H. C Eddy, western manager of the Commercial Union, was elected an honorary life member. Mr. Eddy is at the head of the Underwriters' Laboratories as chairman of the Union's committee on fire-protection engineering. The members visited the Laboratories before leaving the city.

Central-station Industry of Massachusetts.

The annual reports of the Board of Gas and Electric Light Commissioners of Massachusetts are admirable compilations, containing a great deal of interesting and valuable information. From the twenty-first report, recently issued, the following facts are taken:

There are now under the supervision of the board 140 companies, and the gas or electric light plants of 19 towns and three cities. Of the companies, 46 are engaged in the supply of gas only, 26 in the supply of both gas and electric light, and 68 supply only electricity. Of the municipalities, four have plants for the supply of both gas and electricity, the others supplying electricity only.

Testing of Meters.

The testing of electric meters upon the request of customers or companies, under the authority of sections 36 and 37 of chapter 121 of the revised laws, has been continued with the same regulations and the same expert assistance as heretofore. In the six months of 1901, during which the law was in force, six meters were inspected; seven were inspected during the year 1902, 29 in 1903, 67 in 1904, and 50 in 1905. The results of the inspections in 1905 show that most of the variations were trifling, about as many meters registering slow as fast. In one case a meter was reported 42 per cent. slow on half load, but in no case was a meter as high as 10 per cent. fast. Thus the companies appear to have more cause for complaint than the customers.

Municipal Ownership.

"Section 22 of chapter 34 of the revised laws, which relates to the manufacture and distribution of gas and electricity by cities and towns, provides that the 'price shall not, except with the written consent of the board of gas and electric light commissioners, be fixed at less than cost, in which shall be included all operating expenses . . . also depreciation of the plant to be reckoned at not less than five per cent. per annum of its cost.' This provision was a part of the original act of 1891 authorizing cities and towns to undertake this business.

"These requirements fully recognize the importance and soundness of the principle that a fair allowance for depreciation is as much a part of the current cost of carrying on the business as the payments for labor and material used. A practical recognition of this fact by the management is essential to the successful conduct of such a business, whether carried on by a municipal or private corporation. Failure to consider it insures a rapid impairment of the investment, which must become serious if long continued. Provision against this is necessarily a part of the burden upon the consumers, and should not be imposed upon the town as the owner or the taxpayers as the persons whose money is invested in the plant. These facts have been generally recognized in the municipal returns made to this board, and charges for depreciation at the rate named in the act have regularly appeared in the accounts; but, with rare exceptions, no actual provision to meet depreciation has been made, and as a result in nearly every case the original investment has become to a greater or less extent impaired. To continue such a policy indefinitely must be financially disastrous.

"Although the desirability of providing for depreciation was recognized in the original act, the provisions were negative in their character rather than positive, and such recognition as it has received in the accounting has been a matter of bookkeeping merely.

"Attention having been directed to this and other features of the municipal-ownership law at the session of 1905, an act was passed which, along with other changes, is positive in its terms upon this point, and require that actual [illegible] for depreciation. Obviously the [illegible] for this purpose will vary with [illegible] acter of the plant and the [illegible] round their operation. The act [illegible] naming five per cent. as a [illegible] for depreciation, has vested in [illegible] thority upon the request of the [illegible] a different rate.

"The money acquired under the operation of the act are not required to be set apart and invested to accumulate, but may, as in the ordinary course of business probably would, be used for actual renewals and reconstruction, or invested in new and additional plant. As the discretion as to the size of the depreciation fund is vested in the board by the act of 1905, we respectfully suggest the advisability of so amending that act as to give the board a like discretion with respect to the purposes for which it may be used."

In the following table the financial operations of all the municipal plants in the state are combined from the items relating to the manufacture and sale of electricity in the returns of the last two years:

Income	Year ended June 30, 1904.	1905.
From:		
Sale of commercial arc lights	$15,628.20	$12,1[illegible].74
Sale of commercial incandescent lights	11,679.50	8,[illegible]
(contract and meter	168,730.84	128,[illegible]
Sale of domestic incandescent lights	79,782.33	92,[illegible]
Sale of electric power	15,647.62	36,[illegible]1.21
Rent of meters	2,155.85	2,786.76
Rent of motors	607.11	[illegible]
Rent of fixtures	786.58	1,001.67
Other sources	1,821.51	[illegible]
Total	$236,841.54	$287,1[illegible].12
Expenses:		
Coal	124,870.93	113,324.85
Oil and waste	5,024.82	5,151.22
Water	1,599.00	2,118.69
Wages at station	61,245.64	72,266.66
Repairs of real estate	2,298.13	3,710.50
Repairs of steam plant	8,216.76	13,316.45
Repairs of electric plant	9,217.85	3,125.01
Station tools and appliances	663.64	1,119.12
Wages for care of lights, etc	22,752.05	22,685.74
Repairs of lines and lamps	28,715.43	31,568.69
Carbons	5,359.68	4,691.14
Incandescent lamps	1,301.74	4,546.34
Globes	727.31	1,189.55
Distribution tools and appliances	7,162.55	7,228.05
General salaries	23,807.01	25,351.12
Salaries of municipal light board	1,142.50	1,817.49
Committee expenses		101.70
Auditor's fees	115.78	22.32
General office expenses	6,298.09	7,009.77
Rents	230.04	230.04
Insurance	7,410.85	8,387.13
Law expenses	29.50	138.13
Claims		305.98
Bad debts	595.52	1,150.44
Incidentals	21.75	61.58
Total	$321,896.70	$352,019.71
Leaving an apparent loss in operating account of	85,055.16	64,830.59
To which is to be added the following:		
Interest on notes and bonds	61,725.99	62,982.88
Depreciation charges	85,851.27	93,552.21
Losses on other items	463.32	1,016.45
Leaving as the expenditures for town and city lighting	$233,095.74	$222,382.13
Less gains on jobbing	676.05	1,987.97
	$232,419.69	$220,394.16

The table given below is compiled to indicate, as nearly as may be from the data available, the cost per lamp per year of the street electric lights in the several municipalities, as determined by the items shown and upon the average daily number of lights used during the year. The apparent loss in operating is the difference between the operating expenses and the income from private consumers. Interest is computed upon the total investment at the beginning of the year at the rate paid upon the bonds or notes, and depreciation at the rate named in the statute at five per cent. upon the cost of the plant as shown by the books at the beginning of the year. Whenever the lights are of different kinds or candlepowers the total cost obtained in the manner indicated is apportioned to each kind according to the amount of energy theoretically [illegible]

[illegible] cial lighting [illegible]

[illegible]

[illegible] plants, [illegible] the year ended [illegible]

Income	[illegible]	[illegible]
From:		
Sale of commercial arc lights by contract	$[illegible]	$[illegible]
Sale of commercial incandescent lights by contract	[illegible]	[illegible]
Sale of commercial arc and incandescent lights by meter	[illegible]	[illegible]
Sale of public arc lights	[illegible]	[illegible]
Sale of public incandescent lights	[illegible]	[illegible]
Sale of electric power	[illegible]	[illegible]
Current sold to other companies	[illegible]	[illegible]
Rent of motors	[illegible]	[illegible]
Rent of fixtures	[illegible]	[illegible]
Rent of meters	[illegible]	[illegible]
Steam heating	[illegible]	[illegible]
Total	$[illegible]	$[illegible]
Expenses:		
1. Coal or other fuel	[illegible]	[illegible]
2. Rent of real estate used for plant	[illegible]	[illegible]
3. Oil and waste	[illegible]	[illegible]
4. Water	[illegible]	[illegible]
5. Wages at station	[illegible]	[illegible]
6. Station repairs	[illegible]	[illegible]
7. Steam plant repairs	[illegible]	[illegible]
8. Electric plant repairs	[illegible]	[illegible]
9. Apparatus and machinery	[illegible]	[illegible]
10. Wages for care of lights and meters, clerical labor in this department, and salary or commission of collectors	[illegible]	[illegible]
11. Repairs and renewal of lines, meters, lamps and motors	[illegible]	[illegible]
12. Distribution tools and appliances	[illegible]	[illegible]
13. Carbons	[illegible]	[illegible]
14. Incandescent lamps	[illegible]	[illegible]
15. Globes	[illegible]	[illegible]
16. Directors' allowance	[illegible]	[illegible]
17. Salaries of officers	[illegible]	[illegible]
18. General salaries	[illegible]	[illegible]
19. Rent of offices, if separate from plant	[illegible]	[illegible]
20. General office expenses	[illegible]42.22	[illegible]
21. Taxes	[illegible]	[illegible]
22. Insurance	[illegible]	[illegible]
23. Law expenses	[illegible]	[illegible]
24. Claims	[illegible]	[illegible]
25. Bad debts	[illegible]	[illegible]
26. Incidental expenses	[illegible]	[illegible]
27. Current bought	[illegible]	[illegible]2,254.4[illegible]
Total	$4,6[illegible]	$4,[illegible]
Leaving an apparent net profit of	[illegible]	[illegible]
Of this profit the gas companies made in their electrical departments	[illegible]	[illegible]
Leaving for the electric light companies	$2,[illegible]	$2,[illegible]
To which should be added the income from rents, jobbing, etc., amounting to	[illegible]	[illegible]
Making a total of	$3,008,214.95	$2,919,340.23
Against which the following charges were made:		
Interest	424,[illegible]	[illegible]
Dividends	1,[illegible]	1,[illegible]
Depreciation	[illegible]	[illegible]
Sundry items	1,305,444.[illegible]	[illegible]
	$[illegible]	$[illegible]
Leaving an apparent deficit for the year of	465,442.64	[illegible]

Four of the corporations included above appear not to have earned expenses, and 30 others have not earned sufficient to warrant the declaration of any dividend.

From the above data it appears that the gross profits from electric lighting of all the companies increased $299,099.48, and those doing only an electric business show an increase during the last year of $179,989.05.

Municipality.	Apparent Loss in Operating.	Interest.	Depreciation	Other Cost Items.	Total.	Cost per Lamp per Year.
Belmont	$4,133.74	$ 1,317.92	$ 1,045.53[1]		$ 6,407.19	32 c. p., $22.00; 60 c. p., 41.53; 1,200 c. p., $ 81.98
Braintree	591.03	4,589.73	3,858.76	$197.36	9,236.88	25 c. p., 12.89; 1,200 c. p., 60.32
Chicopee	9,055.90	5,606.60	5,396.55		20,059.05	1,200 c. p., 91.79
Concord	229.51[2]	3,852.51	4,233.09[1]		7,856.99	25 c. p., 12.38; 2,000 c. p., 53.44
Danvers	2,119.08	2,204.94	1,824.09[1]	9.60	6,157.71	1,200 c. p., 46.85
Hingham	4,818.83	1,268.40	94.89[1]		6,182.12	32 c. p., 14.13; 1,200 c. p., 54.00
Holyoke	2,293.74	15,540.56[3]	19,767.06	141.98	37,743.34	16 c. p., 8.86; 30 c. p., 14.49; 1,200 c. p., 65.64
Hudson	1,423.44	2,817.97	2,322.78[1]	393.93	6,958.12	25 c. p., 19.53; 1,200 c. p., 92.80
Hull	842.42	7,029.27	4,976.67[1]	25.00	12,873.36	25 c. p., 38.87
Ipswich	4,523.93	1,281.80	1,298.09[1]		7,103.82	16 c. p., 10.69
Mansfield	3,529.53	1,221.88	2,183.78		6,935.19	32 c. p., 17.26; 2,000 c. p., 63.65
Marblehead	3,587.68	4,788.72	4,018.67		12,395.07	25 c. p., 17.64; 1,600 c. p., 63.33
Merrimac[4]	1,028.61	311.67	353.12		1,693.40	16 c. p., 5.29
Middleborough	603.46[2]	3,880.63[1]	2,011.48[1]	192.30	5,480.95	25 c. p., 16.93[5]; 1,200 c. p., 59.38[5]; 25 c. p., 29.42[6]; 1,200 c. p., 116.56[6]
Millers Falls	1,019.30	611.80	640.85		2,271.95	25 c. p., 22.94; 1,500 c. p., 105.57
North Attleborough	755.97[2]	3,329.98	3,016.84	13.84	5,604.69	32 c. p., 8.65
Peabody	7,384.02	4,428.76	3,572.33		15,385.11	16 c. p., 9.30; 32 c. p., 18.51; 1,200 c. p., 68.61
Reading	1,171.66	3,411.96	2,777.83		7,361.45	1,200 c. p., 50.61
Taunton	1,724.84	12,625.33	13,590.42		27,940.59	25 c. p., 21.06; 1,200 c. p., 100.00
Wakefield	6,350.13	3,912.50[3]	2,461.85[1]	21.99	12,746.47	1,200 c. p., 81.26
Wellesley	8,933.27	809.32	619.23		10,361.82	25 c. p., 16.99
Westfield	1,888.38	2,455.09[3]	2,561.71	55.75	6,961.83	25 c. p., 11.09; 2,000 c. p., 59.95

[1] Depreciation, less jobbing income and interest on current account. [2] Gain in operating accounts. [3] Interest and depreciation here stated are the same per cent. of total interest and depreciation as electric plant is of the total combined plant, as shown by the books. [4] Eight and one-half months' operation. [5] Midnight lighting. [6] All night lights.

Note.—In Belmont, $449.40, in Braintree, $270.29, in Chicopee, $2,803.69, in Concord, $778.84, in Danvers, $347.82, in Hingham, $148.71, in Holyoke, $5,270.04, in Hudson, $1,575.81, in Hull, $349.72, in Ipswich, $324.59, in Mansfield, $85.26, in Marblehead, $1,368.87, in Merrimac, $27.35, in Middleborough, $494.24, in North Attleborough, $301.54, in Peabody, $1,974.73, in Reading, $377.35, in Taunton, $1,845.04, in Wakefield, $964.21, and in Westfield, $240, have been deducted from the totals given above as the estimated value of light and power supplied to town buildings, and not in operating accounts.

Changes and Additions in the National Electrical Code.

The April (1906) supplement to the National Electrical Code embodies the changes and additions made to the Code as adopted at the December meeting of the Underwriters National Electric Association. The rules are for use under the rules and requirements of the National Board of Fire Underwriters in the installation of electric wiring and apparatus. The Code is of course of much importance to engineers, electricians and architects, and in the last semi-annual revision a number of important changes were made under the headings of "Generators," "Grounding Low-potential Circuits," "Wires," "Switches, Cut-outs, Circuit-breakers, etc.," "Fixtures," "Sockets," "Slow-burning Weatherproof Wire," "Flexible Cord," "Flexible Tubing" and "Signaling Systems."

The supplement also contains a list of the manufacturers of the various products which have been approved by the Underwriters' Laboratories, Chicago.

BOOK TABLE.

HIGH-TENSION POWER TRANSMISSION. (Vol. II.) New York: McGraw Publishing Company. 1906. Pp. (6 by 9¼ inches), 315, with 116 illustrations. Price, $2.50.

The book is a compilation of the papers on high-tension power transmission presented at the International Electrical Congress in St. Louis in 1904. It includes the papers of Charles F. Scott, John S. Peck, Prof. Harold B. Smith, F. G. Baum, Dr. F. A. C. Perrine, H. W. Fisher, H. W. Buck, F. O. Blackwell, V. G. Converse, M. H. Gerry, Jr., J. F. Kelly and A. C. Bunker, P. N. Nunn, L. M. Hancock, R. F. Hayward, Ralph D. Mershon, Harris J. Ryan and E. Jona. These are printed in full with the ensuing discussion. A preface to the work is written by Dr. Louis Bell of Boston.

NOTES ON ELECTROCHEMISTRY. By F. G. Wiechmann, Ph. D. New York: McGraw Publishing Company. 1906. Pp. (5½ by 8 inches), 137. Price, $2.

The book consists of a set of notes which offer a general survey of the subject of electrochemistry, and which are intended as an introduction to a more extended study of the methods of electrochemical analysis and the applications of electrochemistry, which are contained in standard works treating in detail the theories and practices of the science. Prefacing each chapter is a bibliography of important treatises on the subject matter contained in the chapter. The work is divided into six chapters as follows: "General Principles," "Electrical Energy," "Electrochemistry," "Electrolytic Dissociation," "Electroanalysis" and "Electrotechnology."

ELECTRIC TRANSMISSION OF WATER POWER. By Alton D. Adams. New York: McGraw Publishing Company. 1906. Pp. (6 by 9¼ inches), 335, with 105 illustrations. Price, $3.

In the opening chapter the author makes the statement that "another 10 years will see the greater part of electrical supply on the American continent drawn from water power." Whether this prophecy will be fulfilled is a question. But it is nevertheless true that the development of the water powers in this country is advancing with enormous strides, and that the problems of hydro-electric engineering are becoming more and more to require the attention of specialists in this line. Works on this subject are in demand. The one here considered is thorough in its analysis of the subject from the design of the generating plant and its equipment to the calculation of the transmission line. An interesting feature is the description of a large number of the most important American waterpower developments, such as the Spiers Falls development, the one at Shawinigan Falls, the Sault Ste. Marie plant and many others. The work is made interesting also by the many fine half-tone illustrations of the various notable plants.

THE MANAGEMENT OF ACCUMULATORS. By Sir David Salomons. New York: D. Van Nostrand & Co. (London: Whittaker & Co.) 1906. Pp. (5 by 7¼ inches), 178, with 36 illustrations. Price, $2.50.

The fact that nine editions of this book have been called for is proof of its popularity. Heretofore the work has been issued in three volumes—"Accumulators," "Apparatus" and "Application." But it was deemed advisable to issue the first volume as an independent book, and in consequence this, the ninth edition, has been devoted exclusively to the management of accumulators. As such it fills a notable gap in practical scientific literature. The directions laid down in its pages, if carefully followed, will prove of great service, and will in many cases make unnecessary professional advice. Most of the modern types of accumulators are described and illustrated, but the most important feature is careful directions which are given for the treatment and "doctoring" of cells in actual operation. Setting up of the cells, charging and discharging, causes and remedies for failure, etc., are among the many practical things taken up. The publishers are also to be complimented on the fine appearance of the book and the excellent character of the illustrations.

BOOKS RECEIVED.

"The Seven Follies of Science." By John Phin. Published by the D. Van Nostrand Company, New York. Price, $1.25.

"Electrical Nature of Matter and Radioactivity." By Harry C. Jones. Published by the D. Van Nostrand Company, New York. Price, $2.

"The Principles of Electric Wave Telegraphy." By J. A. Fleming. Published by Longmans, Green & Co., London and New York. Price, $6.60.

Water Diversion of Drainage Canal.

The House committee on rivers and harbors, on May 22d, unanimously accepted an amendment to the bill preserving Niagara Falls. The amendment provides that waters diverted from the great lakes for domestic or sanitary purposes shall not count in the total diversion from the falls. This amendment, if finally adopted, will permit the Chicago Drainage Canal to divert as much water as is necessary to carry out its purposes.

Chicago Street-railway Situation.

The Chicago City Council this week passed an amendatory ordinance providing for the issuing of $75,000,000 of Mueller law certificates at once. The ordinance fills the blanks relating to dates in the ordinance authorizing the issue of the certificates, which was passed by the council January 18th and ratified by the people at the election in April. July 1, 1936, is to be the date of expiration of the certificates, making them of 30 years duration.

The American Trust and Savings Bank is to be the trustee under the trust deed of the ordinance. It is expected that as soon as the mayor shall have approved the ordinance a suit to restrain the city from carrying out its provisions will be begun through the law firm of Shope, Mathis, Zane & Weber on behalf of objecting taxpayers. This suit will be carried to the Supreme Court of the state as soon as possible, so that the validity of the certificates may be known.

Chairman Werno of the local transportation committee reported the ordinance for trolleyizing the West and North Side cable lines and lowering the tunnels used by these lines, and the ordinance permitting the West Side Metropolitan Elevated Railway Company to carry express matter during certain hours. These ordinances were ordered deferred and published.

The warring factions in the Union Traction Company and the North and West Side companies have reached an agreement so far as future dealing with the city is concerned. The internal troubles between the Union Traction Company and its underlying companies are to be thrashed out in the courts, but by the new agreement a sort of trust company to be known as the Unified Chicago Railway Company is to have full authority to fix a valute on the properties and have absolute authority to deal with the city.

Steps toward trolleyizing the South Side cable lines were authorized by the City Council committee on local transportation this week. Special Counsel Walter L. Fisher was instructed to negotiate with President T. E. Mitten of the Chicago City Railway Company toward obtaining immediate trolleyizing of the Wabash Avenue and State Street lines under the indeterminate license plan. The company, however, is opposed to buying a lot of new cars equipped for trolley service so long as the question of underground trolleys is not settled. To change from overhead trolleys to underground would require changes in the construction of car trucks and make a difference in the wiring of the cars. This point will be one of the first to be determined in considering details regarding service under permanent arrangements. The committee is to meet again next Tuesday.

New Permanent-magnet Switchboard Instruments.

The accompanying illustration represents one of the new switchboard voltmeters manufactured by Louis M. Pignolet, 78 Cortlandt Street, New York, which, together with an ammeter of similar construction, completes his line of small electrical measuring instruments.

These instruments are five inches in diameter and 1.5 inches thick and are thus compact and specially adapted to installations where space is limited. They are furnished in various readings up to 150 volts and 50 amperes. Two bolts provided on the

PERMANENT MAGNET SWITCHBOARD VOLTMETER.

back of each meter convey the current and also serve to fasten the instrument to the switchboard, so that but two holes are required in the board. The instruments are of the permanent-magnet type, thus securing the high accuracy and even-scale divisions of this class. The magnets are of imported special steel, carefully treated to insure permanency.

The principle of operation is as follows: An iron armature is pivoted between the poles of each magnet and is provided with an aluminum pointer, which is kept at zero on the scale when no current is flowing through the instrument, by the attraction of the magnet upon the armature.

Current to be measured passes through a coil of wire located between the poles of the magnet and produces a magnetic field at right angles to that of the magnet. This field causes the armature to turn and produces a greater or less deflection of the pointer, according to the strength of the current passing through the coils.

Single-phase Railway Equipment for Anderson, S. C.

The Anderson Traction Company of Anderson, S. C., is now actively engaged in building the first section of its interurban road, which will eventually connect the city with Greenville, 35 miles away. Anderson is the center of the cotton-mill district in the South, and the new line will place it in touch with the surrounding cotton-mill towns as well as in closer connection with the main line of the Southern Railway.

In the city there is already a direct-current railway and the first branch of the interurban is a continuation of the present lines as far as Belton, a distance of 10 miles. Complete station apparatus and motor equipments for single-phase operation have been ordered for the extension. The new cars are of the heavy interurban type and are each equipped with four G. E. A. 605 (75-horsepower) single-phase motors, adapted for operation at 3,300 volts alternating current on the interurban section of the road and at 550 volts direct current on the present direct-current city lines. Each car is fitted with air brakes, for which the motor compressors are adapted for operation on either direct or alternating current, this equipment as well as the car motors being furnished by the General Electric Company.

Power for the operation of this road will be purchased from the Savannah River Power Company, delivered at a sub-station in Anderson at 66⅔ cycles. In the sub-station there will be a three-unit motor-generator set consisting of an induction motor driver direct connected to a generator for the single-phase portion of the line and a direct-current machine to supply the present city line. The driving motor consists of a two-phase 66⅔-cycle 1,150-volt induction motor, receiving its current from the 66⅔-cycle supply above mentioned. Direct connected to this is a 300-kilowatt 25-cycle single-phase 3,300-volt alternating-current generator which will furnish the 10-mile single-phase section now under construction with current directly to the trolley at 3,300 volts without sub-stations. The remaining machine for furnishing the direct current consists of a 250-kilowatt 600-volt railway generator complete, with an exciter on the same shaft as the other three machines.

This newest adaptation of single-phase railway apparatus for interurban service clearly indicates that the trolley companies are in the front ranks of the present industrial renaissance now taking place throughout the South. The officers of the Anderson Traction Company are: President, J. A. Brock; vice-president, F. G. Brown; general manager, Dr. George E. Coughlin. The road is being constructed under the direction of J. E. Sirrine, engineer of Greenville, S. C., with E. F. Lilly of Columbia as consulting electrical engineer

The New Pagoda "Reflecting Arc."

The Holophane Glass Company of New York city reports large sales on its New Pagoda "reflecting arc." Owing to the use of ordinary, stand-

THE NEW PAGODA "REFLECTING ARC."

ard, small-unit, incandescent lamps in connection with this device, the company says that dealers and jobbers in all parts of the country are placing it in stock, and selling it for all kinds of places, large and small. The scientific accuracy of reflecting prisms is combined with the artistic, altogether making an efficient and handsome fixture. The accompanying illustration shows the appearance of the fixture, which consists of a cluster of incandescent lamps, each enclosed in a Holophane shade, and the whole group covered by a large Holophane reflecting shade.

Electrical Equipment of Machine Tools in a Large Projectile Shop.

Of the many improvements in manufacturing methods within the last decade there is no one feature that has aided the advancement of machine tool drive by electric motors more than the rapid development of high speed tool steel for use with metal-working machinery. Consequent to the more severe requirements made upon machine tools by the new regime, the use of belts and shafting became unsatisfactory and wasteful and the logical sequence was the individual motor drive.

To meet the demands of such service, the Westinghouse Electric and Manufacturing Company developed a new line of direct current motors, known as the type SA, with a speed range of four to one on a single voltage. The control of this exceedingly wide speed is obtained by introducing resistance in series with the shunt field coils.

Both mechanically and electrically the type SA motors are identical in construction with the well-known type S motors, with the exception of auxiliary poles and coils. This new feature has been introduced to control the field form during the variation of field strength necessary to secure so wide a range of speed.

The auxiliary poles are bolted securely to the frame midway between adjacent main poles. The winding of the auxiliary poles is connected in series with the armature and produces a magnetizing effect which is proportional to the armature current. This introduces a factor which compensates for the distortion caused by armature reaction and field weakening. In ordinary motors the effect of armature reaction is to shift the path of the magnetic flux, weakening the leading pole tips, and consequently, shifting the neutral point, necessitating a backward lead of the brushes to obtain a field for sparking commutation. By introducing the auxiliary poles a commutating field is maintained in a fixed position regardless of load or direction of rotation.

Practical application of the SA motors is illustrated by a typical installation in the new projectile shop of the Firth-Sterling Steel Company at Demmler, Pa. The equipment consists of eight 10-horsepower type SA motors, driving eight 26-inch swing Bullard lathes, two 15-horsepower type SA motors, each driving a Bullard horizontal boring machine, and one 7½-horsepower type SA motor, direct connected to a Bullard turret lathe. The speed of the motors is varied by controllers with 21 notches, giving 21 motor speeds.

In addition to the SA motors, there is a 35-horsepower type S constant-speed motor belted to a line shaft, which furnishes power to a group of small machines, including a planer, cutting-off machine, centering machine and two drill presses.

In the accompanying group illustration Fig. 1 shows a 15-horsepower motor driving a horizontal boring machine, the projectile being shown in the process of boring. Fig. 2 is a 35-horsepower motor which drives a group of small machines. Fig. 3 illustrates a 10-horsepower motor operating a swing lathe, and shows the mounting of the motor to good advantage. Fig. 4 [illegible] projectile in process of turning [illegible] by a 10-horsepower motor.

By following the [illegible] manufacture of projectiles the [illegible] speed motors to the [illegible] patent.

A novel method of checking the [illegible] employes has been introduced by the Firth-Sterling company, which is made [illegible] electrically driven machinery. It consists [illegible] ing, in a convenient location [illegible] cording ammeter arranged to be connected [illegible] with any machine whenever desired. [illegible] have determined approximately the current [illegible] for a given class of work, so that the [illegible] the ammeter indicates whether or not the [illegible] is working up to its capacity and the time it stands idle.

The first step in the manufacture of a projectile is the making of a steel casting similar in form to the finished projectile, but somewhat larger in diameter. After the metal has congealed it is removed from the mold and allowed to cool. The casting is then heated to a forging temperature and forged by a Bement-Niles steam hammer, when, after cooling, it is again brought to a red heat and placed in a receptacle and covered with lime and allowed to remain until entirely cool, the length of time depending upon the size of the forging. This is known as the annealing process.

After annealing, the forging is taken to the machine shop, and the projection on the small end centered in a centering machine. It is then transferred to a lathe, the butt end being chucked and the small end supported by the center in the tailstock. The machining is begun at the point of the projectile, the lathe speed being decreased with the increase of diameter by varying the motor speed, which illustrates one of the many phases of machine work where variable-speed motors are exceedingly valuable, the operator being able to gauge the proper speed by watching the color of the chip.

After the lathe work is finished the partially completed projectile is placed in a cutting-off machine and the unfinished end that is clamped in the chuck removed. The work is then transferred to a horizontal boring machine, where the recess or chamber for the explosive is bored out. The chamber is threaded near the butt to receive a plug, in the center of which is a smaller plug, through which the fuse is inserted that is ignited by the firing charge and communicates with the explosive at a predetermined time interval, causing the projectile to burst after entering the object at which it was directed.

At two points on the barrel of the projectile the diameter corresponds to the bore of the gun, and at a third point, near the large end, a groove is cut in the barrel, into which a copper band is hammered, which, when finished, is slightly larger in diameter than the bore, causing it to engage in the rifling, giving the projectile a rotary motion.

A groove at the butt provides a means for re-

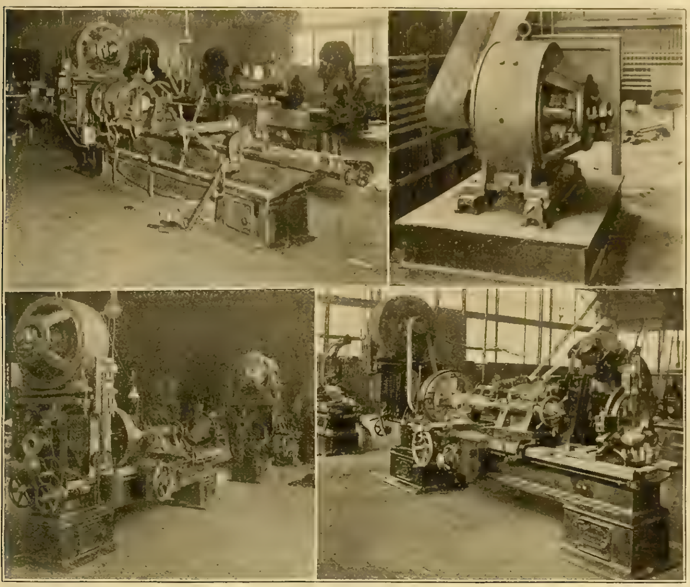


Fig. 1. 15-horsepower Motor Driving Horizontal Boring Machine. Projectile in Process of Boring.
Fig. 2. 35-horsepower Motor for Driving Group of Small Machines.
Fig. 3. 10-horsepower Motor Operating 26-inch Swing Lathe.
Fig. 4. 7-inch Projectile in Process of Turning. Lathe Driven by 10-horsepower Motor.

ELECTRICAL EQUIPMENT OF MACHINE TOOLS IN A LARGE PROJECTILE SHOP.

[illegible] finished [illegible] increased [illegible]

[illegible]

The belt drive [illegible] to motor drive [illegible] an unexpected [illegible] with the [illegible] and light [illegible] the exception of that driving the group [illegible] machines, is a [illegible] aids in cleanliness and [illegible] both natural and artificial.

Hygiene of Rural Electric Railways.

During the last three years Mr. W[illegible] has made it his pleasure to ride a great many miles on trolley railways through [illegible] and having given a study to the [illegible] people riding upon these railways, has [illegible] vinced that there never has been [illegible] and health-promoting influence [illegible] populations than that of the trolley railway. In an article in the Dielectric and Hygien[illegible] Gazette he says:

It has been said that a good many women, both middle-aged and younger, who are inmates of sanitariums, come from the farm or rural districts. When we go into an investigation of the cause of such abnormal conditions, it is shown that the basis of the cause is the monotony of the lives which such persons live. A trolley railway projected from large towns several miles into the country becomes a source of transportation for people living along the line and within easy walking distance of it on either side. Instead of the women and children waiting for the chance of a rainy day so that they can have the old horse to drive down to the village, they can take up the shopping bag, and, after a pleasant walk across the fields or down the lane, hail the trolley and, for five cents taken from the egg or butter money, enjoy a pleasant ride and reach the neighboring town, where they can shop, look around, visit or gossip, and return the latter part of the day with an entirely new current of thought. Thus the monotony of the farm life is broken up and radiations of thought are shot out into a number of channels other than the grind of a daily, monotonous life. This is no fanciful picture, but is a practical absolute fact that has come to stay in our rural districts, and has changed the whole current of the social life of farmers' wives and daughters.

The men, fathers and brothers on the farm, have always been able to go to the nearest village and break up the monotony of their lives or their hard work, because they are called upon to drive to the village for the sale of produce, so that the question of bettering the social conditions of the farmer boy has never been so important as that of improving the lives of the women, mothers and daughters.

It would be a great advance in the political economy of the state if the legislators would authorize the treasurer of every state to advance money, at cheap rates, to trolley companies to build lines into rural districts; it would so improve the mental, moral and social conditions of the people, and the cost of hospital cure for neurotics, whose disabilities come from isolation and monotonous life, would be greatly reduced.

There is, however, another side to this subject, which makes us pause, and demands a most earnest consideration. This is, the noise which comes from the electric-motor machinery, the wheels and running gear of the trolley cars. This noise, in the open country, where the line runs on the public roads or over private right-of-way, is not so objectionable, but it becomes a public nuisance in the town and city streets, and is in every respect a most unhygienic influence.

The cause of the street-railway-car noise lies in faulty construction and imperfect mechanical usage. The best evidence of this lies in the fact that at least one-fifth of the cars do run without any objectionable noise, while four-fifths seem to be devices of the devil to make men and women give vent to their pent-up elements of original sin. This street-car-noise nuisance can and will be corrected.

Metallic Lamp Filaments.[1]

By J. Swinburne, M. Inst. C. E., F. R. S.

The history of the incandescent lamp is instructive, as it shows how inventors tend to work in grooves. The first mention of the incandescent lamp is probably the suggestion, made in 1836, that safety lamps for coal mines should be formed of carbon, made incandescent in vacuo by the electric current. This suggestion was proposed naively, as if such a lamp was the obvious thing to use at that date.

In the late seventies, however, well-meaning people were still trying to solve the non-existent problem of the "sub-division of the electric light." Edison, however, began work on platinum, and Swan on carbon lamps. Edison concentrated his inventive genius on the platinum lamp; and the accounts of his work in the patents of those days were very interesting reading. Then the carbon lamp came into practical use, and platinum was put aside, as it would not stand the temperature necessary to give reasonable efficiency. The curious thing is that, when once carbon was successful, people seemed to think it was quite useless to experiment in any other direction. Certainly there was a little work done towards coating filaments with silicon. Sir Joseph Swan, I believe, made experiments on coating carbon with silicon about 1880, but I have no records of them. The carbon lamp practically held the field in perfect security until the Courts upheld Edison's patent. Inventors then tried to get outside the monopoly by making filaments of silicon or boron. I never saw any silicon filaments. I had some filaments to test which were supposed to be silicon with a little carbon left in them; but I analyzed them and found they were mostly carbon. It is to be noticed that inventors were still on the carbon lines, as silicon and boron are somewhat closely related to carbon.

There was one semi-metallic lamp, the "Cruto." It was said to be made by heating a platinum wire electrically in a hydrocarbon gas until there was a deposit of carbon, and then increasing the temperature until the platinum was volatilized. The Cruto filament had a low specific resistance; so probably there was some platinum left. Even here the endeavor was to get a carbon, not a platinum lamp.

The incandescent lamp industry was fully aroused, however, by the advent of the "Nernst." In this, as is well known, the light was given out by a small rod of zirconia and yttria. Whether the composition of the rods is the same now I do not know. These cannot be used in vacuo because oxygen is given off at the anode. One effect of the advent of the Nernst was that inventors realized that carbon was not, after all, the only material that would do. It seemed possible that some of the highly refractory metals might be used. One of the difficulties in connection with the Nernst was to make an efficient lighter. The problem is now solved by winding a very fine platinum wire around a long thread of magnesia or kaolin, or some similar material; and this seems obvious and simple, but it was not so at first. The idea of a platinum resistance that would take 200 volts and would not cost anything appreciable seemed absurd, so that all sorts of other plans were tried; but no doubt experiments in this direction led many people wider afield, towards new incandescent lamps. At the time of the inception of the Nernst lamp, among many others, I was working at the problem. I tried to make heaters of various materials, such as filaments of agglomerated carborundum. It was very troublesome to get these to conduct at all. A natural step was to try to make a sort of modified lamp which conducted well enough metallically to be worked in vacuo. The first attempt, made no doubt by very many people, was to coat the rod with platinum, by means of the chloride. This would light up once; but the platinum fused into little globules, so the lamp would not light a second time. Pastes were squirted composed of zirconia and powdered molybdenum, tungsten, and silicon. These did not work. The temperature of the rod was so high that the metals fused and ran into globules. Attempts were made to substitute carbides for the oxides by squirting a mixture of carbon and oxide. Some lamps with fine rods of silicon carbide were made in this way, but they were not of any commercial value. The carbides are exceedingly troublesome, as they decompose so easily. The next step was to try to form filaments by reducing the oxides until there was enough metal present to conduct metallically, the fine structure of metal being supported by oxide. The idea of taking a filament say, of thoria, and reducing it to thorium, did not seem practical, because a metal filament, for a current of 100 volts, must be very long and very fine, and the corresponding filament of oxide would not support itself; while if it could be supported it would demand a fabulous electrical pressure to make it incandescent. If a rod of thoria is made incandescent in vacuo, by a direct current, it gives off oxygen at the anode, and generally breaks at once. I therefore found it best to superimpose a direct on an alternating current. The alternating current sufficed to keep the rod hot, and a little direct current superposed heated it further, and gave off oxygen at a convenient rate. The rods were lighted up at first by being heated and set going, and sealed into the bulb while running. This was troublesome, however, and the rods were next lighted by being coated with platinum from the chloride, and finally by the use of the induction coil, which starts them quite easily in a suitable vacuum. Rods were made in this way which would light, and would stand a very high temperature; but the specific resistance was far too low to be of any use. All the same, this method seems to be very convenient for preparing metals which are free from carbon or other oxides. Thorium was chosen because it appeared likely to have a high melting point, from its position in the periodic system of the elements. It seemed probable that uranium, thorium, osmium, tungsten, and tantalum would have the highest melting points, and as I was best acquainted with the ways of thoria, it was chosen.

These experiments were not continued, because the heater problem for the Nernst was solved by the fine platinum, wound on kaolin; but the plan of making filaments of metals in any of the ways tried was obviously unpractical, owing to the enormous difference in specific resistance of the metal and that of its heated oxide.

Others, however, were working successfully in the direction of metal filaments; and at the beginning of this century it was quite realized that the carbon filament was probably doomed, though it would take a little time to replace it.

Auer von Welsbach was very soon to the front with his osmium lamp. This came out at about the same time as the Nernst; and the two inventions were independent, and had nothing in common. This lamp suffers from two or three disadvantages. The filament is probably difficult to make, while the oxide of osmium is very poisonous, and a mere trace in the air hurts the eyes very seriously. Then osmium is a rare metal, and the supply is necessarily very restricted. On the other hand, there has been practically no demand for osmium compounds; and it is marvelous how quickly a rare material will become common as soon as there is a real demand for it. This has been very marked in the case of thoria, for example. The next difficulty is that the wire is soft at the temperature needed, and has to be supported. This difficulty is connected with a drawback possessed by all the metal filament lamps. A lamp to give, say, ten candles at half a candle per watt on a 200-volt circuit must have a resistance of not less than 2,000 ohms. To make a wire fine enough to give only 10 candles at the high temperature necessary, and to have a resistance of 2,000 ohms, seems impossible. If the lamp is to have an efficiency of about one candle per watt, the resistance would have to be 4,000 ohms, the surface being still less. This is, of course, even more difficult, though at one candle per watt the temperature would be higher; and the specific resistance would go up rapidly with it, especially as the metal is near its softening point.

The tantalum lamp was the next. This lamp is a triumph of chemical skill and ingenuity. To make a wire of such material is certainly an astonishing feat. Tantalum was generally known, or rather described, as a metal obtainable only in the form of a powder; and it is one of the metals employed for making special steels. It has been urged in America, I forget by whom, that the tantalum molecules are much smaller than those of the iron, so that they fit in and occupy the gaps, and thus the result is an exceedingly hard metal. Messrs. Siemens and Halske are at present supplying tantalum lamps commercially, for 100-volt circuits.

It is now quite well known that several metals are infusible enough to serve as lamp filaments if they can only be made into that form. The infusibility of the metal is the chief obstacle to its being made into wire, for such metals are generally only obtainable in a fine powder by reduction from the oxide, or in partially fused lumps which contain carbon, and are not in a condition suitable for wire drawing.

Dr. Hans Kuzel has invented a process by which the most refractory and obstinate metals can be made into filaments. It might be said that there is little difficulty in making a filament from a metallic powder by mixing it with an agglutinant and squirting it. Anyone who has tried squirting such things as powdered silicon, tungsten or molybdenum will realize the difficulties. Tungsten powder, for instance, can be squirted in rods about a millimeter in diameter; but that would be of no use for resistances in thousands of ohms. These powders, made into pastes and squirted, generally pack, and only water comes through the nozzle. Squirting can be greatly facilitated by the use of gum tragacanth. It would be interesting to know who first thought of tragacanth in that connection. A comparatively small percentage of the population of the globe knows anything about tragacanth or its ways; and a still smaller percentage is interested in squirting filaments; so that the chances that any one person, knowing about tragacauth and wanting to squirt filaments, should realize that tragacanth would help him are very small indeed. I believe the use of this gum was due to Farnelichm—one of the early workers at incandescent gas light. He made mantles of little baskets of squirted magnesia.

Kuzel is generally supposed to have invented a tungsten lamp. According to his specification, 28,-154/04, which has been sent me, his invention is very much wider than this. It is really a method of making lamp filaments of any suitable metal; and he appears to have chosen tungsten as the most suitable. He makes what he calls "hydrosols, organosols, gels or colloidal suspensions." It will be remembered that Bredig prepared what is called "colloidal" platinum by making an arc between platinum electrodes under water. Apparently the platinum vapor condenses in the water in the form of very fine particles, and the resulting liquid is said to contain colloidal platinum. Kuzel makes colloidal chromium, manganese, molybdenum, uranium, tungsten, vanadium, tantalum, niobium, titanium, thorium, zirconium, platinum, osmium, iridium, boron and silicon; I am quoting from his patent specification. No doubt Kuzel has experimented on all these. Of course, I have not.

Whether such a process really gives metal in a colloidal form is a matter rather of scientific than of commercial interest. The exigencies of journalism do not give a writer time to look up the scientific literature of a subject. This is a great advantage from his point of view, as he can be inaccurate with a clear conscience. I have, therefore, been unable to refer to Bredig's paper; but by a "colloidal" substance is generally meant such a substance as gelatine, which appears to exist in solution in large particles, if such an expression can be used. What is known as "colloidal gold," on the other hand, may be merely gold in very small pieces floating about in a liquid. The particles are too small to be seen properly through an ordinary microscope; but recently an advance has been made in microscopy by means of which the existence of small particles in colloidal gold solution can be seen. I am sorry I cannot remember the name of the inventor of this system; one of his microscopes was shown at the Physical Society lately by Messrs. Zeiss or Beck, with some colloidal gold for examination. It may be said that if the gold is in small particles it would settle, and it would not pass through filter paper. But fine precipitates will pass through filter paper. Ink, or, better still, India ink, is a good example. If ink is examined under a microscope it will be found that the particles are all moving about with immense activity; and this is probably the reason why they do not settle. Very little work has been done in studying this "pedesis" or "Brownian" movement, as it is called. The addition of certain salts to water containing finely-divided ferric oxide, for instance, stops the rapid motion, and the particles group themselves together and descend as a flocculent precipitate. Bredig urged that his colloidal platinum acted as an inorganic ferment in many cases. It is quite possible, however, that the fineness and movement of the particles had much to do with it, and that the "poisoning" of the platinum was intimately connected with the stopping of its pedesis. Whether Kuzel's finely divided metals should be called colloidal suspensions, gels or hydosols is for the present purpose a side issue. The fact appears to be that he has invented a most ingenious way of converting metals into a fine smooth paste, in which the particles are so exceedingly small that very fine filaments of paste can be squirted. These filaments are then heated electrically until they sinter or practically fuse together.

If this invention works practically, as there is little doubt it does, it opens a very large field, because it puts the inventor in the position of being able to make lamp filaments of any metal he chooses. It is simply a matter of choosing one which has a high melting point, and is otherwise convenient. Of course, the melting points of the very refractory metals are not yet ascertained. It has been known for a long time that tungsten is very infusible; and it was considered an achievement when it was first fused in the electric furnace some fifty years ago. The metal is otherwise so unpromising physically that to make from it a lamp filament is a very remarkable triumph over the apparent obstinacy of inanimate things.

The future of metal filaments seems secure; but there are some serious difficulties in connection with actual distribution. Electric supply was settled at 100 volts as being the highest pressure that lamps could easily be made to fit. The distribution people always wanted to go higher and higher; but the incandescent lamp makers, on the other hand, had difficulty in making good small lamps for 200 volts. We now have a compromise; we have 200 to 250 volts, and we have bad lamps to match; but the badness of the lamps is more than compensated for by the goodness and cheapness of the supply; so that, on the whole, we are better off. It may soon be a very serious question whether we shall not have to go back to 100 volts again. It was with a view of getting a high specific resistance that the filaments containing oxides such as zirconia or thoria were made. An ordinary drawing pencil is made of graphite and clay intimately mixed. It has a much higher resistance than pure carbon; and a hard pencil, such as a Faber's No. 5, contains a good deal of clay, and it has quite a high resistance. It seemed likely, therefore, that a filament might contain just enough finely powdered metal to conduct metallically, the powder being held in place by the matrix of oxide, so that a reasonably high specific resistance could be obtained, even if the oxide itself conducted.

One effect of the modern development in lighting is that people now want much more light. In olden days one read with a single candle; now people use incandescent gas mantles which sometimes give 120 candles when new. It is probable, therefore, that

1. From the London Times Engineering Supplement of May 16, 1906. The author is the well-known London engineer, past-president of the Institution of Electrical Engineers. In such matters as the claims of Edison and Swan and the use of eight candle-power lamps, he writes, of course, from the English viewpoint.

the eight candle lamp will give place to that of [illegible]teen or twenty candlepower, as electrical energy gets cheaper, and as the lamp becomes more economical. This will afford the metal lamp a much greater chance of success.

Notes on the Lighting of Churches.[1]

By Edwin R. Weeks.

Churches are still characterized by the notoriously poor lighting inherited from the dark ages when the printed word was unknown. Next to the acoustics there is no feature of church architecture of greater importance than that of lighting. While defective acoustics are an annoyance at all services and deprive parishioners of much of the benefit and enjoyment for which they attend church, they do not belittle the architecture or deplete the exchequer. An inadequate system of lighting, however, is not only an extravagance, but it practically eliminates the beauty and effectiveness of capital, entablature and vaulted roof with their costly decorations and symbolism.

The proverbial "dim religious light" of ecclesiastical structures is due to several causes. Architectural limitations produce an unequal and at times insufficient distribution even of daylight, and the immense distances through vaulted dome and transept make uniform artificial lighting by the old methods of suspension practically impossible. Again, the immemorial custom of using somber woods and gloomy wall tints adds to the difficulties; and the inertia of precedent and a false economy continue these obsolete practices long after better and more scientific methods are available.

Suspension devices have persisted from the time of the torch and tallow dip, although the advent of a most flexible medium has made their use inexcusable. Chandeliers are at best costly in installation, wasteful and hazardous in operation; grouping the lights at a few points, usually in the plane of vision, they are painfully obtrusive and inartistic.

It is, of course, true that lamps in receptacles flush with the ceiling or high wall panels give less light in the reading plane than do the same lamps suspended a few feet above this plane; but when so placed they may be made to serve the purposes of uniform distribution, of didatic symbolism and of displaying and even forming an important part of the architectural and mural decoration. These advantages furnish ample consideration for the cost of the additional lamps required to give the light needed in the reading plane.

The chief requisites in church lighting are adequacy and uniformity. The maximum variation throughout the auditorium should not exceed 20 per cent. This uniformity is seldom secured with daylight, but there is no reason why it should not be attained with artificial light, since electricity can easily be transmitted to all parts of the building.

The amount of light in the reading plane should not be less than two candle-feet; that is, about twice the light required by the average person for reading without the impairment of eyesight. The frugal vestryman may ask, "Why double the amount of light?" The answer is that [illegible] attractive lighting [illegible] frequent and a means of [illegible] quite [illegible] employed [illegible] which are occupied but [illegible] month, [illegible] the controlling [illegible] signed and used. Furthermore [illegible] ing, more than any other [illegible] of persons [illegible] tain persons of all ages [illegible] ing eyesight, and all of whom [illegible] light to enable them to read [illegible] hymn. With an expense of [illegible] which gives perfect satisfaction [illegible] audience and makes of the [illegible] and attractive place for young people, there can be no question of extravagance.

A well planned layout of switch control effects a great economy in any installation, [illegible] cially true in a building containing [illegible] room and using a large number of lights. When circuits are distributively interlaced and a part or all of the lamps are easily turned on or off, only those wanted at any time and place need be used and none will be left burning, because to light them later would be too much trouble. The most economic as well as the most convenient design so places switches that at least a part of the lamps in a room may be turned on and off at every door of the room. In rooms where varying degrees of light are needed and service is for fixed and regular periods the designer can so arrange the groups of lamps that there may be rotation of use, thus keeping them in uniform wear and preventing contrast when all are burning.

There are two general systems of interior lighting, the indirect and the direct. In the indirect system the lamps are entirely concealed from view, and their light is distributed by means of reflecting or diffusing surfaces. The installation of this system is costly, uniform distribution is difficult, and as only about 50 per cent. of the incident light is utilized, the system is wasteful. In the direct system the lamps are so placed that, although they may be seen, they are not in the usual line of vision. The installation by this method is less costly and its operation much less wasteful, since nearly all of the light emitted does useful work. It also facilitates uniform distribution and lends itself more readily to decorative effects and the expression of symbolism.

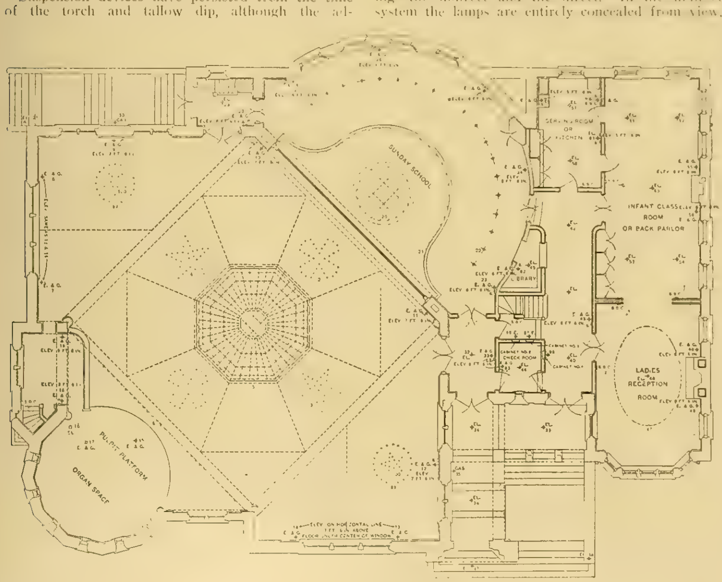


FIG. 1. A LAYOUT FOR CHURCH LIGHTING.

The accompanying drawings may serve to illustrate the application of these principles to a case wherein the expenditure is to be moderate. The results are a good distribution of light and a satisfactory illumination in each room. All parts of the auditorium are visible; each seat receives a minimum of two candle-feet and the variation is less than 20 per cent. The monthly bills for current at the rate of 10 cents per kilowatt-hour, with the usual church services, and including current for organ motor, range from $15 to $23.20.

The installation is three-wire, with neutral equal to the sum of the outside wires, and with 104 volts on each side; the drop inside the entrance is slightly less than two per cent. with full load.

The interior fixtures are of brush brass, and those on the exterior are of black-finished brass or copper. All were specially designed to suit the architecture. Gas is used only for emergency lighting and for the kitchen range, which is, however,

[illegible]

FIG. 2 [illegible]

standard Edison, and all lamps in brackets are frosted spherical.

Lamps over the pulpit platform [illegible] on Fig. 1), being back of the [illegible] are not visible from the auditorium, and furnish [illegible] candle-feet on pulpit, console and [illegible].

The outlets in the ceiling of the auditorium are so constructed (Fig. 2) that lamps are drawn up into the attic for cleaning or renewal.

The bracket lamps are used when light is needed only in certain places as for choir practice, [illegible] work, pastor's study, etc., and are not a part of the general illumination, which is always from above.

In the wall and ceiling decorations deep cream predominates; and the designs for all fresco work have special reference to the location of lamps and the figures employed in their distribution.

1. Abstract of paper presented at the annual convention of the American Institute of Electrical Engineers, Milwaukee, May 31, 1906. Mr. Weeks is a well-known Kansas City electrical man, now a consulting engineer in that city.

Economic Value of Niagara Falls.

Mr. H. W. Buck, electrical engineer for the Niagara Falls Power Company, has an interesting article in a recent issue of the Outlook, in which he sets forth with ability the "industrial side" of Niagara Falls. The following extracts give an idea of his line of argument:

"The economic value of Niagara Falls is probably understood by very few of those who protest and petition against its commercial use. The total hydraulic energy of the falls, if all were developed, would represent about 3,500,000 horsepower. To generate one horsepower continuously for a year by a steam engine requires about 13 tons of coal. To generate, therefore, continuously 3,500,000 horsepower by steam would require about 50,000,000 tons of coal per year. To generate electric power by steam with the most modern steam plant costs not less than $50 per horsepower per year, allowing for fixed charges and operating expenses. Niagara power can be generated and sold in large quantities for $15 per horsepower per year, or for $35 per horsepower-year less than is possible from the use of coal and the steam engine. From the above it will be seen that if all the hydraulic energy of the falls were utilized for power purposes there would result to the country an annual saving of $35 per horsepower for 3,500,000 horsepower, or $122,500,000, and in addition there would be an annual saving in coal consumption of 50,000,000 tons. These figures illustrate what it costs the people of this continent annually to maintain Niagara Falls as a spectacle. They represent the saving to those who would consume the power and not the profit of those who might own the power developments. This waste involved in prohibiting the development of Niagara power might be likened to a great conflagration in which 50,000,000 tons of coal were annually consumed. Such a conflagration might be one of the most magnificent sights in the world, and people might come from all parts to view it, but the human race would certainly be justified in using every effort to stop the waste by putting out the fire."

"Niagara Falls is a great continental asset, not only as a scene, but also as a source of power, and any fair adjustment between the two interests must be made upon the basis of a reasonable compromise. The wave of exaggerated sentimentalism now passing should not be allowed to sweep aside all reason, nor be the only thing considered."

The new Lake Street interurban line of the Twin City Rapid Transit Company is open for business. This will make the third connection between Minneapolis and St. Paul.

Electrical Production of Fuel from Peat.

One of the methods which has been experimented with for the production of fuel from peat electrically is a process by which the peat is placed between the poles of an electric circuit, so that the circuit is closed by the mass. The known processes of this kind frequently depend on the electrothermic action of the electric current. They are thus either intended to evaporate the water contained in the peat by the heating effect of the electric current or to carbonize the peat by the same heating effect of the current.

A second way of treating raw peat by means of the electric current consists in the physical phenomenon called "electro-osmosis"—viz., the migration of particles of liquids, owing to the influence of the electric current or in the electrolytical disintegration of water, respectively. For this kind of process, of course, the use of continuous current is the main condition, as alternating current cannot affect at all electro-osmosis and electrolysis. Besides the fact that continuous current is expensive in use in this kind of process, the peat also is partly decomposed into its organic components. Above all, the organic agglutinants contained in the peat are disintegrated, owing to the electrolysis, which will always come into effect when continuous current is applied. Therefore, it is necessary when using these processes to compress the peat after the electric treatment in order to obtain solid pieces or briquets.

A method recently patented by Joseph Byron of London, England, is for the purpose of obtaining in a cheap manner a dry peat coal which will offer without any compression, merely by self-hardening, a fuel of high value and capable of being transported. According to the invention this is done first by employing such current as will avoid electrochemical disintegration of the organic agglutinants—viz., alternating current—and, second, by regulating this current in its action in such a manner that no heating up to 100° C. in the stuff will take place. In this way any decomposition of the organic agglutinants is avoided. The consequence is that peat treated in such a manner and after the water freed by the electric current has been removed will harden by itself in the air, contracting at the same time, so that no compression is required to obtain solid briquet-like pieces.

The voltage and strength of the alternating-current sent through the peat, also the length of time during which the current must act, depends on the amount of solid parts contained in the peat. The process is said to be very easily and cheaply carried out when an alternating current of 200 volts and 1,200 amperes per ton of solid parts contained in the raw peat is employed for two periods of five minutes each, whereat the water freed by the effect of the electric current is mechanically removed after each period of treatment. During its action the current is regulated in such a manner that a heating of the peat above 100° C. is avoided.

Public Laboratory of Electricity in Belgium.

As a means of giving practical experimental instruction in electricity, Mr. Robert Goldschmidt of Brussels, Belgium, has given to the people of Brussels a complete electrical laboratory where the public may study, free of cost, the varied problems of electricity. Mr. Goldschmidt's object is to develop and extend the use and applications of electricity. The institution is known as the Laboratory-Museum of Electricity of Brussels, and is to be opened in October.

Writing from Brussels, Consul-general Roosevelt says that the institution will contain all kinds of electrical models and appliances, which may be freely handled for study and experiment. Models and apparatus will be conveniently placed at the disposition of the public upon separate tables, and may be connected with the electric current at will. For example, a person desiring to familiarize himself with running an electric tramway will find a complete model, about 10 inches long, of an electric car, which he may freely handle for examination, and operate upon the diminutive rails. Reduced models of every part of an electric-tramway system, various dynamos, etc., are to be found in the museum.

The laboratory is divided into four large rooms. The first is devoted to machines serving to produce phenomena due to magnetism and to electricity by friction and chemical reaction. This room will also be devoted to the demonstration of electrical laws. A circular gallery around this room is designated as the second hall. Here are found the domain of theory and application—machines of all sorts, lamps, bells, agricultural and dairy implements, conveniently exhibited, and may be worked by simply adjusting the electric appliance supplied to each table.

There will also be free telegraph, wireless telegraph and telephone offices. The third hall is subdivided into reading rooms, where the latest scientific periodicals will be on file. In the fourth hall will be found all kinds of large motors, dynamos, etc., with which the public is at liberty to study and experiment.

QUESTIONS AND ANSWERS.

Horsepower Required by Machine Tools.

W. E. M., Chicago Heights, Ill.: Can you give me a formula for finding the horsepower required to run a piece of machinery such as a planer (wood or iron working), blower or any class of machine such as is found in a wood machine shop, run by electric power?

ANSWER.

The question seems to refer more particularly to wood-working machinery, though reference is made to iron-working machines also. A general formula for wood-working machines is hard to derive, owing to the great variation in the materials worked upon. The power consumption in wood-working tools is much larger than would at first be supposed. Mr. G. M. Campbell, in a paper presented to the Engineer Society of Western Pennsylvania, gives a table showing the power taken by an 18 by 30-inch wood planer driven by an individual motor. With a cut 11 inches wide, 0.25 inch deep, feed 50 feet a minute, material oak, 19.6 horsepower input to the motor was required. With a feed 22 inches wide, 0.25 inch deep, 50 feet a minute, same material, 34.1 horsepower was required. With a width of 24 inches, 0.25 inch deep, 49 feet a minute, material oak, 40.2 horsepower was required. In another instance the power required to drive an eight by 24-inch Fay planer, reducing a 6½ to 6¾ by 12-inch oak beam to six by 12 inches, was about 25 horsepower at starting and 5.7 horsepower running light.

As to metal-working machines, the same authority gives a general formula for power required as follows:

$$H P = K W.$$

Where H P = horsepower,
K = a constant depending on material,
W = weight of metal removed per minute in pounds.

Values of K may be taken as follows:
K = 2.5 for hard steel.
= 2.0 for wrought iron.
= 1.8 for soft steel.
= 1.4 for cast iron.

The formula is a very general one and the power required in any particular case may vary 100 per cent., according to the condition of the cutting tool.

Starting of Polyphase Motors.

A. C. R. desires to know the method of procedure in starting polyphase motors.

ANSWER.

There are three ways in which polyphase motors may be started. The motor may be thrown directly on the mains; it may be thrown direct on the mains, but with a resistance introduced simultaneously in the rotor circuit, or it may be supplied at starting with a voltage lower than the running voltage.

The first method may only be used in the case of small motors, and then only when the motor is started light or on no load.

Starting with resistance in the rotor circuit is a method widely used, the resistance cutting down the stator current. This diminishes its lag and at the same time increases the torque of the rotor. One method of doing this is to carry the leads from the supply mains directly to the motor terminals through the proper switch and fuses. An entirely different set of leads starts from three slip rings on the motor to a triple arm tri-phase switch which has connected to its studs three sets of resistances, one slip ring being connected to the last stud of each set. The three arms of the switch are at a fixed angular distance apart and rest on corresponding studs of each set of resistances. Thus the resistance in each phase of the rotor circuit is equal at any position of the switch. As the motor speeds up the resistance is reduced by moving the arms of the switch.

The last-named method of starting—with reduced voltage—is frequently used. This consists in supplying the motor at starting with a voltage lower than the running voltage either by throwing resistance in series with the stator circuit, which, by the way, is wasteful of current, or by using an autotransformer, which is more satisfactory.

Use of Thermo-electric Couple to Measure Temperatures.

H. M. K., St. Louis: How may the principle of the thermo-electric couple be applied to the measurement of temperature?

ANSWER.

In cases where a thermometer cannot be used easily in the measurement of small variations in temperature, the thermo-electric couple may be used to advantage. The method of procedure is as follows: Take two wires of dissimilar metal, such, for instance, as German silver and copper, and solder two of their ends together. The opposite ends are then attached to the terminals of a D'Arsonval galvanometer. The principle of the couple is that when there is a change of temperature at the junction of the two metals a current will be generated if the circuit of the wires is complete—in other words, the action is that of the well-known thermopile. Having connected the wires to the galvanometer, the junction is placed in a vessel containing melting ice, which is at 0° C. The deflection of the galvanometer is then noted with a telescope and scale in the usual manner. The temperature of the water is then raised slightly and the deflection noted again. This is kept up until the water is brought to the boiling point, the various deflections and the corresponding temperatures being carefully recorded. A curve is then plotted between temperatures and deflections and the calibration of the thermo-electric couple is complete. All that remains, then, to ascertain the temperature of a body is to apply the couple to it and read the deflection of the galvanometer. Take this deflection and apply it to the curve and read therefrom the corresponding temperature. Care should be taken in applying the couple that it is not affected by external influences. It is well also in calibrating the couple to take the average of several sets of readings to obtain the values from which the curve is plotted.

An Efficient Cinder Trap.

In Portland, Ore., where the operating plant of the street-railway system uses lumber refuse as fuel, much annoyance was caused to residents by the large cinders from the smokestacks. One of the lumber mills also had thousands of dollars' worth of lumber refused by inspectors on account of blackened spots caused by the burning cinders. During the last year a cinder-separating apparatus was put in operation, which has proven successful. As described in the Engineering News, this device consists of an induced-draft plant discharging through a large steel separator of the same form as shavings separators used on sawmills. The induced draft is obtained by a 20-foot steel-plate fan, connected to the boiler upcasts, which discharges into a steel-plate flue leading into the separator. The latter is simply a vertical cylinder of steel plate, 32 feet in diameter, partly closed at the top so as to leave a 16-foot central opening, through which the smoke escapes. Inside the cylinder is a spiral of the same diameter as the smoke outlet. The bottom of the separator forms a huge conical hopper for receiving the cinders. The height of the separator, from bottom of hopper to discharge opening, is 56 feet. The smoke, entering the separator tangentially, describes a spiral path and loses velocity until it passes up through the open top of the separator. The maximum velocity of flow of the gases in the flue leading from fan to separator is about 5,200 feet a minute; the velocity at the discharge opening, which is twice the size of the flue, is therefore about 1,300 feet a minute. The cinders are dropped in the range between these two velocities. As the gases lose velocity, the cinders, being heavy, drop in a spiral path to the hopper-shaped bottom. Here they collect until removed by a steam-driven conveyor, which takes them to the boiler furnaces for burning. The cinders collected vary in size from very fine particles up to pieces about one inch long.

Iron Wires Substituted for Copper in Telegraph Work.

Owing to its greater conductivity copper wire was long ago substituted for iron in the more important telegraph circuits. Recently, however, there is a tendency to revert again to the iron wire in certain districts, particularly those in which sleet storms are prevalent and also where the lines pass through wooded districts. The Postal-telegraph Cable Company, as pointed out in the Telegraph Age, is now improving its wiring through such districts. At exposed places in the Alleghany Mountains iron wire has been substituted for copper, and its great tensile strength has made it much more serviceable. To get the desired conductivity nothing smaller than a No. 6 wire is used. In the West, out through the mountainous districts, the copper wire is still retained, as sleet storms are not so prevalent at the higher altitudes, and because the character of the timber is such that little difficulty is experienced from blown-down limbs of trees breaking the wires.

Bralley Syndicate Gets Federal Telephone Properties.

James S. Brailey, Jr., of Toledo, Ohio, has purchased a controlling interest in the United States Telephone Company and the Cuyahoga Telephone Company of Cleveland, and thereby secured for his syndicate the dominating interests in all the subsidiary companies of the Federal Telephone Company, which is an Everett-Moore organization. According to the plans reported, the capital stock of the United States Telephone Company will be increased sufficiently to allow it to become a holding company for all the others except the Cuyahoga. By a peculiar arrangement, the syndicate does not purchase the stocks of any other organization than those named, but at the same time all of them will come under its control.

The entire deal amounts to something like $2,500,000, and the money will be used to pay the debts of the Federal and get its affairs in good shape. The company was organized to own and control the subsidiary companies, and this accounts for the securities that it holds and also explains the reason for making the United States Telephone Company a holding company for the others. The Everett-Moore syndicate will still be interested in the properties, although their control goes into the hands of the syndicate that is looking after the long-distance lines through the Central West. The majority of the stock is to be placed in the hands of a voting trust, to be organized later. It is said that the Cuyahoga Telephone Company will be left largely in the hands of local people. This is the policy of the Independent people. But the voting trust idea is to prevent by any chance the possibility of the properties getting away from the Independents. The stock is to be deposited with the Cleveland Trust Company.

The increase of the capital stock of the United States Telephone Company will be from $2,000,000 common and $500,000 six per cent. cumulative preferred to $4,000,000 common and $1,000,000 six per cent. cumulative preferred. Of this $638,000 par value of the preferred and $1,100,000 par value of the common stock will be exchanged for the securities of the following companies, now in the treasury of the Federal Telephone Company: Findlay Home Telephone Company, Citizens' Telephone and Message Company of Fostoria, Columbiana County Telephone Company, Lancaster Telephone Company, Massillon Telephone Company, Stark County Telephone Company, Youngstown Telephone Company, Zanesville Telephone and Telegraph Company and the Mansfield Telephone Company.

Col. F. S. Dickson has resigned as president of the United States and Cuyahoga telephone companies and James S. Brailey, Jr., has been chosen in his place. E. W. Moore was chosen vice-president of the United States, vice Henry A. Everett, resigned. C. Y. McVey will remain as manager of the Federal properties, including the Cuyahoga, but O. F. French will be the manager of the Cuyahoga as far as local matters are concerned, it is said.

Among the firms interested in the purchasing syndicate are Otis & Hough and Wright, McLoud & Baker of Cleveland, Secor & Bell of Toledo and the Altheimer & Rawling Investment Company and Bauer Bros. of St. Louis, besides investors in Columbus, Cincinnati, St. Louis and other cities. St. Louis probably has a very strong representation.

The control of the Ohio companies assures a long-distance line from Albany, N. Y., to Kansas City, it is said, besides many other advantages that the local companies have not enjoyed. Further, it is said that the system will be extended to cover much more territory. The United States Company is said to have 99-year working contracts with the local Independent companies over the country. The close association of the Independent companies in Ohio has made it possible to bring them under a community of interests strong enough to insure proper co-operation. The National-Interstate Telephone Association is working along the same lines. The companies will retain their local interests and be to all intents and purposes upon the same basis as when they started. C.

NEW COMPANIES.

The Manufacturers' Telephone Company of Chicago was incorporated last week at Springfield, Ill. The capital is $5,000 and the object is stated to be a general telephone and telegraph business. La Verne W. Noyes, C. H. Smith and John E. Wilder are the incorporators.

Among recently incorporated telephone companies are the following: Clinton Mutual Telephone Company, Clinton, Okla.; Modern Telephone Company, Sayre, Okla.; West Side Telephone Company, Millstadt, Ill.; Southwestern Telephone Company, Osmond, Neb.; Farmers' Mutual Telephone Company, Bennet, Neb.; Salem Mutual Telephone Company, Eureka, Kan.; Council Grove Mutual Telephone Company, Council Grove, Kan.; Marion Township Telephone Company, Henley, Neb.; Mangum Telephone Company, Mangum, Okla.; Montgomery County Farmers' Mutual Telephone Company, Jefferson, Kan.

Indiana Telephone Items.

The telephone [illegible] ... [illegible] ... will ratify the change alleged to have been agreed upon by the city officers.

It is announced that the Home Telephone Company has secured a franchise to establish an exchange in Jeffersonville. It is the purpose to connect the new plant with the New Albany exchange and also with the exchange of the Louisville Home Telephone Company.

The Central Telephone Company of Greenfield has been incorporated with a capital stock of $7,500, to operate in Sugar Creek, Brandywine and Center townships in Hancock County. The company is in the market for material and skilled labor. John O. White heads the directors.

The Central Union Telephone Company has refused to accept a contract drawn by the city of Richmond, permitting the company to put its wires underground, providing the company agrees to a new schedule of rates. Representatives of the company say that in no city in the country has the Central Union accepted a franchise with a maximum rate clause. It is said that the city may now try to force all wires underground in a general conduit system.

The largest electric sign in Indianapolis has just been placed on the top of the Majestic Building by the Central Union Telephone Company. It measures 80 feet in length, with letters three feet high. There are 313 eight-candlepower electric lights in the letters. One of the unique features of the sign is that the letters are so constructed that they are as distinct in the daytime as at night. Current for the lights in the sign comes from the basement of the building.

The Vandalia Coal Company has just put in a private-branch exchange and switchboard, with a capacity of 50 wires, in its mine near Bloomfield. This system will be connected with the Home Telephone Company at Bloomfield and a branch-exchange toll line to Indianapolis. It is understood that other large coal companies are likewise placing telephones in their mines.

O. L. Barber of Converse, president of the Citizens' Automatic Telephone Company, announces that he is getting material on the ground for the construction of the new automatic system in Marion for which he was recently granted a franchise.

It is announced that there is a hitch at Columbus and Mount Vernon between the Independent telephone company and the Central Union Telephone Company in the arrangement announced last week. The Central Union proposed to place a toll board in the offices of the North Vernon, Vernon and Columbus Independent companies and furnish trunk lines to their local boards and to withdraw from the field for local service. But because the Central Union refused to put its proposition in writing, so it could be enforced, the Independents refused to carry out the negotiations. The Central Union says it will now proceed to construct a new office and exchange building in Columbus.

The managers of the Independent telephone companies who attended the recent telephone convention and observed the working of the automatic exchange systems on exhibition by the supply men were greatly pleased with the system. S.

Ohio Telephone Notes.

The village of Conneaut has brought suit to collect $9,518 from the Central Union Telephone Company, alleging that in constructing their lines the company agreed to be responsible for all damages. A number of people were injured by walking into the excavations made by the construction force.

J. B. Hoge, president of the National-Interstate Telephone Association, has issued a letter regarding the investments in independent telephone securities. Numerically, Mr. Hoge says, the Independents are stronger than their opponents and have many more stockholders and investors. The gains the independents are making far outstrip those of their competitors.

The Oakwood Telephone Company of Oakwood has been incorporated, with a capital stock of $10,000, by W. C. Crater and others.

The Country Home Telephone Company of Grover Hill has been incorporated, with a capital stock of $25,000, by J. M. Hutchinson, F. M. Saum, S. W. Storck, D. D. Bailey and C. G. McClure.

W. G. Blackmore and others have incorporated the Boughtonville Telephone Company of Boughtonville, with a capital stock of $10,000.

At Pattersonville the Farmers' Mutual Telephone Company has been incorporated with a capital stock

[illegible]

Canadian Telephone Items

[illegible]

Further [illegible]

The [illegible] pendent telephone lin[illegible] of $10 a year.

A bill has been introduced [illegible] Parliament, entitled [illegible] ment telephone line [illegible] It bargains that the [illegible] authorized by the Legislature, shall [illegible] purchase or expropriate [illegible] or partly within the province. The [illegible] lature may also delegate to [illegible] province the same powers of [illegible] priation within its territorial limits. The bi[illegible] subjects the Bell Telephone Company [illegible] rights and property in Manitoba to the [illegible] jurisdiction of the Provincial Legislature. W.

Telephone News from the Northwest.

W. S. Bartholomew will establish a telephone system at Avon, Minn.

The Cumberland Telephone Company of Cumberland, Wis., has begun the construction of rural lines.

The Vought-Berger Telephone Company of La Crosse, Wis., manufacturer of telephone supplies, has increased its capital stock from $57,000 to $200,000.

Local merchants of Hanley Falls, Minn., are considering the installation of a local exchange.

The Sheldon (N. D.) exchange of the Western Telephone Company has been absorbed by the Northwestern Telephone Exchange Company.

The Town and Country Telephone Company of Dawson, Minn., has been incorporated with $50,000 capital stock by Albert Ewing and others.

The Hawkeye Telephone Company will rebuild and enlarge its exchange at Perry, Iowa.

The E. H. Martin Telephone Company has ordered an additional 200-drop switchboard for its exchange at Webster City, Iowa.

The Nebraska Telephone Company is building a number of new lines out of Oakland, Neb., including one to Uehling.

A telephone exchange is to be established at Bowdon, N. D., by A. B. Cox of Valley City. R.

Southeastern Telephone Developments.

At Columbia, S. C., an ordinance is pending to require all wires in the center of the city to go underground, and the Bell Telephone Company is already making preparations to begin work which it says can be completed within six months.

The Carolina County Telephone Company of Bowling Green, Va., has been chartered by C. T. Smith, president of Bowling Green, and associates.

The Hattiesburg (Miss.) Home Telephone Company has received a charter, with $150,000 capital. The incorporators include S. A. Jones, H. S. Stevens and others.

The Upper Rappahannock Telephone Company has arranged to have connections with the Tidewater Telephone Company at Rappahannock, thus giving the former company a greater field. L.

Illinois Telephone Convention.

The executive committee of the Illinois Independent Telephone Association at a meeting in Peoria, Ill., selected Peoria as the place to hold the state convention. It will be held June 12th and 13th. The plan of the executive committee is to bring a number of the most prominent Independent telephone workers to Peoria for the convention. Delegates to the National convention in Chicago will be selected at the state convention. The executive committee consists of President E. R. Conklin of Peoria, Secretary C. B. Cheadle of Joliet, C. O. White of Princeton and J. W. Barrett of Pekin.

CORRESPONDENCE.

Great Britain.

London, May 16.—One of the largest and most important railway schemes for London that has been promoted in recent years is now under consideration. It has several features of more than ordinary interest. The line is called the London Outer Circle Railway, but really is a semi-circle running from the east to the west of London and touching the north en route. It will be a surface railway, and the single-phase system of electric traction has been decided upon. The capital involved is nearly $30,000,000, the line being 32½ miles in length. It is backed by an influential body of men, and even the existing railway companies have perforce to recognize that its financial position is unassailable. The promotion of the new route is really one of the outcomes of the report of the Royal Commission on London Traffic, and, in fact, one of the engineers to the line is Sir John Wolfe Barry, who was a member of the Traffic Commission, while one of the lawyers for the bill now before Parliament is Mr. Macarsly, who was secretary to the commission.

Reference to the Traffic Commission recalls the fact that considerable impatience is being manifested at the slackness of the government to take any action upon the report, and only again last week did the president of the Local Government Board refuse to see a deputation on the matter on the plea that it was not intended, at present, to put any of the recommendations of the report into force, presumably on account of lack of opportunity through press of other matters. Admittedly through this delay, one of the members of the commission, who is also a member of the House of Commons, has introduced a bill in his own name to establish a traffic board for London, a proposal which was hailed with satisfaction on all sides when the traffic report was first issued, nearly 12 months ago. It is unlikely, however, that the bill will get very far. Probably it was only intended as a protest.

Electric lighting of one sort and another has been the subject of a good deal of discussion lately. Most engineers are familiar with the efforts that are being made to improve the color of the mercury-vapor lamp by the addition of some carbon-filament lamps, and some very good examples of the effect thus produced were shown at the electrical exhibition in London last autumn. A late effort of this sort was described in a paper read before the Glasgow section of the Institution of Electrical Engineers last week. In one instance even such a critical class of customers as a London West End tailor has been given satisfaction, while in another case, the combination of mercury and carbon-filament lamps has replaced Welsbach gas lamps in a London billiard room. A 60-watt mercury lamp, combined with a 60-watt carbon-filament lamp, has turned out two five-foot burners. Further, with gas at 3s. per 1,000 feet and electricity at 3d. per unit, there was, price for price, better and more light.

In another direction, a further tale of success of electricity over gas comes to hand, and the satisfaction to be derived is intensified by the circumstance that it is in London, where it has been somewhat falsely published that gas is wholly replacing electricity for street lighting. A short time ago the roof of Charing Cross station collapsed, and the lower level of the new roof has necessitated different lighting arrangements. The gas company, so it is said, got the ear of the railway company as against the electric supply company, which had put in a cheaper tender, and suggested a public competition. This was duly held and electricity won anyhow, so to speak, price for price, giving about twice as much light. It is also stated that experiments with the mercury arc have obtained a life of 10,500 hours without appreciable diminution in the efficiency.

The postmaster-general announced the other day that it was almost certain that during the present year there would be an international congress to deal with wireless press messages. He hoped that this would put the matter of wireless press messages on a better basis than it occupied at present. It is assumed that this will form part of the deliberations of the second international conference on wireless telegraphy, which has been postponed several times, principally, of late, on account of the Russo-Japanese war.

Probably one of the most interesting features of English tramway practice, to the American and other visitors here in June, will be the extent to which double-decked cars, both open and covered, are in use in Great Britain. Every week sees orders for extensions of the use of such cars, and the financial results in the bad weather are extremely satisfactory. In fact, some of the petrol motor-bus companies are credited with a desire to do likewise.

The London County Council's tramway proposal along the Victoria Embankment and over the Thames bridge, has again been passed by the House of Commons. Last year and in previous years the House of Lords rejected it. G.

Dominion of Canada.

Ottawa, May 26.—The Dominion government will allow its bill now before the Canadian Parliament, dealing with the regulation of the exportation of electric power by Canadian companies, to remain over until next session.

Letters patent have been issued incorporating the Saguenay Electric Light and Power Company of Quebec, with a capital stock of $250,000, and giving it power to acquire and take over the Cartierville Electric Light and Power Company.

Several capitalists of Ottawa have incorporated as the Camaguay Electric Company, with a total capital stock of $350,000, and having principal place of business in Halifax, N. S. The company will carry on the business in electric light, heat and power chiefly in the island of Cuba.

A Canadian syndicate, comprising leading Montreal and Toronto capitalists, has purchased $1,300,000 of the preferred stock of the Tri-City Railway and Light Company, which controls all the street railway, gas and electric light companies in Davenport, Iowa, and Rock Island and Moline, Ill. It is intended that the stock as well as the bonds of the company should be at once listed on the Montreal and Toronto stock exchanges.

The contract for the new power house of the Montreal Light, Heat and Power Company, which is to be constructed on the Soulanges Canal, has been let to the Canadian White Company for the sum of $416,000. The new power house will be one of the finest on the continent, and it is understood that work on its construction will commence at once. The erection of the new offices of the company and the laying of conduits during the summer season will require a large expenditure. W.

Winnipeg, Man., May 26.—The Sunday car committee of the City Council has recommended to the council that a by-law be submitted permitting the operation of Sunday cars with the labor clause inserted, by which the company agrees not to require its men to work more than 10 hours a day or 60 hours a week.

The Southwestern Traction Company of London, Ont., is negotiating with the St. Marys Town Council as to the possibility of forming the North Midland Traction Company. The idea is to have St. Marys citizens take a portion of the stock in the company, which would build a radial line from St. Marys to London and connect with the Southwestern Company's lines.

The Hamilton Radial Electric Railway has running 12 cars daily between Hamilton and Oakville, half way to the city of Toronto.

The Montreal Street Railway now has an assistant superintendent in the person of A. Gaboury. The position is a new one, Mr. Gaboury having been promoted from the position of claim agent.

The Canada Central Electric Railway of St. Johns, N. B., financed in England by Senator Dornville, and to be built to carry freight as well as passengers, is getting into good shape. It will run from Montreal to Ottawa and on to the Great Lakes, and will be operated by electricity throughout its entire length.

James A. Moore of Vancouver, in the interest of the Canadian Pacific, is building a tunnel under the city of Seattle, paralleling the big bore of the Hill roads. He has arranged to go on with the work of building the electric railway between the cities of Seattle, Wash., and Vancouver, B. C., for which he obtained a franchise some months ago. It is to run from Vancouver through Blaine, Bellingham and Everett to Seattle.

The Grand Trunk Pacific Railway Company has been granted a franchise for an electric railway by the Council of Regina, Sask., as one of the conditions upon which it will decide to enter the city and make it a divisional point.

The city engineer of Edmonton has prepared plans for the building of an electric street railway to run from Kinistino to Twenty-first Street on Jasper Avenue and from Jasper to the Canadian Northern depot on First Street. The estimated cost of the railway is $66,000. H.

New England.

Boston, Mass., May 24.—The Massachusetts Legislature has voted "leave to withdraw" on the Cambridge mayor's two petitions for legislation authorizing that city to build, buy, operate or lease underground conduits for electric wires and authorizing any city with less than 200,000 people to build, buy, operate or lease underground conduits for electric wires.

The Massachusetts Legislature has passed a bill authorizing the American Woolen Company to furnish electric light and power in the town of Acton, the electricity to be generated in the company's power house in Maynard.

The Massachusetts Legislature has passed a bill amending the law so that municipalities operating electric-light plants shall charge three per cent. of the cost of the plant to depreciation, instead of five per cent., and the cost of the land and water-power is exempted from the valuation.

The United States government has advertised for proposals to install electric-light fixtures in the band barracks at Fort Williams, Maine, the bids to be opened June 15th; and for electric wiring of N. C. S. O. quarters at Fort Strong in Boston Harbor, and of an addition to a hospital at Fort Revere in Hull, Mass., the bids to be opened June 6th.

The Johns-Pratt Company, manufacturer of electric insulation and supplies, will enlarge its plant in Hartford, Conn. A building committee has charge of the work. The floor space will be doubled.

In the United States District Court at Hartford, Conn., Judge Platt has issued a decree sustaining the validity of the Western Electric Company's patent on desk stands, in an infringement suit against the Connecticut Telephone and Electric Company of Meriden, Conn. The patent was issued to Charles L. Boyce. The court held that the Connecticut company infringed the plaintiff's rights by selling telephone desk stands containing the patented article, and it issued an injunction against the sale of such stands by the defendant. The complainant waived any demand for an accounting of the defendant's profits, and, by special agreement, 4,260 stands made for the defendant by the American Pin Company of Waterbury, Conn., were exempted from the injunction.

The city of Boston will install arc lights on Savin Hill Beach for use for night bathing.

The Old Colony Street Railway Company has received the Massachusetts railroad commissioners' approval of its extension of freight service from Brockton to Abington, Rockland and Whitman.

The labor unions recently held a public meeting in Faneuil Hall, Boston, at which they appointed a committee of 15 persons to formulate a political platform for the unions. The committee reported, among other things, as favoring "public ownership of those utilities which in their nature are monopolies."

The Stanley Electric Company has awarded contracts for the construction of a large addition to its machine shop at Pittsfield, Mass. The building will be 500 by 63 feet and will cost $70,000. As much more money will be spent for lathes, drills, cranes and other special machinery.

The management and employes of the Massachusetts Electric Companies have reached an agreement, after many conferences, over the employes' demand for increased wages and shorter hours. By the contract, which will expire in 1910, the company recognizes the union and has agreed to a wage increase which approximates seven per cent. According to the new scale, motormen and conductors will receive 22 cents per hour during the second, third and fourth years; 23 cents during the fifth, sixth and seventh years; 24 cents during the eighth and ninth years, and 25 cents after 10 years' service. The hours of labor will remain the same —10 hours in 11 to make a day. An arbitration board will be established and the probationary term will be shorter.

George P. Dole has been appointed superintendent of the New Bedford and Onset and the Taunton and Buzzard's Bay street railways. He has been superintendent of the Providence and Fall River street railway.

The New England Telephone and Telegraph Company is to establish a new exchange in Boston, to be known as the Fort Hill Exchange. It will be located in a building which the company will erect. The capacity of the Fort Hill Exchange will be some 14,000 instruments, and they will all be located in the business district of the city. The company has bought land on Church Street in Dedham, Mass., where it will build a local exchange costing $10,000. B.

New York.

New York city, May 26.—The construction of the Pennsylvania terminal will be done by the George A. Fuller Company, the contract having been awarded today. No announcement of the amount of the Fuller company's successful bid was made, but it is said that the project will involve about $25,000,000. The terminal building will cover the two blocks bounded by Seventh and Eighth avenues, Thirty-first and Thirty-third streets. All the plans for the work have been prepared and the erection of the building will be begun as soon as the excavation has been completed. It was also announced yesterday that the Fuller company had secured the contract for putting up the immense office and terminal buildings for the downtown McAdoo tunnels from Jersey City. These two buildings will cover the two block fronts on the west side of Church Street, from Cortlandt to Fulton Street. Their estimated cost is about $7,000,000. Both blocks have already been cleared of old buildings.

Club women of this city were entertained recently at an electrical tea given by Dr. Frances Wallach Monell. Club members to the number of 800 were invited to her home in One-hundred-and-seventh Street, where all the refreshments were cooked or prepared by electricity. Tea, coffee and chocolate were prepared in separate urns having electrical connections. Electrical stoves and an electrical oven were also used. Guests were told that they might indulge in an electrical Turkish bath, and it was said that there was electricity in the punch. The electrical decorations in the house were beautiful; tiny electric bulbs made the house plants blossom profusely.

E. P. Bryan, vice-president of the Interborough

Rapid Transit Company, and H. H. Vreeland, president of the New York City Railway Company, were elected directors of the New York City Interborough Company at the stockholders' annual election yesterday. The company is the Belmont surface system in the Bronx.

Announcement was made after the meeting that the first section of the company's lines would be put in operation next Thursday, the lines beginning at the One-hundred and eighty-first Street subway station in Manhattan, running along Washington Bridge, Aqueduct Avenue, Fordham Road, One hundred-and-eighty-ninth Street, Southern Boulevard and One-hundred-and-eightieth Street in the Bronx. There is a comprehensive system of transfers, three-cent transfers being issued by the subway and elevated lines and free transfers being issued to and accepted from the Union Railway lines. The west side of the Bronx is brought into complete touch with Manhattan and the subway and West Side elevated lines. The New York City Interborough lines were designed especially as feeders to the elevated and subway systems, and other sections will be opened soon.

Damage to the amount of $275,000 was done to day in the building occupied mainly by the Zucker & Leavett & Loeb Company, manufacturer of chemicals and electrical apparatus. The fire was caused by the explosion of a carboy. The Connecticut Dynamo and Motor Company occupied part of the building.

The elevated railroad car barns, occupying the entire block between One-hundred-and-forty-fifth and One-hundred-and-forty-sixth streets and Seventh and Eighth avenues, were completely destroyed by fire a few nights ago. The car barns have been useless to the Interborough Company since the installation of the third rail, and for a week workmen have been engaged in tearing them down.

First Vice-president U. N. Bethell of the New York Telephone Company made known to the Board of Estimate yesterday that his company is willing to negotiate with the city authorities to arrange a basis of annual compensation to the city. Briefs in opposition to the Atlantic Telephone Company's application for a franchise were also submitted. No action was taken by the board on the franchise yesterday, and none can be taken until the Atlantic company's briefs are submitted early next week. The letter from Mr. Bethell deals with the suggestion made by Harry P. Nichols, chief of the Bureau of Franchises, that the city enter into an agreement with the New York Telephone Company exclusively if the city could obtain proper terms and conditions from the existing company. Mr. Bethell says that his company maintains its service at the highest possible efficiency, and restricts its gross earnings to the amount required to meet necessary operating expenses, including depreciation, and to provide approximately 10 per cent. a year for dividends, interest and contingent reserves. He says that the company announced in January of this year that it would reduce its pay-station rates on July 1st, and also would make other reductions. The new rates, Mr. Bethell says, will be made public in a few days. Mr. Littleton, for the Atlantic company, insists that the only way the Board of Estimate could compel the proper regulation of the New York company's affairs would be to reduce rates, improve the service, extend the development, and require the use of the latest inventions in telephony. If this were done, Mr. Littleton says, there would be no attraction in the New York field for any other company. Mr. Littleton insists that the company's rates are too high, and he says the Merchants' Association last year reported that the company was making 14 per cent. instead of 10, as stated by Mr. Bethell.

Governor Higgins has signed two important bills supplementing the Elsberg rapid-transit bill, which became a law recently. The more important was the Elsberg-Prentice bill, providing that before the Rapid Transit Commission finally fixed the terms of any contract for construction or equipment it should set a date for a public hearing on the proposed contract, publishing such date for at least two weeks before the hearing in the City Record and at least twice in two daily papers in the city.

August Belmont of the Interborough Rapid Transit Company paid to the city on Thursday $431,429 demanded by Controller Metz as the initial one per cent. sinking-fund payment for the ultimate redemption of the bonds issued for the construction of the subway. C. I. C.

Southeastern States.

Charlotte, N. C., May 26.—The town of Newport News, Va., has announced that it will sell an electric street-railway franchise to the highest bidder up to the first Tuesday in June, the Town Council reserving the right to reject any or all bids. The city clerk is W. L. Cooke.

The Eastern Light Company of Norfolk has been chartered. W. H. Carr is president.

The Asheville (N. C.) Automobile and Transit Company has been chartered with $10,000 capital by F. Ward and other citizens of Asheville.

A company with $100,000 capital, proposing to build an electric railway in Georgia, is being organized. The line will connect Fitzgerald, Bowen Hill, Syracuse and other points.

An 88-mile electric railway from Atlanta to Macon is proposed by [illegible] who has [illegible] franchise in [illegible] the Atlanta, Griffin and [illegible] Company. The [illegible] $10,000, [illegible] M. J. M[illegible] Moore are the [illegible]

The [illegible] Power Company [illegible] is [illegible] completing the [illegible] electric plant to operate the [illegible]

Sargent & Lundy, consulting [illegible] cago, are preparing the plans [illegible] power house for the [illegible] Light Company. The total capacity [illegible] kilowatts. There will be electric [illegible] paratus.

The Alabama Railroad Commission [illegible] that the property of the Birmingham R[illegible] and Power Company could not be [illegible] railway in the purview of the [illegible] hence an electric line is not a road [illegible] within the law by which traffic [illegible] regulated.

The Union Buffalo Mill Company, which [illegible] the bankrupt cotton mill plant of the [illegible] mills, will merge these properties with [illegible] waterpowers, including one at Neal Shoals, where electric power is generated, to run seven large mills. The merger company has a capital of $7,000,000. E. W. Robertson of Baltimore and Lewis W. Parker of Greenville, S. C., are directors.

The promoters of the proposed Greensboro-High Point (N. C.) electric railway have met a serious obstacle in the refusal of the High Point town authorities to grant them a franchise, rights having been secured at all other points. It is not known what effect this will have on the plans of the company.

The power plant of the Ware Shoals Manufacturing Company on Saluda River, near Laurens, S. C., is completed and ready for operation. Power will be used to operate the Ware Shoals Manufacturing Company's cotton mill. L.

Ohio.

Cleveland, May 26.—When the consolidation of the Northern Ohio Traction and Light Company and the Tucker Anthony properties is consummated, as mentioned in the Western Electrician last week, the first-named company will in effect absorb the other three companies and retain its own name. But for operating purposes the Canton-Akron, Canton and New Philadelphia and the Tuscarawas Traction Company will be brought into one corporation. In order to take care of this deal the capital stock of the Northern Ohio Traction and Light Company will be increased about $500,000. This consolidation marks the beginning of large systems in the northern part of the state to correspond with those in the southern and western portions.

The Supreme Court has held that a street-railway company is responsible for the mistakes of conductors in punching transfer slips, if the passenger, after ordinary care, does not discover the mistake. It is said that this decision does not upset the rules of street-railway companies; it simply holds the companies responsible for the mistakes of its employes.

The purchase of the Cleveland, Painesville and Ashtabula Railway Company by the Cleveland, Painesville and Eastern is said to have been completed, but the actual transfer has not been made. This deal will put the Everett-Moore people in possession of the lines from Ashtabula to Toledo and Detroit, and is another indication of the tendenc to merge the small systems into larger ones.

E. W. Moore, president of the Lake Shore Electric Railway Company, has been granted a franchise to build an electric railway from Fremont to Sandusky.

About $450,000 will be spent for additional power, new cars and other improvements by the Toledo Railways and Light Company this year, in addition to $175,000 to be used in the erection of a new terminal station. Negotiations are pending for the refunding of the bonded debt, falling due in 1909, by a number of financial institutions. About four per cent. will be earned on the stock this year, and perhaps a little more.

Incorporation papers have been filed by the Cleveland Gas and Electric Company. The articles give the company the right to manufacture and sell gas and operate electric-light plants and street railways. The company is formed for the purpose of merging the two gas-light plants in Cleveland, and the officers deny that they will attempt to operate electric-light plants or street-railway systems.

Otto Miller is one of the men interested in the Cleveland Heat and Power Company, which was incorporated a few days ago for the purpose of constructing plants for lighting, heating and furnishing power for groups of buildings in the heart of the city.

For the year ended April 30th, the Cleveland Electric Railway Company showed gross earnings of $5,517,751.02, an increase of $551,730.57 over the former 12 months.

Farmers and people living along the line are said to be largely responsible for the incorporation of the Cleveland, Brooklyn and Elyria Electric Railway Company, with a capital stock of $100,000. After passing through Brooklyn, the road will strike Columbia, Eaton, Strongsville and Chestnut Ridge.

[illegible]

Indiana.

[illegible]

The Indianapolis and [illegible] Traction Company has [illegible]

The Winona Interurban Railway Company has completed its trolley line from Warsaw to [illegible], a distance of [illegible] miles, and [illegible] The company is now turning its attention to the Warsaw-Peru division. The company has [illegible] nine miles of grade and [illegible] the old Wabash [illegible] road. At present the Winona power house supplies the power, but a much larger plant is now being constructed. The new plant has a cement smokestack 170 feet long, the only cement smokestack in [illegible]. When the Winona system is completed it will open up direct trolley connection between Winona Lake and Indianapolis, Elkhart, South Bend and many points in Michigan.

The injunction case of the Louisville and Nashville Railroad against the Evansville and Mount Vernon Traction Company has been dissolved by the court and the steam road ordered to replace the trolley-line crossing torn out by the former near Mount Vernon.

The cars of the Muncie and Portland Traction Company, which are to run between the cities named, were tested during the last week, and it is announced that regular trains over the line between Muncie and Portland will be put on May 30th.

Walter Carruth is under arrest in Indianapolis charged with defrauding street and interurban companies in this and other cities. The defendant has a peculiar ankle which he can throw out of joint at will, and with this ankle was able to feign an injury.

Eugene Rush of Frankfort, Ind., president of the Michigan Hydraulic Company, announces that the company is completing arrangements to construct a 25-foot dam in White River at Decker, 10 miles from Vincennes. An electric plant will be built to transmit current to Evansville, Vincennes, Princeton, Washington, Mount Carmel, Sullivan and other towns in the vicinity to furnish light, heat and power. The company is asking for franchises to furnish street arc lights at $50 a year.

The Lambert Engine Company of Anderson has invented a gasoline motor that can be used in the field for plowing. Eight to 10 acres a day is plowed easily with the machine, it is said.

The electric light trustees of Crawfordsville have recommended a reduction of 20 per cent in the rates for light and power. The present rate is 12½ cents a kilowatt, and it is proposed to reduce this to 10 cents.

The Varney Electric Manufacturing and Supply Company of Indianapolis has increased its capital stock from $90,000 to $150,000.

The first automobile hill-climbing contest ever held in this state was held at Glens Valley Hill, south of Indianapolis, on May 24th. The Apperson car, driven by Edgar Apperson of Kokomo, made the best time of the 42 contestants, making the quarter mile at a 10 per cent. grade in 31.2 seconds. The Stodard-Dayton machine, driven by Frank Moore, was second, making the mark of 32.2 seconds. S. S.

Illinois.

Peoria, May 26.—Specifications for the fire-alarm and police cables, including the work of pulling them into the conduits, have been made by City Electrician Lyons.

Three routes of entrance to Jacksonville by the Illinois Traction Company are under consideration. The entire right-of-way between Peoria and Bloomington has been secured except a strip three miles

on either side of Mackinaw, where the price asked for land is considered too high. The company has received a franchise from the town of Danvers, in return for which it will light certain streets.

The Terminal Railway of East St. Louis is making an effort to prevent the Illinois Traction Company from entering St. Louis. The Chicago and Alton Railroad filed a petition before the State Board of Railroad and Warehouse Commissioners, objecting to a grade crossing by the Decatur and Edwardsville Terminal Railway at Venice. The Illinois Traction Company will probably have to bring the matter into the courts and have a right-of-way condemned, as the Terminal Association controls most of the land between Venice and the river.

The work on the bridge here is progressing at a rapid rate now, as the differences between the traction company and the C., B. & Q. have been settled. The foundations are to be of concrete reinforced by steel. The power house will have two of the largest smokestacks in the city, built of concrete and 214 feet high.

The new limited car "Missouri" of the Illinois Traction Company, on a run from Granite City to Springfield, left Granite City with B. R. Stephens, general traffic manager, and his wife, and W. W. Waterson, terminal superintendent, at 8:10 a. m., and arrived in Springfield at 11:33 a. m., making the 90 miles in three hours and 23 minutes. A delay of 13 minutes was experienced. Over the stretch of 20 miles of rough track, between Staunton and Carlinville, it took 50 minutes. This can be made when the track is in good order in 35 minutes. A distance of 6½ miles was made in 7½ minutes. The run was made to test the car for long runs at the high speed, and the new cars will go into regular service between Springfield and Granite City, with connections for St. Louis, making the trip in about four hours. The fare will be $2.95 for the round trip, or the same as the present one-way fare on the steam roads.

The contracts for the construction of the interurban between Pana and Springfield have been let and the surveyors are soon to start on the line from Pana to Vandalia.

A meeting of the stockholders of the electric road proposed to be built from Roodhouse to Virden has been called at Roodhouse for June 5th.

The surveyors who are running the surveys for the proposed line for the Mattoon, Shelbyville and Hillsboro Traction Company have passed through Shelbyville and will complete the survey in about 10 days. From Shelbyville the line runs direct to Lithia Springs, the seat of the Lithia Springs Chautauqua and summer schools.

The Chillicothe Water Light and Power Company of Peoria, with a capital of $50,000, has been incorporated to distribute water, heat, light and power. Incorporators are W. H. Foster, Frank H. Earl and Charles A. Kingsbury.

The Columbus Electric Construction and Supply Company of Chicago, capital $15,000, proposing to manufacture and deal in electric supplies, has taken out incorporation papers. James W. Keating, Olive L. Erwin and William Reuben are the incorporators.

V. N.

Northwestern States.

Minneapolis, May 26.—A favorable report has been made in Congress on the Stevens bill, which provides for the establishment of a power plant at the government lock and dam, between the Twin Cities, which will utilize the water passing through the locks in furnishing power for the government buildings in St. Paul and Minneapolis. The Treasury Department spends $10,000 yearly in the two cities for electrical power and the War Department $15,000.

The establishment of an electric railway from Forest City to Clear Lake, Iowa, is contemplated. T. A. Kingland and others of Forest City are endeavoring to interest capital in the matter.

The St. Cloud (Minn.) Electric and Power Company has been incorporated with a capitalization of $100,000, J. C. Jacobson being president and O. T. Hougen secretary-treasurer. It is proposed to build a dam in the Mississippi River at St. Augusta.

A survey is being made from Eau Claire to Menomonie, Wis., by the Chippewa Valley Electric Railway Company with a view to determining the feasibility of extending its trolley line to the latter city.

E. A. Edmonds has applied for a franchise to establish a street-railway system at Rhinelander, Wis.

The council of Bocey, Minn., is corresponding with F. McCormack of Duluth relative to installing an electric-light and waterworks system in the former town.

The General Electric Company's bid for a new electric-light plant at Luverne, Minn., was accepted at $1,154.

R.

Pacific Slope

Oakland, Cal., May 24.—The San Francisco Gas and Electric Company has about completed the work of inspecting service pipes and turning on gas in the unburned districts of the city. A large force of men was employed and every precaution has been taken to prevent another conflagration such as might be started from the use of defective pipes in houses. The cooking with coal stoves in the streets which was universal for a month after the fire is being gradually discontinued. Gas stoves in the houses will be used pending the reconstruction of chimneys. In some cases gas stoves will be used in the streets temporarily.

The San Francisco Coke and Gas Company is making arrangements for resuming business rapidly. The company's plans for an electric-lighting plant to supplement its gas plant have not been completed, but the subject will be investigated to see if present conditions warrant the outlay.

The Pacific States Telephone and Telegraph Company has been making strenuous efforts to rehabilitate its San Francisco system, but has been badly handicapped by the loss of all but one of its operating buildings by fire. The new main exchange building on Rush Street, near Kearny, where the largest switchboard in the world was destroyed, is being restored as fast as possible, but months will elapse before the work that was undone in a few hours can be done over again. Louis Glass, general manager of the company, says that the new telephone directory covering the temporary arrangement of the system will be out very soon. The fact that over 16,000 subscribers in the unburned district must be located, 10 to 15 per cent. of the subscribers having moved since the fire and that an equal number have taken temporary quarters with other subscribers made this a difficult piece of work. The long-distance lines are in much better condition than those in the city. Over 1,000 new subscribers have been added to the Oakland system since the disaster, necessitating radical changes and extensions on that side of the bay. The repairing of damage to the system at Oakland, Berkeley and Alameda was very expensive and a large force of men was employed for some days.

The San Francisco Gas and Electric Company has leased the Sacred Heart Academy through Archbishop Riordan for two years. The building is located at the corner of Ellis and Franklin streets, being suitable for general office purposes.

The Decker Electrical Company has been incorporated with a capital stock of $20,000 by Peter Decker and Maurice G. De Long of San Francisco, Peter Murman of Oakland and Edgar D. Hand of Alameda.

The Interurban Transit Company's electric road into Palo Alto, a small portion of which has been constructed, is to be completed by November 15th next. L. E. Hanchett, who controls the company, has deposited an additional forfeit of $2,000 to guarantee the road's completion by that time. The Town Board has since ordered the franchise forfeiture proceedings stopped.

The Municipal Street Railroad Company of San Francisco, which proposed to install about 200 miles of electric conduit road at an estimated cost of $14,000,000, has proceeded with the filing of its incorporation papers, prepared before the fire. The incorporators are Claus Spreckels, J. D. Phelan, George Whittell, Charles S. Wheeler and Rudolph Spreckels. The loss of population consequent upon the fire will temporarily render the project less likely to be carried out. However, Rudolph Spreckels is still heading the opposition to the rebuilding of the Sutter Street cable road of the United Railroads system as an overhead trolley, notwithstanding the sweeping order by the Board of Supervisors giving permission to trolleyize the entire city.

The Presidio and Ferries Railway Company's cable line, extending from the corner of Washington Street and New Montgomery Avenue to the Presidio Barracks, is unlikely to be rebuilt as a cable road. The roadbed was badly wrecked by the earthquake in many places. In fact, the worst-looking pictures of damage to car tracks on made ground in the city were taken on this line. Between Pierce and Steiner streets the tracks were shifted six feet. The partial damage to the power house by the earthquake was completed by the fire. Not a single car was saved and the roadbed was badly twisted. As the company's franchise has only six years yet to run, the re-equipping of the cable plant would not be justified by the returns. The owners are now considering plans for the reconstruction of that portion of the Union Street system between Polk street and the Presidio as an electric line. It would be possible to purchase electric current for its operation from the Pacific Gas and Electric Company or some other source. The success of the scheme, however, would depend largely upon the securing of transfer privileges to and from the lines of the United Railroads system. The Presidio Barracks, Presidio Heights and a large and populous section of the city that has been without convenient transportation facilities since the fire would thus be brought into closer communication with other parts of the city.

The Oakland terminus of the new Twenty-second Street branch of the Key Route electric car line, which has just commenced operating, will soon have a handsome $12,000 depot. Permission for the remodeling of an existing building has been granted by the Board of Public Works. The structure will be in the form of an arcade, into which trains will run under cover. The building will be finished by July 1st.

The Edison Power Company will build a bridge at Trimmers Springs, Fresno, Cal., and proposes to establish light and transmission stations along the Kings River. The company will spend not less than $15,000 for the bridge.

Sealed bids will be received by John D. Boyd of Palo Alto, Cal., up to June 4th for furnishing and installing of machinery and making improvements on the municipal water and lighting plant.

The Portland General Electric Company has applied to the council of Portland, Ore., for a 25-year franchise to install a steam heating plant at a cost of $250,000. The company will build an immense plant and will lay mains in all of the principal streets.

E. H. McAuley has purchased the Emmett Power and Water Company's plant at Emmett, Idaho, and will make changes and improvements in the plant. The method of operation will be changed from steam to waterpower.

In anticipation of an early sale of the $500,000 bonds voted at the last election in Seattle, Wash., Superintendent Young of the municipal lighting department has placed orders for sufficient wire to keep several gangs of construction men working for the next year. Difficulty in securing wires makes it necessary to get orders in early. Difficulty is being encountered in securing poles also. Immediately on securing bond money, plans will be perfected for the installation of another unit of power at the lighting department headworks at Cedar River, Wash.

Instructions have been received from the Navy Department inviting bids for the erection of a wireless-telegraph station on Tatoosh Island, Wash. The bids will include the erection of the necessary buildings and masts for the equipment, and they will be opened at Seattle, Wash., May 26th. Instruments to complete installation have been received.

A.

PERSONAL.

A. Stavenov, chief traffic manager of the Berlin street-railway system, has arrived in America, and while here will study traffic handling in some of the large cities.

A dispatch from Peru, Ind., says that William Walsh, local manager in Peru for the Central Union Telephone Company, took his own life on May 27th. No cause is given for his act.

L. J. Oliver, for some time manager of the Southern Bell Telephone Company at Columbus, Ga., has been promoted to the position of superintendent of the seventh district, embracing South Carolina, with headquarters at Charleston, S. C.

John Break, superintendent of the London (Ont.) street railway, who has been with the company for 12 years, has resigned. He is succeeded by Assistant Superintendent E. Whittaker. Mr. Break resigned to go into business for himself.

William Herrick, manager of the William Herrick Company of Chicago and treasurer of the Drake Electric Company, died of apoplexy in Chicago on May 25th. Mr. Herrick was prominent in the automobile business. He was 40 years old and was born in Chicago.

R G. Hunt, who has been manager of the Consolidated Gas and Electric Company of San Diego, Cal., for the last nine months, will be transferred to the home office of H. M. Byllesby & Co. in Chicago soon. He will take a position in the operating department.

L. E. Holderman, superintendent of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., was in Chicago this week in the interest of the new-business department of his company. He was accompanied by L. A. Lange, editor of the Fond du Lac Daily Reporter.

R. L. Woolfolk has resigned as manager of the St. Paul branch of the Northwestern Telephone Exchange Company and will be succeeded by C. H. Edwards of Fargo, who has been manager of the company's lines in North Dakota. S. T. Hudson has been promoted to be manager at Fargo.

Frederick C. R. Spence has severed his connection with the Stanley Instrument Company, Great Barrington, Mass., and is now with the Fort Wayne Electric Works, Fort Wayne, Ind. His headquarters are at Fort Wayne, Ind., and he is acting in the capacity of a special representative for the sale of meters, in which line the Fort Wayne company is prominent.

John F. Wallace, president of the Electrical Properties Company, has published in pamphlet form his supplemental statement submitted to the United States Senate committee on interoceanic canals. The statement is in reference to the Panama Canal and Mr. Wallace's reasons for retirement as chief engineer of the Isthmian Canal Commission. Secretary Taft's relations with the incident are especially referred to.

Mrs. Frances Ernest Drake, formerly Miss Colton of Chicago, wife of the director of the American electrical machinery department at the Paris Exposition of 1900, died in Berlin, Germany, on May 27th, of heart failure. Mrs. Drake lived in Chicago for several years prior to her husband's removal to Paris. Of late the Drakes have resided

in the German capital. Mr. Drake, who is well known and highly esteemed by electrical men, has the sincere sympathy of his friends.

Mr. Walter Robbins, assistant to the manager of the apparatus department of the Western Electric Company, Chicago, has resigned his position with that company and will enter the service of the Wagner Electric Manufacturing Company, St. Louis, as assistant to the manager of that company. This change will become operative July 1st.

William Thomas Bouchelle, secretary to the president of the New York Telephone Company, died suddenly at his home at Rock Ridge, Greenwich, Conn., a few days ago. He was at business three days before his death, when he was taken with severe intestinal troubles. He is survived by a widow. He was born in Baltimore 58 years ago.

H. M. Byllesby, accompanied by O. E. Osthoff, engineer, and J. J. O'Brien, general auditor of the firm of H. M. Byllesby & Co., Chicago, will leave in about a week for a trip to the Pacific Coast. San Diego, Cal., will be the objective point, where the company owns the Consolidated Gas and Electric Company. The Byllesby company owns a number of similar plants in the West.

Professor Hyland T. Plumb of Purdue University, Lafayette, Ind., recently delivered an interesting public lecture at the university upon the subject of "Novel Alternating-current Phenomena." About 500 people were in attendance at the lecture, which included many practical demonstrations of the varied effects of currents of high voltage and frequency, illustrated with stereopticon lantern slides, explaining fully the causes of the action demonstrated.

C. G. Du Bois, secretary of the Western Electric Company, Chicago; W. R. Patterson, plant engineer, and E. J. Frost, traffic manager of the same company, are in San Francisco co-operating with the California Electrical Works in caring for the Pacific Coast trade of the Western Electric Company. These gentlemen will remain two months or more, and will lend their assistance in the upbuilding of the electrical interests of San Francisco.

Mr. S. O. Ochs, who was formerly associated with the Stanley Instrument Company, Great Barrington, Mass., is now representing the Fort Wayne Electric Works, Fort Wayne, Ind., in its New England territory, with his headquarters at Boston. He is well known to the electrical fraternity throughout the New England states and in New York. Mr. Ochs has just suffered a severe bereavement by the loss of his sister, who died in Kansas City recently.

ELECTRIC LIGHTING.

Pender, Neb., has voted $10,000 in bonds for a municipal lighting plant.

V. L. Beshears is moving his electric-light plant from Vandalia, Mo., to Eldorado.

Lyndon, Kan., contemplates voting $10,000 for the construction of an electric-light plant.

Oxford, Kan., is to vote on the proposition to issue $20,000 in bonds for an electric-light plant.

Frank X. Schaefer is seeking a franchise for an electric-light and power plant in Muscatine, Iowa.

James A. Shinn and associates have applied to the City Council at Leadville, Colo., for a franchise to do an electric-light and power business in Leadville.

Local capitalists at Leitchfield, Ky., will put in at that place one of the latest and most improved electric-light plants. Will P. Allen, who is now in Louisville, will have charge of the plant.

The annual meeting of the stockholders of the Chicago Edison Company will be held at the office of the Company, 139 Adams Street, Chicago, on Monday, June 11, 1906, at 12 o'clock noon. A board of directors will be elected and other business transacted. William A. Fox is secretary.

Sealed proposals are being invited until June 14th for furnishing electric current for illuminating and small-motor purposes, and for the construction and installation of a complete exterior and interior electric-lighting system, with fixtures, etc., at Fort Sam Houston, Tex. Address L. J. Fleming, constructing quartermaster, Fort Sam Houston, for additional information.

The Isthmian Canal Commission is inviting sealed proposals until June 8th for furnishing equipment for an electric-light plant, to be erected on the isthmus. Specifications and proposal blanks can be obtained upon application to D. W. Ross, general purchasing agent, Washington, D. C.; the assistant purchasing agent, 24 State Street, New York, and of the chief quartermaster, Department of the Lakes, Chicago.

A law to establish a board of municipal electric-light commissioners for Jamestown, N. Y., is now in force. It had previously been approved by the council of Jamestown. The city conducts a municipal electric-light plant, also a water plant. The water plant is managed by a commission and has been successful, but the operation of the light plant has been unsatisfactory; hence the decision to create a commission to have charge of its operation. The new law requires the mayor to [illegible] the [illegible] commissioners [illegible] city [illegible] commission [illegible] commissioners [illegible] commissioners will have control and [illegible] municipal electric-light plant now [illegible] city.

The fund appropriated for the [illegible] additional electric light in Scranton, Pa., seems to have been exhausted. Under the city charter no additional funds can be appropriated, except in case of emergency, and as it has been held that an appropriation for an electric light does not come under the head of emergency, it is said about the city hall that Scranton will have no electric lights placed this year.

The new ordinance fixing the rate for electric current to be charged by the Commonwealth Electric Company and the Chicago Edison Company, and permitting consolidation of these two companies, was introduced at the Chicago council meeting this week and was made a special order for the next meeting. It is understood that about a dozen of small producers of electricity in the city will contest the ordinance if passed. They declare that the ordinance discriminates heavily against them.

ELECTRIC RAILWAYS

Noah Newbanks and Frank Fisher have been granted a franchise for a street railway system in Pierre, S. D.

Plans are being laid in Kansas City, Mo., for the building of an interstate electric railway, with the eastern terminus at Carthage, Mo., and the western at Independence, Kan.

An electric block-signaling system is being installed on the lines of the Chattanooga (Tenn.) Railway Company. The company is preparing to build new shops in Chattanooga at a cost of $30,000.

Traffic managers of the interurban lines which operate between Detroit, Mich., and Toledo, Lima and Dayton, Ohio, met recently and decided to eliminate all excess fares on the limited trains operated by the Indiana and Ohio merged lines. The matter of reducing charges on baggage was also discussed.

The West Newton and Webster (Pa.) Street Railway Company has made a formal transfer of its property to the Pittsburg, McKeesport and Westmoreland Company, which will build a line from Irwin to the Monongahela River at Donora, a distance of 18 miles. The contract to build the line was let to the South Penn Construction Company. The trolley company has made traffic agreements to connect with the West Penn Company at Douglas and with the Monessen and Fayette City at Monessen.

The feature of the opening of interurban railway traffic a few days ago between Lenexa, Kan., and Kansas City, by the Missouri and Kansas Interurban Railway Company, was the fact that a Strang gaso-electric car was used on the initial trip. This form of motive power will be used on the new road. A. F. Hunt, manager of the company, stated that the road would be open to Olathe, Kan., by July 4th. A motor car and one trailer was used at the opening. Several more of the Strang cars are being built for the road.

While the Senate was considering a bill from the committee on the District of Columbia authorizing extension of the street-railway lines and providing for an increase in the taxes of the public-utility companies of the District amounting to 12 per cent. on the net earnings, Senator Patterson is reported to have declared that the average cost of carrying passengers on publicly owned street-car lines is 1 1-10 cents, and asserted that the manipulation of the utility corporations is "the cause of 95 per cent. of the municipal corruption that has made municipal government a stench in the nostrils of the people."

The Calumet Electric Street Railway, Chicago, the principal remaining asset of the failed National Bank of Illinois, has been sold by the receiver to Cobe & McKinnon, representing Chicago financiers who are said to have formed a syndicate to take hold of the electric railway property and put it on a profitable basis. The purchase price, exclusive of cash in the receiver's hands, is about $3,150,000. It is figured that the railway property represents about $3,000,000 of the total. The road has been operated by a receiver since the failure of the bank in 1896. About $1,000,000 has been spent on the line in improvements in the last five years. The company owns 80 miles of single track south of Sixty-third Street and has 250 cars. The road was started in 1890 as a world's fair proposition by W. V. Jacobs, but at the time of the bank failure was in the hands of Farson, Leach & Co. H. M. Sloan, a well-known street-railway man, is the manager of the road.

PUBLICATIONS.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] to go [illegible]

The Street Railway Review [illegible] Chicago, has been [illegible] Railway Age [illegible] railroad interests. [illegible] Company [illegible] the Street Railway Review [illegible] proved.

The Fletcher Manufacturing Company of St. Louis, manufacturer of [illegible] and brackets, has issued [illegible] products. The [illegible] described is constructed [illegible] system, and the device [illegible] possible positions which are required [illegible] line construction.

An interesting pamphlet from the Cooper Hewitt Electric Company of New York describes the [illegible] uses of mercury-vapor lamps for industrial lighting. There are a great many places where these lamps may be used advantageously, and the pamphlet contains a number of illustrations where the lamps have been applied with satisfactory results. The pamphlet also contains descriptions of the [illegible] types of lamps, a list of interesting installations and a brief description of the mercury-vapor converter.

"Fibre Conduit" is the title of a new catalogue recently issued by the Fibre Conduit Company, Orangeburg, N. Y. A description of the manufacture of the conduit, bends and fittings is given, followed by a brief resume of the advantages offered in the use of this type of conduit for underground and power house construction. The catalogue contains tables showing the dimensions and weight of the various sizes and types of conduit produced; and drawings are given which show the radius upon which the various bends are made, together with drawings showing methods of connecting fibre bends and fibre conduit. As an appendix to the catalogue are given 13 pages of bulletins describing various types of manholes, methods of constructing manholes, appliances for use in underground construction and tables showing the dimensions of wire and light, power and telephone cables. It is the purpose of the Fibre Conduit Company to issue new bulletins at regular intervals and with this in view the catalogue is arranged in loose-leaf form that the new bulletins may be easily added thereto. Mr. W. W. Smythe, Jr., of Chicago, western manager of the company, is to be credited with the preparation of this excellent publication.

In these days of 100,000-kilowatt power stations the notion is apt to obtain that the old familiar primary battery has been relegated to the high-school laboratory and the ringing of doorbells. Primary batteries are still used in immense quantities, as for the operation of railroad signals, the sparking of gasoline engines and for places where a limited amount of electrical energy is needed constantly and uniformly. The batteries now being supplied are an improvement over the old cells, and their manufacture and design have been reduced to scientific perfection. On this subject a pamphlet entitled "Edison Primary Batteries" has been published by the Edison Manufacturing Company of Orange, N. J. It describes Edison's improvement of the Laland caustic-potash cell, which, as the pamphlet declares, by quotation from Professor Carhart, "has a capacity of work per unit weight greater than any other, either primary or secondary." It is stated that the energy of the Edison cell applied through a perfect motor would raise the cell 16.17 miles. The improvement made by Edison consists in forming the copper oxide depolarizer into firm briquettes, which reduces both the internal resistance of the cell and the tendency to polarize, at the same time making the renewal of the cell much more convenient. The cost of electrical energy from these cells for some purposes would not be excessive, as, for instance, a 600-ampere-hour renewal comprising all the perishable parts of the cells costs only $2.52, which is less than one-half cent per ampere-hour. It is asserted that this cell gives rise to no fumes, that the liquid does not corrode machinery, that there is no creeping of salts and that the cells do not freeze in ordinary cold weather.

MISCELLANEOUS

The Illuminating Engineering Society of New York will meet in the Edison Auditorium, 44 West Twenty-seventh Street, on June 8th, at 8.15 p. m. Dr. Louis Bell of Boston will read a paper on "Some Physiological Effects in Illumination and Photometry." Some distinguished oculists will take part in the discussion.

A novelty in the way of exhibiting transformers will be found at the booth of the Wagner Electric Manufacturing Company of St. Louis in the west aisle of Young's Pier, at the Atlantic City convention. The company has taken a standard transformer and cut away part of the case, so that the coils and sheet-iron may be plainly seen. This is a very good method of showing graphically the actual construction of these transformers, especially to non-technical people.

The committee of the National Civic Federation which has been studying municipal ownership of public utilities in the United States left New York on May 22d to study the question abroad. In London the committee will join five other members of the commission already there, Melville Ingalls being the chairman. The members of the committee are the same men who visited Chicago recently, with the addition of William J. Clark, foreign manager of the General Electric Company; F. J. McNulty, president of the International Brotherhood of Electrical Workers, and several others. They will make a thorough investigation of municipal ownership of gas, water, light and traction systems as operated in London and other towns in the United Kingdom.

A peculiar lone thunderbolt visited Chicago on May 23d. At noon a terrific flash of lightning followed by a violent clap of thunder startled everybody in the downtown district. The lightning seemed to be striking at once in a dozen different places. The occupants of a score of the large office buildings were sure their particular buildings had been struck. Several persons were more or less injured in Chicago, while just outside the city limits three persons were killed. At the stockyards and several other places the lightning did some damage to telephone instruments and telegraph lines. The flash lasted but an instant, but in this time electricity seemed to be present everywhere. Prof. Cox, weather forecaster in the Federal Building, said he had never experienced like conditions; there were few clouds in the skies.

TRADE NEWS.

It is said in Cleveland that the National Carbon Company has purchased the property of the United States Carbon Company.

The general offices of H. M. Byllesby & Co., engineers, were removed on May 21st to the American Trust Building, corner Clark and Monroe streets, Chicago. Telephone, central 4182-4183.

San Francisco representatives of the Gould Storage Battery Company have found temporary offices at 1701 Geary Street. The Crossley Building, in which they had their offices, was destroyed by the fire.

W. R. Lea, O. C. Meyer and E. R. Lea of Chicago have incorporated as the National American Telephone Company of Chicago. The capital is $1,000 and the object is to manufacture telephones, etc.

Trade of the United States with Africa in the fiscal year 1905 aggregated about $30,000,000, the smallest total since 1900. The commerce of the United States with that continent reached its highest level in 1903, when the total was $51,000,000.

W. N. Matthews & Brother of 219 North Second Street, St. Louis, offer to buy outright, manufacture and sell on a royalty basis, or furnish cash to procure patents for an interest in them, on newly invented devices in the telephone, electric-light or electric-railway field.

The Dale Company of New York and Chicago does not expect to make an exhibit at the Atlantic City convention, but there will be present a number of prominent officials of the company, including President John H. Dale, Manager H. G. Salt, Western Salesman R. C. Heather, Eastern Salesman H. S. Rainsford and Electrical Engineer W. S. Gibson.

The Stanley-G. I. Electric Manufacturing Company's San Francisco office, which occupied temporary quarters in the Blake Block, Oakland, has been moved into rooms 403, 404 and 405 Atlas Building, 604 Mission Street, San Francisco. The company is among the first of the electrical manufacturing companies to resume offices in San Francisco since the fire.

The Gould Storage Battery Company of New York has recently organized a special telephone battery department to look after its rapidly increasing business in storage batteries for telephone service. A corps of experienced engineers has been engaged to devote their entire time to this application of the battery. Over three years ago a large telephone company placed the first order for a Gould storage battery as a trial installation, which was subsequently followed by orders for the similar equipment of six additional exchanges. The success of the storage battery in replacing gravity and other forms of primary cells in the modern telephone exchange is said to be due to three factors: First, the less space occupied; second, less care and attendance required, and third, considerable savings in the cost of maintenance.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until June 19th for furnishing western navy yards with the following material: Schedule 566, wattmeters, mica; schedule 567, electrical supplies; schedule 568, armature, batteries, etc. Proposal blanks can be obtained upon application to the bureau at Washington or to the navy pay office in San Francisco.

The new lamp invented by Dr. Hans Kusel, the Austrian chemist, has been given by him the name "Syrius" lamp. Experiments, it is asserted, have shown that the lamp can burn for 3,500 hours at a stretch. Another advantage is that the intensity of the light of the new lamp always remains the same, the lamp bulbs never becoming blackened. The new lamp, it is said, will be put on the market next autumn.

The Wagner Electric Manufacturing Company of St. Louis extends to all members and visitors to the National Electric Light Association convention at Atlantic City an invitation to visit its booth in the west aisle of Young's Pier. A number of pieces of apparatus manufactured by this company will be on exhibition there in operating condition. Central-station men and others interested will be glad to hear that an opportunity will be afforded them to examine a single-phase elevator equipment, together with controller.

Sealed proposals are being invited until June 15th for furnishing and installing fixtures and installing wattmeters; transformers, making service connections, furnishing transformers and wattmeters for the electric lighting of two double barrack buildings, one field officers' quarters, one double captains' quarters and one eight-set bachelor officers' quarters at Fort Wright, Wash. Plans and specifications will be furnished on application to Capt. E. W. Shuttleworth, Fort Wright, Wash., or the quartermaster's offices in Portland, Ore., Seattle, Wash., and St. Paul, Minn.

It is probable that many odd electrical coincidences will come to light as progress is made in reconstructing the city of San Francisco. As has been mentioned in the Western Electrician, the warehouse of the San Francisco office of the General Electric Company was completely destroyed by the earthquake and fire, the apparatus burned including a stock of the company's heating devices. Recently, in cleaning up the ruins, the workmen found a flatiron, with its wooden parts burned away. On testing it was found that the electrical element was still as good as new. This iron has been advertised as indestructible, and the statement will probably never be better proven than in the present instance.

Announcement of the incorporation of the engineering firm of W. S. Barstow & Co., with offices at 56 Pine Street, New York city, and Failing Building, Portland, Ore., is looked upon in electrical circles as a natural outcome of the great development in transmission and lighting on the Pacific Coast. Mr. Barstow, who has in recent years been closely identified with this work, has now secured the co-operation in the new company of J. B. Taylor, late with Westinghouse, Church, Kerr & Co., and R. L. Donald, late with the Southern Pacific Railroad. They will undertake the complete designing and construction of electric-lighting, railway and power plants and distributing systems, the designing and construction of industrial plants, supervision and management of electrical properties, and special reports and examinations on operation, improvement and extension of existing installations. It is said that the company has already booked orders for seven important installations running into the millions of dollars. Mr. Barstow, who was at one time prominent in the electric-lighting field, and manager of the great Edison system in Brooklyn, is at present the president of the New York Electrical Society.

BUSINESS.

A small pocket mirror, showing a design of the International meter on the reverse side, is an attractive article distributed by the International Electric Meter Company of Chicago. The mirror will be sent to anyone on request.

Smiley & Gleeson of St. Louis, the well-known electrical manufacturers' agents, who confine themselves strictly to handling electrical specialties, report a most excellent business. T. P. Gleeson will be in attendance at the Atlantic City convention of the National Electric Light Association next week.

The Mathews-Scott Electrical Company of Kansas City, Mo., is just completing a contract with the United States government for wiring and installing fixtures in about 150 officers' quarters and other buildings at Fort Riley, Kan. In this work the company used 5,600 Pass & Seymour sockets. In writing to Pass & Seymour the Mathews-Scott company made this complimentary statement: "While we have always appreciated the time saved in wiring your sockets, we find that we were lacking in our appreciation until we had occasion to install 5,600 of them on one contract, where time enters so materially into our profits."

The American Electrical Supply Company has recently moved into larger quarters at 211-213 Lake Street, Chicago. The rapid increase in business of this comparatively young supply house has necessitated this action, and with three times as much space as formerly it is now in position to give all orders the best attention.

A large cyanide gold mill is reported sold by Fairbanks, Morse & Co. of Chicago, the entire plant to be operated by Fairbanks-Morse direct-current dynamos and motors, driven by water-power. The mill will be near Boulder, Colo., where a 240-foot head of water is available, and will contain many features of novelty and interest. It will be a modern and complete plant in every way.

The Lindsley Bros. Company, the well-known producer of cedar poles and ties at Spokane, Wash., says that it is devoting all of its energies to the western cedar-pole business. The company is excellently equipped to handle western cedar poles and to make prompt delivery in any quantity in sizes from 30 feet, seven-inch top, and up. The company is especially fortunate in having a complete stock of the longer lengths.

The Canadian Westinghouse Company, Ltd., reports a large business in steam turbo-generator equipments. The Northern Electric and Manufacturing Company of Montreal duplicated an order recently for a 300-kilowatt Westinghouse-Parsons turbo-generator unit, to be installed in its power house alongside of one of the same capacity now in service. The generator is a 220-volt three-phase 7,200-alternation machine, operating at 3,600 revolutions per minute, and will be of the latest enclosed type, while the turbine will operate at 150 pounds steam pressure with 100 degrees superheat. The present turbine is operating part of the year condensing and through the winter non-condensing, the exhaust steam being used during the winter for heating purposes.

The Dickinson Manufacturing Company of Springfield, Mass., successor to the Dickinson Hard Rubber Company, established in 1875, three years ago discontinued the manufacture of hard-rubber goods and now uses a composition substance which it asserts will answer all purposes for electrical goods and costs only about 40 per cent. as much as hard rubber. The exception is made, however, that it will not stand heat, salt water or acids. The company also manufactures to order full lines of push-buttons, switch and socket key receivers and caps, shell and tail pieces, bushings, switch bases, etc. It is at present filling orders for some of the largest electrical concerns, and will have a representative at the Atlantic City convention of the National Electric Light Association.

The instrument department of the Wagner Electric Manufacturing Company of St. Louis, Mo., will be glad to have switchboard builders and contractors and central-station men call at its booth, west aisle of Young's Pier, during the convention of the National Electric Light Association, and examine the line of switchboard and testing instruments made by the company. Switchboard builders and others up in this line will be surprised to note the extent and completeness of this line of instruments. Two instruments of particular interest to central-station managers will be the new combination voltage and frequency indicator and the new lamp-testing volt-wattmeter. This latter instrument is used with great success by the complaint departments and the new business departments of central stations.

The Crocker-Wheeler Company of Ampere, N. J., recently shipped to San Francisco a carload of form L motors ranging from one-quarter to three horsepower, to be distributed from the San Francisco temporary office at 2611 Broadway. The company has also obtained important orders from the city of Natchitoches, Natchitoches Parish, La. (105-kilowatt alternating-current motor), Seton Leather Company of Newark, N. J. (90-horsepower direct current motor), Independent Brick Company of Trenton, N. J. (one 80-kilowatt generator, four direct-current motors). A new line of Crocker-Wheeler engine-type generators has recently been put on the market, the machines being size 83D and rated at 75 kilowatts. The company reports several orders already for these machines.

The Dale Company of New York and Chicago manufactures a number of specialties which are deserving of mention. One of them is the Connectome, which permits of a portable lamp, fan or curling iron being connected to the wall or outlet box, the Connectome becoming part of the fixture when installed. It does away with the necessity of splicing, soldering and taping wires. Another device is a current tap made for series or parallel connection and enabling the user to take two lights from one socket or one light and a fan motor, etc. The Dale wireless cluster is simple and neat in design, and is fitted with a bushing to admit of a cord for a pendent switch. The cluster is also made in pendant form. This company is also making a fixture to take care of the G. E. M. high-efficiency lamp of 100 candlepower, to be used in conjunction with a Holophane reflector.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 22, 1906

820,949. Door-operating Mechanism. Chester A. Bell, Forest Hills, Mass. Application filed October 18, 1905.

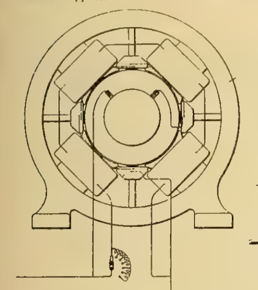
An electric motor controlled by an electromagnetic device under the control of an operator moves the door back and forth by means of gears.

820,977. Electric Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed June 10, 1905.

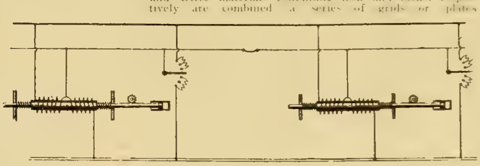
A receiving device comprises a polarized relay connected to the line and ground, respectively. A normally closed local circuit embodying an electromagnet is provided with a resistance, a shunt around the resistance and means at the relay to open and close the shunt.

820,978. Electrical Measuring Instrument. Wesley E. Laird, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed October 12, 1904.

A yielding abutment is provided with two parallel springs supported at one end and connected to each other at their free end. A wire adapted to be traversed by electric current is stretched between the abutment and another support. A compensating wire approximately parallel to the first wire connects the abutment to a fixed support.



NO. 821,064.—DYNAMO WITH AUXILIARY MAGNET COILS.



NO. 821,287—MULTIPLE-UNIT CONTROL SYSTEM.

820,996. Electrically Operated Fountain. Arthur D. Southam, New York, N. Y. Application filed May 27, 1905.

Located in a casing is an electric motor and a pump adapted to be operated by the motor. Means connect the outlet of the pump to the nozzle. A pair of electrical contacts are carried by a plate, co-operating with a pair of contacts carried by the bottom of the casing and adapted to rest on the contacts carried by the supporting plate. One of the sets of contacts is sharpened and of very small diameter.

820,997. Armature Winding. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 10, 1904.

An armature winding is described as having a number of coils per slot and a coil width equal to the distance between adjacent slots multiplied by a whole number plus a fraction having as its denominator the number of coils per slot.

821,009. Automatic Motor Reverser. George H. Whittingham, New York, N. Y., assignor to the Automatic Switch Company. Application filed December 9, 1902. Renewed October 21, 1905.

Combined with the armature and field windings of a motor are means for preventing a reversal of current in one of the windings, except when the current in the other winding is less than a determined value.

821,017. Composition of Matter for Electric Conductors. Walter G. Clark, New York, N. Y., assignor to the Parker-Clark Electric Company, Jersey City, N. J. Application filed January 24, 1906.

A composition for electrical conductors consists of a dense non-porous and non-crystalline combination of silicon and carbon.

821,020. Magnetic Clutch. Henry H. Cutler, Milwaukee, Wis., assignor to the Arnold Magnetic Clutch Company, Milwaukee, Wis. Application filed January 18, 1902.

The combination consists of clutch members, of a second member and means to attract either of the clutch members and the second member together. Further means are actuated when one of the members is first attracted to release by impact the other member.

821,021. Electrical Step-by-step Controller. Henry H. Cutler, Milwaukee, Wis. Application filed May 10, 1902.

In an electric controller for starting motors are a resistance, magnetically operated means for cutting out the resistance by successive movements in one direction and means for varying the extent of each movement.

821,022. Magnetic Clutch. Henry H. Cutler, Milwaukee, Wis. Application filed August 5, 1903.

Associated with a driving and a driven member are a main winding for exerting a force to connect the driven member with the driving member, a supplemental winding and means operated by the force exerted by the supplemental winding when it is energized to entirely separate the members. The windings are adapted to be energized one at a time.

821,023. Phase Splitter. Henry H. Cutler, Milwaukee, Wis. Application filed January 7, 1905.

Combined with a number of resistances of different character arranged in parallel paths are several independently actuated switches for controlling the resistances, each switch being adapted to control all of the resistances.

821,024. Magnetic Clutch. George [illegible], Chicago, Ill., assignor to the [illegible] Clutch Company, Milwaukee, [illegible]. Application filed April 17, 1903.

A magnet member having [illegible] produce magnetic fields [illegible] field moving in an opposite direction [illegible] other, whereby, when [illegible] destroys the residual magnetism [illegible]

821,028. Removable Anvil Contact and Bridge Support for Electric Vibrator. Willard L. [illegible], Braintree, Mass. Application filed March [illegible], 1905.

Patentable features in this device are [illegible] brator, a vibrating contact breaker, [illegible] adjustable thereon and intermittently [illegible] contact breaker and means permitting [illegible] tact to be instantly removed or placed [illegible] disturbing the adjustment of the contact.

821,029. Electric Binding Post. Willard L. Doe, Braintree, Mass. Application filed August 21, 1905.

A hollow post provided with a diagonal slot in its side has a spring-actuated clamp sliding in it transversely of the slot and occupying a [illegible] position when opposite the mouth of the slot and a clamping position when adjacent the lower, inner end of the slot.

821,032. Storage Battery. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed September 28, 1904.

In a storage battery employing an alkaline electrolyte and active materials containing iron and nickel respectively are combined a series of grids or plates carrying pockets for the iron composition and a series of grids or plates carrying pockets for the nickel composition, the latter grids are placed in pairs between the individual grids of the former series, and the volume of active material carried by each grid of the battery is substantially the same.

821,042. Treating Contact Substances Used for Catalytic Action. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to C. L. Hamilton and W. F. Hamilton. Application filed February 24, 1903. Renewed November 2, 1903.

The process of reimparting to platinum contacts the catalytic power they formerly possessed consists in making such contacts part of the anode of an electrolytic apparatus at the same time at which a current of electricity is passed through the apparatus.

821,043. Telegraphic Transmitting Device. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed May 27, 1905.

Details are described.

821,044. Induction Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 27, 1904.

In an alternating-current motor are a primary member having a winding adapted to produce a number of magnetic poles and means for changing from one number of poles to another. The secondary member comprises a slotted core, conducting bars in the core slots, high-resistance end rings connected to all of the bars and low-resistance end rings connected to the high-resistance end rings at a number of points corresponding to a definite number of magnetic poles.

821,056. Incandescent Electric Lamp. Herschel C. Parker, New York, N. Y., assignor to the Parker-Clark Electric Company, Jersey City, N. J. Application filed April 21, 1904.

An incandescent electric lamp comprises a transparent tube, a pencil of mingled refractory conducting and non-conducting materials held longitudinally in the tube and terminals of larger cross section than the pencil, the terminals filling the tube ends and forming a support for the pencil so as to make a gap between the pencil and the sides of the tube.

821,061. Automatic Electric Metal-working Machine. Adolph F. Rietzel and George E. Barstow, Lynn, Mass., assignors to the Thomson Electric Welding Company, Lynn, Mass. Application filed December 5, 1904.

An electric welding and upsetting apparatus is described in which the material to be worked is heated electrically.

821,062. Wire and Insulator Holder. Arthur J. Seguin and Ernest P. Gingras, Ottawa, Can. Application filed March 6, 1905.

A wire and insulator holder having one end bent to encircle an insulator has the other end terminating in a resilient open spiral, the resilient spiral being concentric with the insulator holder.

821,064. Dynamo-electric Machine. Ferdinand Sieber, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed May 1, 1905.

Combined with an armature is a field magnet having a set of main coils and a set of auxiliary coils that alter-[illegible]

[illegible]

821,0[illegible]. [illegible] Application filed May [illegible], 19[illegible].

[illegible]

821,0[illegible]. [illegible] 16, 190[illegible].

[illegible]

821,077. System and Apparatus for Operating [illegible] the Switching [illegible], assignor to the General [illegible] Company of New York. Application filed September 30, 1902.

Apparatus for controlling [illegible] vidually.

821,098. Automatic Fire Alarm. John W. Gr[illegible], Pawtucket, R. I. Application filed April 10, 1905.

Claims of the patent [illegible] one face a longitudinal [illegible] face longitudinal and transverse [illegible]. Circuit wires are [illegible] tubular section [illegible] first mentioned channel [illegible] held by the binding [illegible] tubular section, a movable contact [illegible] fusible means normally holding the contacts separated.

821,126. Transmission Tower. Daniel R. Scholes, Chicago, Ill., assignor to the Aermotor Company, Chicago, Ill. Application filed February 21, 1906.

Plans for a steel insulator tower for a transmission line are set forth in the patent.

821,129. Speed Controller for Sewing Machines. Henry R. Schweinler, Brooklyn, N. Y., assignor to W. T. Macon, administrator of Jacob H. Macon, Jr., deceased, Tampa, Fla., and Frank M. Simonton. Application filed May 4, 1905.

A device for regulating the speed of a motor-operated sewing machine are described.

821,140. Self-winding Electric Clock. Bernhard Tropp, New York, N. Y., assignor to William Henry Laird, New York, N. Y. Application filed July 16, 1904.

In a self-winding mechanism for clocks are an electric motor and two circuit-closers, one consisting of a spring and a stud on the hour-wheel of the clock, and the other consisting of a spring engaging the periphery of the notched spring barrel.

821,151. Synchronizer. Melzar L. Ballard, Durango, Colo. Application filed August 10, 1905.

Combined with a coil are a shaft slidable therethrough, a core upon the shaft within the coil, a stationary nut, screw threads upon the end engaged with the nut, a gear keyed to rotate with the shaft but slidable longitudinally thereon, an operating shaft and a gear upon the latter in mesh with the gear upon the first-mentioned shaft.

821,180. Electric Massage and Vibrator Machine. Sampson W. Moon, Chicago, Ill., assignor to the Horto Electric Company, Chicago, Ill. Application filed May 18, 1905.

In a massaging machine is a casing having a handle and provided with an electromagnet arranged in the casing for operating the vibrating parts.

821,247. Telephone Support. William B. Lehmkuhl, Cambridge, Mass., assignor of one-half to Samuel B. Shapleigh, Boston, Mass. Application filed June 9, 1905.

A support for holding a subscriber's instrument is described.

821,249. Dynamo-electric Machine. Robert Lundell, New York, N. Y. Application filed May 20, 1905.

A laminated pole core having a pair of supporting end plates is held together by a rivet bar passing through the laminations and the end plates, the rivet-bar being provided with shoulders against which the end plates may be riveted so that the distance between the end plates may be accurate while the laminations may be comparatively loose.

821,251. Switchboard. Albert T. Newman, Greeley, Kan. Application filed June 14, 1904.

On a pivoted contact-lever are contact points arranged in pairs with wires leading therefrom. Contact fingers are arranged also in pairs with contact ribs and a roller for carrying them. An arm projecting from the roller and a spring connected to the roller, and a spring keeper for holding the lever, complete the details.

821,252. Railway Signal. James P. Norwood, Chicago, Ill. Application filed June 23, 1905.

The chief features of originality in the device are electrically operated registers located in each train and in certain stations along the road, together with devices for their automatic operation.

821,264. Process of Treating Wood for the Extraction of Turpentine. Frederick T. Snyder, Oak Park, Ill. Application filed December 1, 1905.

Electrically developing heat in the interior of the furnace is sufficient to produce destructive distillation of the wood.

821,287. Multiple-unit Control System. Henry M. Harding, New York, N. Y., and Charles M. Clark, Summit, N. J. Application filed January 6, 1906.

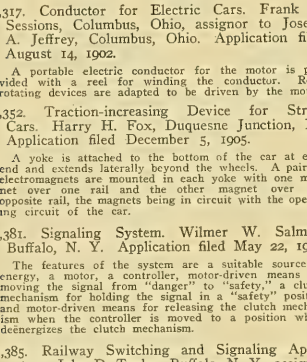
In a multiple-unit control system are magnetic devices on the several cars having opposed or differential windings with means for impressing a continuous current in series through the windings. A pilot-wire extends throughout the train and is connected to the windings. Means vary the potential of the pilot wire whereby the relative effect of the opposed windings of each magnetic device is changed. (See cut on preceding page.)

821,292. Electrical Measuring Instrument. Adrian H. Hoyt, Penacook, N. H., assignor to the Whitney Electrical Instrument Company. Application filed June 7, 1904.

Combined with a current-carrying wire are means for multiplying the expansion of the wire, comprising a movable element, an arm carried by the movable element having two extensions, a pivoted shaft and a connection between the two extensions and the pivoted shaft.

821,294. Station Indicator. Charles E. Johnson, Indianapolis, Ind. Application filed January 30, 1905.

An electrically operated device adaptable for use on trolley cars for indicating stations is described.



NO. 821,416.—AUTOMATIC VENTILATING APPARATUS.

821,317. Conductor for Electric Cars. Frank L. Sessions, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. Application filed August 14, 1902.

A portable electric conductor for the motor is provided with a reel for winding the conductor. Reel-rotating devices are adapted to be driven by the motor.

821,352. Traction-increasing Device for Street Cars. Harry H. Fox, Duquesne Junction, Pa. Application filed December 5, 1905.

A yoke is attached to the bottom of the car at each end and extends laterally beyond the wheels. A pair of electromagnets are mounted in each yoke with one magnet over one rail and the other magnet over the opposite rail, the magnets being in circuit with the operating circuit of the car.

821,381. Signaling System. Wilmer W. Salmon, Buffalo, N. Y. Application filed May 22, 1905.

The features of the system are a suitable source of energy, a motor, a controller, motor-driven means for moving the signal from "danger" to "safety," a clutch mechanism for holding the signal in a "safety" position and motor-driven means for releasing the clutch mechanism when the controller is moved to a position which deenergizes the clutch mechanism.

821,385. Railway Switching and Signaling Apparatus. John D. Taylor, Buffalo, N. Y., assignor to the General Railway Signal Company, Buffalo, N. Y. Application filed February 10, 1903.

In combination with switch and signal apparatus are operating and indication circuits, polarized relays in the indication circuits and controllers normally connecting the indication wires with their respective relays, a conductor being common to all operating and indication circuits.

821,386. Apparatus for Operating and Controlling Railway Switches and Signals. John D. Taylor, Buffalo, N. Y., assignor to the General Railway Signal Company, Buffalo, N. Y. Application filed June 20, 1903.

In combination with a mechanical interlocker are a source of energy, operating and indication circuits, a circuit-controller, a motor and an electric switch. An operating lever manually actuated in its initial movement stores up energy to produce the final movement and to move an element of the mechanical interlocker. Electromagnetically-operated means cause the stored-up energy to cause the final movement of the lever and to move an element of the mechanical interlocker.

821,400. Ball-bearing Electric Trolley Wheel. Robert S. Boyle, Fort Branch, and Walter G. Cleveland, Cynthiana, Ind. Application filed June 16, 1904.

Mechanical features are described.

821,401. Insulator. Taylor Carter, Frankfort, Ky. Application filed May 23, 1905.

Combined with a body member provided with a slot for engaging the wire are another slot for engaging the key and a key removably engaging the last-named slot, the ends of the key being recessed to form tongues adapted to be bent on each side of the line wire in order to hold the key in position.

821,416. Automatic Ventilating Apparatus. James H. Hummel, Mount Vernon, N. Y. Application filed April 6, 1905.

An exhaust fan driven by an electric motor is provided with a box having doors adapted to swing in the direction of the air-current created by the fan. Means normally tend to hold the doors in a closed position, an electrically controlled latch normally locking the doors in the closed position. A number of thermostats and a circuit including the thermostats, the motor and the latch complete the apparatus. (See cut.)

821,418. Automatically Regulated Liquid Rheostat Operated by Means of Compressed Air. Coloman de Kandó, Budapest, Austria-Hungary, assignor to the Railway Electric Power Company. Application filed November 27, 1903.

A liquid rheostat combined with a supply of compressed air, a hand-operated valve for controlling the connection between the supply and the rheostat, a throttle valve located in the connection and a supplemental device operated by compressed air to control the action of the throttle valve are the features of the system.

821,431. Time-limit Dashpot. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 25, 1903.

Combined with an automatic circuit-breaker are a dash pot having a pivoted abutment therein, means for connecting the abutment with the tripping mechanism of the breaker and means for automatically disconnecting it after a definite time of movement.

821,435. Railway Switching and Signaling Apparatus. Wilmer W. Salmon, Buffalo, N. Y., assignor to the General Railway Signal Company, Buffalo, N. Y. Application filed March 28, 1904.

In a railway switching apparatus are a source of energy, a switch motor, mechanism for moving the rail switch, a controller, an indicating device and an operating and an indicating circuit. Mechanism is provided for storing up energy during the period of rotation of the switch motor and means for calling the energy into action when the rail switch is home and locked. A generator produces an indicating current, and mechanism applies the stored-up energy to actuate the generator and thereby cause indication through the indicating device.

821,459. Signaling Device. Neal A. Butler, Hampton, Va., assignor of one-half to W. H. Boyenton, Hampton, Va. Application filed August 4, 1905.

Associated with a thermometer are a plunger therein, a lever connected with the plunger and having a contact point, a slotted plate and a sleeve adjustably secured thereto, a contact screw in the sleeve and an electric circuit and signaling device between the two contact points.

821,470. Electric Lamp. John T. H. Dempster, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 19, 1903.

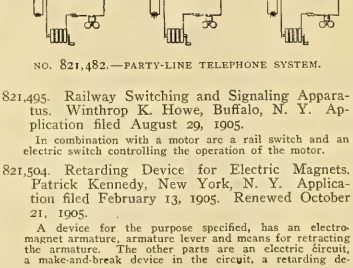
An exhausted envelop contains a filament and several anchoring devices for the filament located at points along the filament, each anchoring device consisting of a support carrying a bushing loosely engaging the filament.

821,475. Automatic Electrical Balance. Wincenty Dworznski, Warsaw, Russia. Application filed July 11, 1904.

Electrical contacts close circuits which move the weight back and forth along the balance arm until a balance is arrived at.

821,482. Telephone System. James H. Gorden, Cooper, Texas, assignor of one-half to James Patteson, Cooper, Texas. Application filed June 10, 1903.

In a party-line telephone system are a line wire connecting the stations in series and a ground or common return to which the stations may be connected in multiple arc. Contacts are under the control of the receiver-hook which has means serving to limit its movement to form a connection from the line wire on one side of the station through the station to the common return and to cut out the connection with the line wire on the opposite side. On extended movement a similar connection is formed with the opposite line wire to cut out the previous connection. A receiver-hook locking magnet is in series with the line wire and a manually-operable catch permits extended movement of the receiver-hook. (See cut.)



NO. 821,482.—PARTY-LINE TELEPHONE SYSTEM.

821,495. Railway Switching and Signaling Apparatus. Winthrop K. Howe, Buffalo, N. Y. Application filed August 29, 1905.

In combination with a motor are a rail switch and an electric switch controlling the operation of the motor.

821,504. Retarding Device for Electric Magnets. Patrick Kennedy, New York, N. Y. Application filed February 13, 1905. Renewed October 21, 1905.

A device for the purpose specified, has an electromagnet armature, armature lever and means for retracting the armature. The other parts are an electric circuit, a make-and-break device in the circuit, a retarding device for the armature and regulable, automatic means for actuating the make-and-break device, the means comprising a rotating carrier provided with an adjustable detent which acts on the make-and-break device.

821,506. Electric Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed August 26, 1905.

In a system of telegraphy are two sources of current, one of higher electromotive force than the other, the sources oppositely connected to each other, and means to shunt the source of higher electromotive force, the shunt embracing a transmitting key and a resistance.

821,512. Trolley-wire Hanger. Adam J. Laverty, Athens, Ohio. Application filed April 21, 1905.

Details are described.

821,515. Railway Signal. John B. Lineback, Siloam Springs, Ark., assignor of one-half to Robert S. Morris, Siloam Springs, Ark. Application filed December 14, 1905.

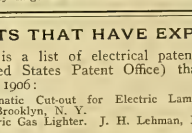
Electric circuits extend from each of the stations in opposite directions toward the next adjacent stations and arranged upon opposite sides of the track. Translating devices in the circuits are arranged at intervals along the track and at the next adjacent stations. Electric generators at the stations supply electric current to the circuits and switches for opening and closing the circuits.

821,516. Process of Recovering Copper and Other Values from Certain Ores. Thomas J. Lovett, Chicago, Ill. Application filed January 16, 1906.

A dry and wet process of concentrating and collecting the non-magnetic sulphide contained values in low-grade chalcopyrite ores carrying a material percentage of magnetic iron, consists of the steps of coarse-crushing the ore in a dry state to reduce the sulphide and iron and allow of the dislodgement of adhering sulphide powder and magnetically separating from the dry, reduced mass the disunited iron particles.

821,521. Method of Operating a Multiphase Transformer Having the Windings for One Phase Inoperative. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 22, 1904.

The method of operating a three-phase shell-type transformer consists in delta-conecting the windings for two of the phases into a three-phase system and short-circuiting part or all of the windings of the other phases. (See cut.)



NO. 821,521.—OPERATION OF MULTIPHASE TRANSFORMER.

821,581. Fire-alarm System. Benjamin F. Beane and Roy P. Bennett, New Paris, Ohio. Application filed July 10, 1905.

Combined with a bell are a rotary clapper, a winding mechanism, a trip for holding the mechanism in inoperative condition, an electromagnet, an armature for actuating the trip for releasing the winding mechanism, an electric generator, an annunciator and circuit-closing devices.

821,586. Circuit-breaker. Edgar W. Gough, Great Barrington, Mass., assignor to the Stanley Instrument Company, Great Barrington, Mass. Application filed December 30, 1904.

An electromagnet in the switch mechanism has a polarized armature and means controlled by the electromagnet and armature for opening the circuit when the current is abnormally large or is reversed in direction.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on May 28, 1906:

403,941. Automatic Cut-out for Electric Lamps. E. R. Knowles, Brooklyn, N. Y.
403,944. Electric Gas Lighter. J. H. Lehman, Philadelphia, Pa.
403,955. Porous Cup for Batteries. C. B. Noble, Cleveland, Ohio.
403,957. Secondary Battery. J. B. Price, Wollaston Heights, Mass.
403,969. Trolley for Electric Railways. T. Streat, Richmond, Va.
404,015. Electrical Switch for Elevators. W. E. Nickerson, Cambridge, Mass.
404,067. Electric Motor. W. S. Belding, Chicago, Ill.
404,069. Clamp for Electric Motors. W. S. Belding, Chicago, Ill.
404,112. Automatic Circuit Interrupter for Electric Circuits. A. L. Reinmann and P. Lange, Pittsburg, Pa.
404,114. Electric Converter Box. A. Schmid, Allegheny, Pa.
404,118. Apparatus for Treating Filaments. F. S. Smith, Pittsburg, Pa.
404,120. Regulating Self-exciting Alternate-current Electric Generators. W. Stanley, Jr., Great Barrington, Mass.
404,139. System of Electrical Distribution. G. Westinghouse, Jr., Pittsburg, Pa.
404,149. Trolley for Electrical Railways. D. A. Ainslie, Richmond, Va.
404,165. Telegraph. J. Burry, New York, N. Y.
404,168. Secondary Battery. H. F. De B. Cameron and T. Harris, Detroit, Mich.
404,170. Electrical Signaling Apparatus. J. P. Coleman, Swissvale, Pa.
404,221. Electrical Switch for Elevators. W. E. Nickerson, Cambridge, Mass.
404,232. Pole for Electric Wires. U. Snead, Louisville, Ky.
404,244. Arc Lamp. La Motte C. Atwood, St. Louis, Mo.
404,245. Electric Arc Lamp. La Motte C. Atwood, St. Louis, Mo.
404,306. Process of Electric Riveting. E. E. Ries, Baltimore, Md.
404,310. Electric Meter. R. P. Sellon, Lambeth, County of Surrey, England.
404,324. Electrodynamic Motor. C. J. Vandepoele, Lynn, Mass.
404,351. Electric Arc Lamp. J. R. Fox, Fort Wayne, Ind.
404,361. Electrical Apparatus for Controlling Elevators. R. F. McFeely, Pittsburg, Pa.

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EVERY SATURDAY

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An 800-horsepower Motor for the Operation of a Pulp Mill.

By Orrin E. Dunlap.

The Niagara River Manufacturing Company has recently started its new pulp mill on the lands of the Niagara Falls Power Company in Niagara Falls, N. Y. The plant is attracting some little attention, because it is operated wholly by electricity. The majority of pulp mills are operated by hydraulic power, and in many, if not all, of such mills the grade of pulp varies when the grinder pockets are taken off or put on. In the case of this electrically operated mill, however, the claim is made that the use of electric power to drive the grinders produces a very even grade of pulp, there being no variation of speed under the conditions referred to.

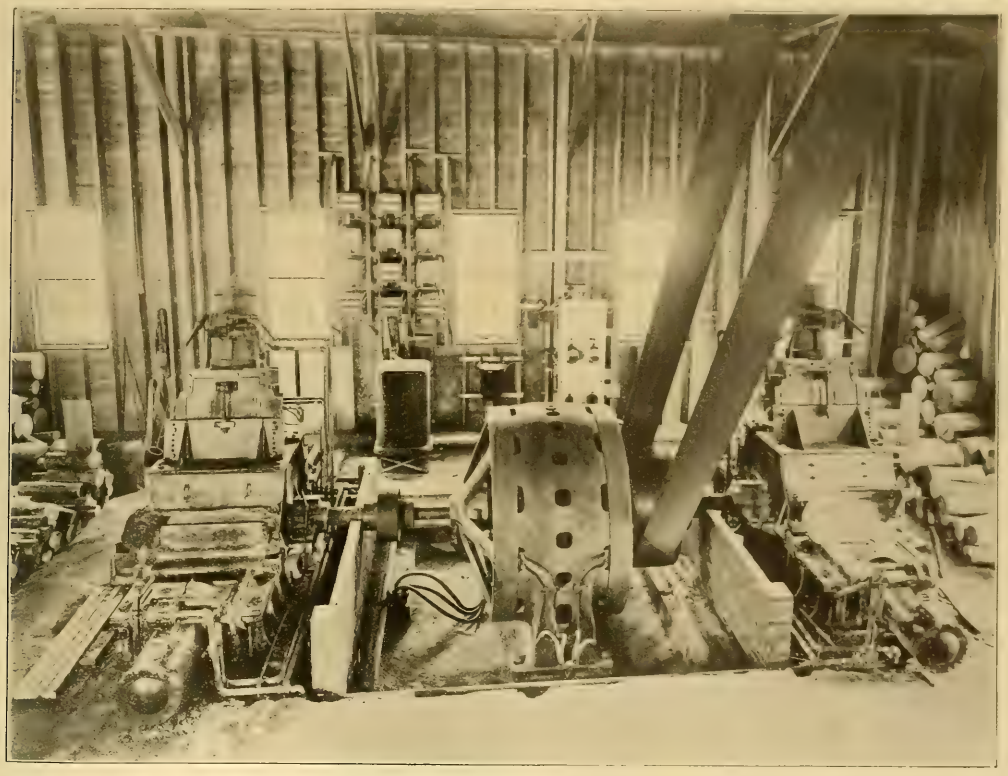
An electric motor of 800-horsepower capacity, and operating at 250 revolutions a minute, drives the machinery. It is of Westinghouse make, and is set in a shallow pit between two grinders, as shown in the accompanying illustration, each of six tons output capacity. These grinders have 14-inch cylinders, take a stone 30 inches wide and grind 28-inch wood. The motor is direct connected to the grinders, rigid couplings being used and spacers one-fourth inch in thickness being placed between the faces of each coupling, so as to provide clearance should it become necessary to shut down either grinder.

Electric power is supplied by the Niagara Falls Power Company from a two-phase 2,200-volt circuit, and the current is applied direct to the motor at this voltage. In starting, the full voltage is applied at once to the primary windings through an oil circuit-breaker, a heavy rush of starting current being prevented by the introduction of resistance in the secondary circuit of the motor. The resistance is connected through brushes and [illegible] upon the shaft midway of the [illegible] circuit passing from the brushes to a [illegible] roller, and thence to a grid [illegible] upon the wall of the building.

When the current is thrown on the motor starts slowly, three minutes being allowed for full speed acceleration, and the starting current under full load at no time exceeds normal full load running current. All external resistance is short-circuited when the motor attains full speed. A net full load efficiency of over 94 per cent is obtained.

In addition to driving two grinders, the main line shaft of the mill is operated from a pulley placed upon the motor shaft, directly inside the coupling. It is from this line shaft that all pumps, screens, wet machines, etc., are operated. The company has contracted for a large block of power, and the output capacity of the mill will be increased as demand makes it necessary. It is the intention to abandon the belt drive to the line shaft and substitute motor drives upon most of the apparatus in the mill, leaving the big motor for the operation of the grinders.

Charles B. Hyde is president and manager of the Niagara River Manufacturing Company, and associated with him are Col. Charles B. Gaskill and other gentlemen well versed in pulp and paper making. They have located their mill with a view of receiving raw material, as well as shipping the finished product, as the plant is right on the river front, between the docks at Iroquois and Sugar streets, where they have about 10 acres of storage space in a pond to be created by throwing a boom from dock to dock. Their wood can be received by water or rail, and their product shipped in the same manner.



AN 800-HORSEPOWER MOTOR FOR THE OPERATION OF A PULP MILL.

Distribution System of Great Northern Power Company in Duluth, Minn.

[illegible] carried over to Superior, Wis., via Rice's and Connor's points, and a third will go to West Duluth over Railroad Alley and various streets to supply current to the Zenith Furnace Company and a carbolite works.

The policy of the power company has undergone a complete change from the original plans, and there seems to be a disposition to substitute a less expensive and less substantial type of construction work than was contemplated six months ago. The present plans provide for the use of wood poles, conductors insulated with weatherproof cover and guard equipment where other lines are crossed. Parts of the routes selected are already congested with from one to four pole lines carrying light, power and signal wires. The local inspector has been able to suggest changes in these routes which will greatly diminish the danger of crosses due to falling wires, but the difficulties to be overcome in order to make many of these changes available are such as to increase the desirability of placing much of the system underground.

The maximum potential to be employed on the

distribution system will probably be about 13,000 volts for the present, to be doubled later on as the demand for current increases, at which time the company proposes to place its wires underground.

The route of the transmission line to carry 60,000 volts has been slightly changed near the sub-station at the foot of Fifteenth Avenue, West, and instead of passing down the bluff and into the sub-station on a private right-of-way a comparatively unfrequented street will be used for part of the distance.

Power-transmission Line and Third-rail System of the Long Island Railroad.

Transmission lines of the Long Island Railroad to be first equipped comprise the Atlantic Avenue division, between Flatbush terminal and Belmont Park, and the Rockaway Beach division between Woodhaven Junction and Rockaway Park. The equipment of this latter division has also been extended to enable electric operation via Far Rockaway to Valley Stream.

A study of the traffic conditions to be met by the electric equipment upon these divisions resulted in a preference for sub-station sites at Woodhaven Junction, East New York, Flatbush Avenue, Rockaway Junction and Hammel. These were ultimately selected as permanent sub-station locations, except that Grand Avenue, about one mile out from the terminal, was later on substituted for Flatbush Avenue.

Since the original installation described in this article was completed, a sixth sub-station has been located at Valley Stream, receiving its power from an extension of the overhead line by way of Springfield Junction.

Two portable sub-stations were also provided as the most economical method of supplying current for the very heavy periodic traffic to and from the Metropolitan race track south of Jamaica, and the new Belmont Park race track about five miles east of Jamaica. These loads occur for two hours each day, for periods of two weeks, twice a year. The portable sub-stations consist of 1,000-kilowatt rotary-converter outfits, complete with transformers and switchboard, each mounted in a heavy steel boxcar.

The topography of the system is such that Woodhaven Junction sub-station becomes a natural distributing center between the power house and the other sub-stations, and it was therefore decided to make it the objective point of a main power transmission trunk line which should bring directly to it the entire output of the power station for distribution among the sub-stations. The problem of line construction was therefore to build a trunk line from the main power station to Woodhaven Junction, with two branch transmission lines running along Atlantic Avenue between Grand Avenue and Rockaway Junction, with two subordinate branches from Rockaway Junction to the two race tracks, and a third subordinate branch running directly south from Woodhaven to Hammel sub-station across the Jamaica Bay trestle.

The trunk line as originally built carries five circuits from the power station to Woodhaven Junction sub-station, running in an 18-duct conduit line to Dutchkills Street, thence on a line of steel poles which follows the right-of-way of the main-line division to a point about due north of Glendale Junction, where it bends to the south across the fields for about a mile, until it strikes the Rockaway Beach division, which it follows to Woodhaven Junction. A branch line of three circuits runs westward from Woodhaven Junction to the East New York sub-station, two circuits running thence to Grand Avenue sub-station, all these being run in underground conduits. To the east of Woodhaven Junction there are two circuits run underground to Dunton, where the transmission is changed from underground to overhead, continuing easterly on steel poles to Rockaway Junction sub-station. The branch circuits from Rockaway Junction to the portable sub-station terminal buildings at Belmont Park and Springfield Junction are carried on wooden poles running along the main line and the Montauk division, respectively, to their destination. Southward from Woodhaven, two circuits follow the Rockaway Beach division across Jamaica Bay trestle to Hammel sub-station. These circuits are carried on a line of steel poles to the southern outskirts of Ozone Park, half a mile or more from the sub-station, and the remainder of the distance on wooden poles.

The general arrangement of the transmission circuits is shown in Fig. 1. It will be noted in this diagram that the incoming trunk-line circuits at Woodhaven Junction are distributed along a set of busbars called the "transfer bus" and divided into sections from which the outgoing transmission circuits lead in various directions. It is possible by manipulation of the bus junction switches to operate these circuits separately or together from outlying sub-stations all the way back to the power station. The same general arrangement is carried out in a smaller degree by similar transfer buses at East New York and Rockaway Junction.

The total mileage of conduit lines now in use is 9.69 and that of pole lines 26.19 miles.

Conduit Construction.

Between the power station and the railroad tracks the construction of the duct line involved no serious complications, except such obstructions as are frequently met with in city streets. The remainder of the line involved not only some blasting through a ledge of rock, but was also rendered especially difficult because much of it was situated below the level of the ground water, which, for a large part of the distance, was nearly at the surface, so that special provision for the drainage of the ducts and manholes was necessary.

This conduit line is constructed of single vitrified clay ducts 18 inches long, with square holes 3 13-16 inches inside measurement and walls three-quarters inch thick. They were designed especially for this construction, and the ducts are seven-sixteenths inch greater diameter than usual in order to facilitate the installation of the three-conductor high-tension cables, which are nearly three inches in diameter. A single duct was preferred to multiple ducts because of the thicker wall between ducts, which is better able to resist heat in case of a possible short-circuit. A square hole with rounded

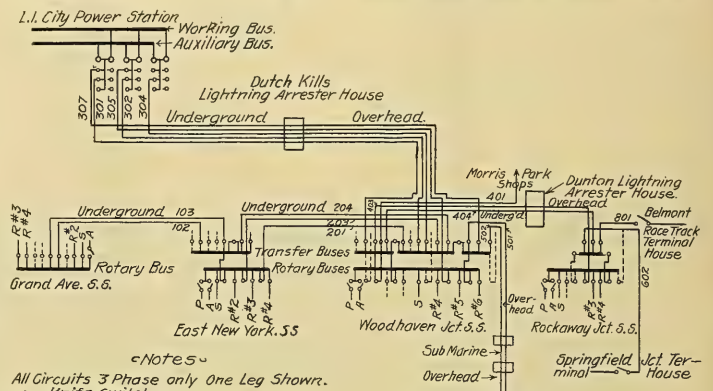


FIG. 1. DIAGRAM OF TRANSMISSION CIRCUITS ON LONG ISLAND RAILROAD.

FIG. 2. CONDUIT MANHOLES CLOSE TO TRACKS ON ATLANTIC DIVISION OF LONG ISLAND RAILROAD.

corners was preferred as affording space for dirt and pebbles to slide to one side instead of being dragged along underneath the cable and injuring the sheath, as would be the case if round ducts had been used. The ducts are laid in cement mortar in such a way as to break joints in all cases, and are surrounded on the top, bottom and sides by a covering of concrete four inches thick, composed of one part Portland cement, 2½ parts sand and five parts broken stone. The ducts are arranged three wide and six high.

Manholes for drawing in and splicing the cables are located 400 feet apart on straight work and a shorter distance on curves. The standard manhole for straight-line work is eight feet long, four feet wide and 6½ feet high, inside dimensions. The corners are cut off so that a horizontal section of the manhole resembles an elongated octagon. The side walls at the bottom are 12 inches thick and at the top six inches thick, reinforced with expanded metal. The manholes are built of concrete, having a composition the same as that surrounding the ducts. An opening at the top is 25 inches square and is closed by two covers, the inner one of which can be locked, clamped and packed gas tight.

The conduit system on Atlantic Avenue comprises two kinds of construction. The portion lying between Atkins Avenue and Dunton, a distance of 4.4 miles, is in general identical with the above described construction for the main transmission line. It is installed on the south side of the tracks near the edge of the right-of-way. On this part of the construction the soil is of a very light sandy nature, so that the system is sufficiently drained by providing openings at the bottom of the manholes. As shown in Fig. 2, this section of the conduit construction was very close to the railroad track; in fact, the track overhung it for a good part of the distance, so that it became necessary to support the railroad track (which was in continual use), on one edge of the excavation.

Atlantic Avenue improvement conduits are built of four-way vitrified clay duct 36 inches long with square holes 3⅜ inches on a side. These ducts are laid in cement mortar, the joints being first covered with cotton cloth saturated in Portland cement grout.

On the Subway portion of the improvement the manholes for the conduit lines consist of niches in the side walls five feet wide, 8½ feet in length and 15 feet high. On the other portions of the Atlantic Avenue improvement the manholes are built of concrete and are generally oval in form, seven feet long, five feet wide and 6½ feet high inside.

Underground Cables.

Underground high-tension cables are of the three-conductor type, each conductor having a cross section of 250,000 circular mils and being composed of 37 copper wires. Each conductor is covered with a wrapping of impregnated paper seven-thirty-seconds inch thick. The interstices between the insulated strands are then filled in with jute insulation and another layer of seven-thirty-second-inch paper insulation is wound over the entire group. The outside sheath is nine-sixty-fourths inch thick and is composed of lead with about 1½ per cent. of tin added. The completed cable is 2⅞ inches, outside diameter. Each length of the cable was tested at the factory by applying 30,000 volts between each pair of conductors and between each conductor and the sheath; and after the cable was installed in the ducts and jointed up ready for service it was again tested by applying between each pair of conductors 30,000 volts, and between each conductor and the sheath 27,000 volts for a period of 30 minutes.

At each end of every high-tension cable there is sweated on a spun-brass end-bell, which is filled with G. E. compound to properly seal the ends of the cable and prevent injurious static discharges. The end bell is about 7¾ inches in diameter and about seven inches high. The three conductors are brought out separately through a wooden head in the end-bell, after being wrapped with varnished cambric tape, and are surrounded by micanite tubes.

At the drawbridge in the Jamaica Bay trestle the cables are of the armored submarine type, and the conductors are insulated with seven-thirty-second inch of rubber around each strand, with another seven-thirty-second inch of rubber around the group

of three. This insulation is composed of 30 per cent. pure Para rubber and is covered with a sheathing nine-sixty-fourths inch thick and composed of lead with about 1½ per cent. of tin added and over this is an armor of No. 4 B. & S. galvanized iron wires laid spirally on the outside of the lead covering, with a thin layer of jute between the lead and the armor. There are two such cables at each drawbridge.

The high-tension cables are located in the lower portion of the conduit system wherever possible, with the idea of separating them from any other cables for different purposes which may be installed subsequently. They are carried around the sides of the manholes in racks. The minimum radius of the bend in this type of cable is 18 inches. Where exposed in the manholes and at the sub-station terminals the cables are wrapped with a layer of hard rolled asbestos mill board one-eighth inch thick, and outside of the asbestos mill board there is a wrapping of asbestos listing two inches wide, laid on until it averages three-eighths inch thick. The whole is then wrapped with galvanized-iron tape one-sixty-fourth inch thick and one-half inch wide, laid on with edges overlapping. At each manhole there is a strip of sheet copper sweated on to the lead sheath and brought out through the wrappings to allow of grounding the cable should it be necessary to protect it from electrolysis.

There is in all about 25 miles of high-tension underground cable installed, besides 0.418 mile of armored submarine cable.

Arrester Houses.

Vulnerability of underground cables to lightning and to other static disturbances which may be set up in the transmission line require that the outlying

Fig. 3. Arrester House at Broad Channel Drawbridge.

Fig. 4. Main Overhead Trunk Line near Woodhaven Junction.

POWER-TRANSMISSION LINE AND THIRD-RAIL SYSTEM OF THE LONG ISLAND RAILROAD.

ends of transmission cables exposed to lightning discharges be provided with protective apparatus. Wherever the underground cable section of the transmission line is joined up with the overhead system, lightning arresters and choke coils are installed, suitable houses being provided to shelter this apparatus, there being one on the main transmission line at Dutchkills Street, Long Island City, and another at Dunton, on the branch line running east of Woodhaven. Smaller houses were also provided for the same purpose at the two drawbridges, one of which is shown in Fig. 3 at Broad Channel drawbridge.

The house at Dutchkills Street is a brick structure and at present contains room sufficient for eight outgoing overhead circuits, which leave the house four on a side. The general design of the transmission line is such that the circuits on one side of the poles can be shut down for repairs without shutting down those on the other side, and this idea was carried out in the construction of the arrester house, so that there would be no confusion possible between live and dead conductors whenever it might become necessary to do any repair work on the line. Arresters are all provided with knife switches, so that they can be readily disconnected from the circuit. A choke coil is also provided in series with each main circuit and another knife switch between the choke coil and the cable bell, enabling the cable to be entirely disconnected from the overhead line. The disposition of the material is such as to economize space and at the same time makes each circuit capable of ready access without the necessity of incurring risk from other apparatus in case it needs repair.

A similar house to the foregoing is located at Dunton, where the branch transmission line running eastward from Woodhaven Junction is changed from conduit to overhead construction. At the drawbridge channels in Jamaica Bay three houses are provided to shelter similar apparatus.

[illegible]

There are two general [illegible] construction, the trunk line [illegible] Street and Woodhaven Junction [illegible] line between that point and [illegible] Junction. The trunk line [illegible] built of steel pole[illegible] Dunton and Rockaway Beach [illegible] which the latter [illegible] station are tied, and upon which [illegible] tation not yet connected [illegible] also equally important as the trunk line and therefore built of steel. From Woodhaven Junction the branch pole line to the east is carried on [illegible] stations are of wood. From Woodhaven Junction south the poles are of steel to the eastern outskirts of Ozone Park, because of the rather exceptional height at which the cables have to be carried to clear other wires, but from Ozone Park to Hammel they are of wood.

The pole lines have not been duplicated for the sake of greater security, as is sometimes done where plenty of room is available for pole line and where other conditions make it desirable. It was decided that a sufficient degree of insurance would be obtained by constructing a single pole line in the most substantial manner. The suburban lines of the Long Island Railroad form several loops or meshes of a network which may afford an opportunity for the construction of additional transmission lines by other routes should future conditions require such a development.

The trunk line is designed to carry eight three-phase transmission circuits consisting of three 250,000-circular-mil cables each, together with eight low-tension cables of 500,000 circular mils each. As the latter, when installed, must be 25 feet above the

Wooden pole[illegible] yellow pine [illegible] and 35 feet [illegible] one at the [illegible] to 80 feet [illegible] top, and treated [illegible] tar per cubic foot of the [illegible] all at 15 feet and the [illegible] of a water jet. They are all set so as to have the tops 30 feet above the [illegible] enough away, in one [illegible] any interference with the wires [illegible] pile driver that is used to [illegible] trestle bridge. These poles are [illegible] with creosoted yellow pine timber.

The total number of steel poles employed is 377 of chestnut poles 490 and of creosoted yellow-pine poles 264.

Cross-arms are of yellow pine, five by six inches cross section, housed on top to a 12-inch radius, and they are painted with one coat of asphaltum paint. On the wooden poles they are gained one inch into the pole and held by one three-fourth-inch through bolt with two-inch square washers.

The two circuits on the Jamaica Bay trestle and on the line immediately north of it were carried one above the other on two sets of cross-arms on the side of the pole, the cross-arms being flush on the side of the pole opposite to the circuits. On the trestle itself the circuits were both on the side of the pole away from the track, in order to get them as far as possible outside the sweep of the pile driver used to replace piles in the trestle bents. On the main line, to the north of the trestle, however, this position was reversed, on account of the four tracks here laid. The poles had to be set as far as possible toward one side of the right-of-way, and there was not room enough to carry the wires on the outside of the pole without overhanging the adjoining property. The cross-arms here are four feet and five feet long, but the standard bracing and fastenings are used.

Insulator pins consist of malleable-iron castings clamped to the cross-arms by means of U-bolts threaded through the body of the pin and held by a plate fitting over the U-bolts and against the cross-arm. This type was first used on this transmission line and represents a new departure in pin design, inasmuch as by its use all boring of the cross-arm is avoided. The strength of the cross-arm is maintained and the depreciation resulting from entrance of moisture through holes bored in the arm from top to bottom is obviated. The form of pin used is also of much greater strength than is possessed by a pin in which the bending moment where it enters the arm has to be met by small cylindrical cross section, which in case of the iron pin is

sometimes not more than three-quarters inch in diameter, and in a wooden pin 1½ inches to two inches. The strongest part of this pin is at the base, where it joins the cross-arm. It admits of easily following up any shrinkage of the cross-arm (which cannot be done in a pin which is set in a hole in the cross-arm), as all that is necessary, if the pin comes loose, is to tighten up the nuts on the underside of the clevis.

The straight-line insulators are 6½ inches in diameter and five inches high, made of porcelain in two parts connected together. The insulators are colored with a brown glaze to render them less conspicuous. They are designed particularly for the conditions here imposed. The pin and insulator together carry a 250,000-circular-mil cable 6½ inches above the cross-arm. The ties are made of ordinary soft copper wire, tied on top.

The tests to which the insulators were subjected at the factory include a rain test at 30,000 volts and a salt-water flash test of 50,000 volts for two minutes. The insulators were further obliged to pass the test of plunging them into hot water and then into ice water without cracking. After the insulators were erected and the cables strung upon them ready for operation they were tested by applying 30,000 volts between the conductor and the ground for four minutes. The insulators underwent all these tests successfully.

Strain insulators are of the "spool" type and made in one piece 7½ inches in diameter and eight inches high. Each strain insulator has two petticoats, one above and one below the point where the wire is attached. A 1⅛-inch by 12-inch steel pin is cemented in the center of the insulator, and this steel pin rests in sockets at the top and bottom, which are firmly clamped by U-bolts to the cross-arms.

The insulators were cemented onto the pins before erection. The cement used throughout was composed of litharge moistened with a mixture of glycerine and water. This type of cement was found after careful trials to be preferable to Portland cement, and although the materials were more expensive, it was found that the labor cost of doing the cementing and the risk of breakage were so much less as to more than counterbalance the extra cost of material.

Cables and Cable Racks.

The transmission cables are of 250,000-circular-mil stranded copper and are fastened to the insulators with ties of No. 6 copper wire, three feet long. Splices were made by cutting back the core of the cable and wrapping the outer layers of strands around the abutting cables after the manner of the ordinary Western Union splice. All the joints were soldered. Where jumpers were used to lead into sub-stations or arrester houses,

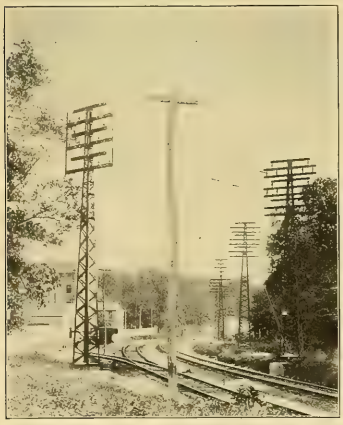


FIG. 5. TRUNK LINE POLES OVER RAILROAD TRACKS, LONG ISLAND RAILROAD.

the ordinary half-connection joint was made and carefully soldered.

The cables were strung for the most part by means of teams of horses and running lines of 1,000 feet or more in length, the cable reels being mounted on stationary stands.

On the trestle, however, this method could not be so readily followed and the cables were strung in the following manner: The reel of wire was carried on a flat car, upon which was carried a boom capable of being swung to one side to the position which would be occupied by the wires. At the end of this boom was a snatch block, through which the wire passed and by which it was guided on the cross-arm. The car was moved along slowly by a locomotive and wire paid out, the boom being raised at each cross-arm so that the wire would drop down on to the arm. This method proved very economical and is illustrated in Fig. 6. The total amount of overhead transmission cable erected is 62.03 circuit miles, or 186.09 miles of cable.

After the line was finished the railroad company installed a telephone line, which is carried on the same poles that support the power circuits and connects the power house with all the sub-stations. It also has instruments connected to it and mounted in boxes at intervals of about 2,000 feet, which are used by the men patrolling the line.

At the Woodhaven and Rockaway Junction sub-stations special terminal poles or racks are provided to distribute the overhead circuits along the face of the building parallel to the high-tension switching galleries in such a manner that the disposition

FIG. 6. STRINGING CABLE ON JAMAICA BAY TRESTLE OF LONG ISLAND RAILROAD.

of the cables after entering the building will be most convenient. The conditions to be met at such places were somewhat conflicting. The disposition of the circuits on the line poles is such as to enable those on one side of the pole to be shut down for repairs, while those on the other side are kept in operation, and it was desirable in leading the cables into the sub-station buildings to adhere as closely as possible to a disposition that would be consistent with this scheme.

The sub-station galleries were laid out for the most convenient subdivision of the high-tension bus into sections for distributing power to the branch-feeder circuits, as above noted, so that it was necessary to lead certain circuits into particular openings in the side of the building without special regard as to whether that particular disposition was the most convenient for keeping the circuits clear and free from crosses outside of the building. An idea of the manner in which these conditions were met is best given by Fig. 7.

The wires of the circuits as they come from the trunk lines are brought into the same plane, the upper circuits going to the top cross-arm which is located at the rear or farthest end of the terminal pole. The next lower circuits are anchored directly in front of these, and so on, gradually working toward the front of the pole, and downward from the top of the pole as one circuit after another is added, thus obviating interference with working circuits when new ones are being erected. By an arrangement of jumpers the outside circuits are led around without interfering with other circuits and brought opposite their proper pigeonholes in the side of the sub-station structure.

Type of Third-rail Construction.

In the selection of the general type of third-rail construction adopted for the Long Island Railroad, the general requirements were that both the rail and the contact device must be suitable for collecting heavy currents at any speed. The rail must be so placed as to encroach as little as possible beyond the fixed clearances of the permanent way, and it must clear all forms of equipment in general use on the road. The design of mounting must be mechanically stable, and besides including good insulation must provide a reasonable degree of protection to employes against accidental contact and be proof against interruption of service by weather conditions.

It was also desired to settle upon a standard form and location of rail that would permit a free interchange of ordinary passenger and freight equipment between the Long Island Railroad and other roads in the vicinity.

A study of the equipment clearances pointed to the necessity of locating the third rail with its gauge line 26 inches from the inside of the gauge line of the running rail and its top at a height of 3½ inches above the top of the track rail. After considering a great variety of designs, both of rails and contact shoes, it was decided to adopt the top-contact type which is now almost universally employed. In order to best combine the qualities affording protection to employes and immunity to weather troubles it was decided to provide a horizontal type of guard extending directly over the rail, requiring the use of the slipper type of contact shoe. With this type of contact rail a tee section was naturally adopted on account of its stability. The location of the contact rail with reference to the track was also governed by the fact that it could not be placed much farther away from the track rail without interfering with bridge gussets and other fixed objects, while, if placed higher, the guard would be interfered with by 50-ton hopper-bottom steel coal cars when heavily loaded.

The rail used for most of the construction is a modified tee shape weighing 100 pounds to the yard, in 33-foot lengths. The section is four inches high, with a head three inches wide, bottom flange six inches wide, and web 1½ inches thick. This particular shape was selected because of the limited vertical distance between contact and running rail tops requiring that the upper rail be of as low section as possible to provide maximum insulation distance to tie. In some cases running rails were only 60 pounds section, reducing the available distance from the top of the tie to the top of the third rail to only 7½ inches. The section, therefore, is that of heavy rail squeezed out horizontally, with a broad base adapted to reduce overturning. The rail is of extra-soft steel.

All of the main-line tracks on the elevated line are provided with this 100-pound third rail, excepting about 7½ miles, which are fitted with 70-pound standard relaying tee-rails. For side-tracking and unimportant spur work, 60-pound relaying rails were used.

The contact rail is supported every 10 feet on vitrified clay insulators set on extra long ties. The insulator consists of a cylindrical piece of vitrified clay with a beveled flange projecting at the base and a two-inch hole through the center to aid in manufacture. A malleable-iron ring having two projecting lugs and holes in each lug for lag screws fits over the flange at the base of the insulator, two lag screws being used to fasten it to the tie. Resting on top of the insulator is a malleable-iron cap which projects down over it for a distance of 1⅛ inches and has two ears 1¼ inches long projecting upward. The rail rests on top of the cap between the ears. With this type of insulator no vertical strain comes upon it, due to the sagging of the tie when a train passes, as the rail is in no way directly attached to it. The design also facilitates the removal of broken insulators, as the whole device may be removed by taking out two lag screws in the base. There being four different sizes of running rails and three sizes of third rails, the dimensions of the insulators are made in three sizes to suit the conditions. Two of them are six inches in diameter and 3⅞ inches and 5 3-16 inches high, respectively, the other being 4½ inches in diameter and 3⅝ inches high, but of the same general form. In this way the proper height of third rail above the running rail is maintained.

The end-approach blocks and incline for lifting the third-rail shoes are of cast iron. Two lengths

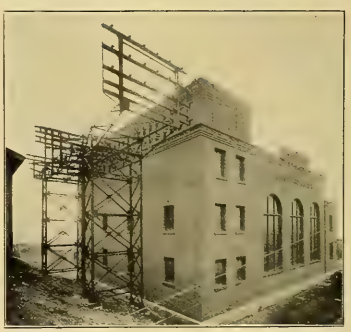


FIG. 7. TERMINAL CABLE RACK AT WOODHAVEN JUNCTION ON LONG ISLAND RAILROAD.

are used, one being 5½ feet long and used on main-line tracks where the shoes must be raised and lowered at high speed; while the other, which is 2½ feet in length, is used only on spur track and sidings. The approach blocks are attached to the end of the rails by the regular splice plates and are supported on standard third-rail insulators at their outer ends.

The third-rail joints are bonded by laminated copper foot bonds with plug terminals. They are of varying sizes, according to the weight of the rail to which they are applied, 300,000, 350,000 and 400,000-circular-mil sizes being employed. The holes for the plug terminals were punched in the base of the rail by hydraulic punches, and the terminals riveted into the holes by hydraulic compressors.

The third rail is frequently interrupted by highway crossings and switches, and at such places un-

derground cables are provided to maintain its electrical continuity.

As at present installed the third-rail system is not fed in separate sections from the sub-stations, but is treated as a continuous conductor between sub-stations, except where the number of switches and cross-overs incidental to a station terminal or junction necessitates dividing it into sections that can be easily isolated from the remainder of the third rail should emergency require. There are, therefore, no low-tension cables running along the tracks to reinforce points distant from the sub-stations, but the frequency of highway grade crossings and track switches and cross-overs requires the frequent interruption of the third rail. To maintain its electrical continuity at such places underground jumper cables are provided.

These cables are in three sizes—500,000 circular mils, 1,000,000 circular mils and 2,000,000 circular mils. The cable is insulated with varnished cambric four-thirty-seconds inch thick, which is covered with a lead sheath one-eighth inch thick for the 1,000,000 and 2,000,000 circular-mil and three-thirty-seconds inch for the 500,000 circular-mil cable. Outside of the lead there is a layer of prepared paper and two layers of jute wound on spirally in opposite directions and thoroughly impregnated with asphalt. This unusual precaution is taken to protect the lead from acids and alkalis in the soil and from possible electrolytic action of return currents in the ground.

The Stilwell-Slater type of guard was adopted for the third rail; it consists of yellow-pine plank 1⅞ inches thick, seven inches wide, placed above the rail, with 2½-inch clear space between the top of the rail and the under side of the plank. The edge of the plank nearest the track extends seven-eighths inch beyond the line of the third-rail head and is beveled back to give the necessary clearance

switches are installed [illegible] that by opening the two [illegible] between them can be cut out [illegible] switches are kept [illegible] near the [illegible] around the [illegible] switches [illegible] and are located in [illegible] third rail guard.

Practically all the line [illegible], excepting two stretches which [illegible] Atlantic Avenue between [illegible] Woodhaven Junction, and [illegible] from Woodhaven Junction [illegible] of the [illegible]. The third rail [illegible] these two sections are supplied by separate feeders from Woodhaven Junction, and [illegible] connected with the main line [illegible]. South of Woodhaven, however, the third [illegible] track are cross-connected. Each of the [illegible] third rail has a separate feeder leading [illegible] Junction sub-station, but at the [illegible] the two east-bound tracks are connected together through a knife switch and a [illegible] circuit breaker, located in the switch house at the side of the track. The two west-bound tracks are similarly connected so that under ordinary conditions they work in multiple. In case of a short circuit, however, the circuit breaker will open, separating the tracks at that end, and the separation can be completed by throwing the switches in the sub-station.

There are several very important places on the line where the arrangement of interlocking switches is such as to require special provision for cutting the third rail into sections. Woodhaven, Ozone Park, Jamaica and Hammel are points where the arrangement of intersecting and side tracks is such

[illegible] run in vitrified-clay ducts.

[illegible]

The completed [illegible] service on April 27, 1905, [illegible]

Fig. 8. Standard Third-rail Construction on Atlantic Avenue Elevated Structure.

Fig. 9. View on Main Line and Sidings Equipped with Third Rail.

POWER-TRANSMISSION LINE AND THIRD-RAIL SYSTEM OF LONG ISLAND RAILROAD.

for running equipment. Each plank has a saw cut three-eighths inch deep in the middle of the under side to prevent warping. The planks vary in length from 14 to 16 feet. The guard is supported directly from the third rail, there being four supports to each plank. The planks are butted together without splicing so as not to interfere with the free expansion and contraction of the rail and to facilitate repairs.

Fig. 8 is an excellent view of the standard third-rail and guard construction as it appears on top of the elevated structure on Atlantic Avenue.

Additional protection is provided for the third rail at stations. This additional protection on the outer side of the rail consists of a yellow-pine strip four inches wide and 1¼ inches thick, set at an angle of about 45 degrees with the rail and almost completely covering the side of it.

Cables connecting the third rail with the sub-stations are of 2,000,000 circular mils and connections are made directly in front of the sub-stations. In some cases these short feeders are located in conduit and in other cases laid directly in the ground in the manner above described for the crossing jumpers. Such cables when laid in ducts are insulated with five-thirty-seconds inch of paper, covered with a layer of sheathing one-eighth thick.

Near each sub-station the third rail is interrupted by a 40-foot gap. Should any section break down it is then impossible for a single car to bridge the gap between the live rail and the grounded one, thus avoiding the possibility of injury to the car wiring and equipment. The east and west-bound tracks are in most cases supplied by a separate set of feeders and are not cross-connected, except through the station bus-bars. Current can therefore be cut off from the section of either track lying between two sub-stations simply by opening the proper feeder switches in the stations at each end of the section.

In order that part of a section between two sub-stations may be disconnected in case of emergency, instead of requiring the whole section to be thrown out of service, 1,600-ampere disconnecting

as to require this special treatment. Fig. 9 shows the arrangement of the third-rail circuits at a rather complicated interlocking point just east of Jamaica station.

Return Circuit.

Both running rails of each track are used for the return circuit. On a considerable portion of the line an automatic block-signal system is used, requiring the use of both running rails for its operation, so that a special method had to be used in order to allow the tracks to be used jointly as a power-return circuit and for signal purposes. The signal system was developed by the Union Switch and Signal Company, and employs alternating current for the operation of the signals. With the aid of a special arrangement of bonding, to be described hereafter, the track is used for carrying both direct and alternating current, without the former affecting the latter.

About 20 miles of track on Atlantic Avenue is laid with 100-pound tee rails. The remaining portion of the electrified system is laid with various weights of rail, running from 60 to 80 pounds per yard.

The problem of bonding the rail joints was solved by different methods, on different portions of the line, depending largely upon the local conditions. The rails having been practically all laid when the work of equipment began, the type of joint plate then in position had much to do with the various types of bonds employed.

It was found impossible to install bonds of sufficient size beneath the splice bars already in use. Foot bonds could not be used on the elevated portions of the Atlantic Avenue improvement, because this track had supported joints, and where the tracks were laid on the surface they could not be used, because the leakage through them would unfavorably affect the operation of the signal system. On a portion of the line which has no automatic block-signal system, however, soldered foot bonds, placed underneath the rail joints, were used.

A good deal of the bonding was done with laminated bonds of the soldered type, attached to the

first put into service about May 13, 1905. Regular operation began July 26, 1905. The operation of the transmission line and the third rail have been remarkably free from interruptions of whatever nature, and have demonstrated their efficiency as a substantial and reliable transmission system for a suburban railroad on whose regularity of operation thousands of people are daily dependent.

The design and construction of the foregoing transmission system was carried out by Westinghouse, Church, Kerr & Co., engineers for the Long Island Railroad Company, and the entire work was under the direction of Mr. George Gibbs, chief engineer of electric traction of the Long Island Railroad, subject to the approval of an electrical committee, consisting of the chief operating officials of the road, with the president as chairman.

Large Generators Operating at 18,000 Volts.

At Redondo, a suburb of Los Angeles, Cal., a new power plant is about to be installed containing many interesting features. The new station will supply power for the entire street-railway system of Los Angeles and surrounding towns, in connection with the various other power plants and water transmission systems in the vicinity. It will, in fact, form another unit in the interconnected electrical transmission lines in Southern California which almost entirely prevent the discontinuance of service due to accident at a single plant.

The new plant will have a capacity of 15,000 kilowatts, consisting of three 5,000-kilowatt engine-driven units, and illustrating the present tendency toward simplifying the power house. Instead of dividing the power into a number of smaller machines, the total output is concentrated in three generators of large capacity. This phase of engineering has become of greater importance since the advent of the steam turbine.

Each of the units in the Los Angeles station con-

sists of a 5,000-kilowatt generator direct connected to a combined vertical and horizontal compound engine. The generators are built by the General Electric Company, and, aside from their large capacity, are notable for the high voltage at which they operate. Each will supply current at 18,000 volts directly, and, moreover, can be successfully operated at 22,000 volts. The machines are of the revolving-field flywheel type, delivering three-phase 60-cycle current at 100 revolutions a minute. The engines will operate under 175 pounds pressure with 100 degrees superheat and 27½ inches vacuum. For operating the generators in parallel under variable load, the engines are provided with special electrical speed-changing devices, so that they may be easily synchronized.

Beside the main generators, there are engine-driven exciter sets, and two engine-driven alternators, of 300 kilowatts and 150 kilowatts respectively. These machines will furnish current at 480 volts and 50 cycles for operating the auxiliary apparatus in the station. It is unusual to operate this class of apparatus by alternating current, but in the station under consideration direct-connected induction motors will be used to drive all the auxiliary station apparatus.

A special note may also be made of the boiler system. The equipment will consist of 18 600-horsepower Babcock & Wilcox water-tube boilers, with integral superheaters. The boilers are fuel-oil fired, the oil being heated and delivered to the burners by special apparatus.

New Public Service Building of the Milwaukee Electric Railway and Lighting Company.

The holding of the first day's session of the twenty-third annual convention of the American Institute of Electrical Engineers in the auditorium of the Public Service Building, recently erected by the Milwaukee Electric Railway and Lighting Company, served as a dedication of the edifice. While the building equipment is by no means completed, a description of its general features and the nature of its equipment may be given.

This building, at present a four-story structure with basement, occupies the entire block between Second and Third streets and between Sycamore street and the Chicago, Milwaukee and St. Paul tracks. The plans allow of the ultimate addition of eight floors to the building, thus making it a 12-story structure. It is constructed of concrete and steel with an exterior of Bedford stone. An estimated cost of the completed structure is given as $2,000,000.

This building serves as the headquarters of the Milwaukee Electric Railway and Lighting Company, and it is utilized for a sub-station, an auxiliary steam station and a central heating plant, machinery for this purpose being located in the basement. There are also storage for interurban cars and repair shops, extensive storerooms, waiting rooms for interurban passengers, demonstration rooms, an extensive testing department, general and engineering offices and draughting rooms, and a large auditorium and stage. The main entrance to the building is on Sycamore Street, and the first floor is given up to waiting rooms, storage of cars and miscellaneous storage rooms. The main waiting room is very nicely furnished and fills a long-felt want in the city of Milwaukee. A restaurant, in which all cooking is to be done by electricity, is an adjunct to the main waiting room. The public office of the company is located near the waiting rooms, and a portion of this room is fitted up for the demonstration of electric-heating apparatus; the company expects to very materially increase its sales of current by introducing the use of such apparatus.

Storage tracks for interurban cars are looped between Second and Third streets on the main floor, and the repair shops and operating employes' room are conveniently located.

The basement of the building at present contains a portion of the sub-station equipment consisting of motor-generator sets driven by alternating current and furnishing power for the street-railway system. A large storage battery is installed in connection with these sets. The boiler plant is designed to furnish steam for turbo-generator sets, soon to be installed, and to also furnish steam for heating purposes. For heating, the steam will be delivered through tunnels under the streets to various users in the business district. A great deal of this tunnel work has already been completed. The conduit system for electrical feeders is distinct from these tunnels.

The auditorium, occupying the center of the building on the second floor, has a seating capacity of about 2,000. The floor is not elevated and the seats are arranged so that they can be easily removed, leaving the floor space free for other purposes when desirable. The remainder of the second floor is given up to general offices.

An extensive testing department is being arranged for in this building for the testing of meters and other apparatus as well as for carrying on investigation work under the direction of the engineers. The meter-testing equipment is completely installed at the present time.

The train dispatcher's office is located in the same room with the telephone exchange for the

NEW PUBLIC SERVICE BUILDING IN MILWAUKEE.

building. All interurban cars are despatched by telephone, a very ingenious telephone box being located at certain places along the routes for the use of conductors in making reports and receiving orders. The automatic telephone system is used for the strictly office business, but any of these automatic instruments may be connected with the system of the Wisconsin Telephone Company when such connection is desired. A surgeon's office with complete equipment is maintained by the company for emergency cases.

A portion of the building is devoted to the publicity department. The company maintains its own printing office, printing all advertising material, tickets, transfers, etc.

The offices of the president of the company and the director's room are located on the fourth floor of the building. These apartments are very pleasantly located and magnificently furnished. It is difficult to imagine a more complete or elegant building equipment or a better organization for any operating company than is furnished by the new Public Service Building.

Signaling in the Electric Zone of the New York Central.

Both block and interlocking work in the electric zone of the New York Central Railroad will be all-electric, operated by current taken from a power line running the whole length of the system. All track and signal circuits will be operated by alternating current, the only batteries to be used being storage batteries for the operation of interlockings, which will be charged by a motor-generator drawing current from the power line.

The contract for all block signaling and interlocking in the electric zone has been awarded to the General Railway Signal Company of Buffalo, N. Y. Besides being the largest signal contract ever awarded, this work represents an important advance in the art of signaling.

The system offered by the General Railway Signal Company is known as the "Young system." Alternating current is used for track circuits in connection with reactance bonds, permitting the passage of the direct propulsion current freely through both of the running rails, while impeding the alternating current used in signaling. This two-rail system was deemed best suited to the conditions.

Work to be undertaken at the present time covers only that portion of the road to be electrified this year, which carries the work from the Grand Central Station to High Bridge, on the Hudson Division, and to Wakefield, on the Harlem Division.

For the operation of signal circuits, signal motors, indicators and signal lighting, the 3,000-volt current of the signal transmission line is stepped down to 50 volts, through transformers placed on signal bridges or transmission-line poles. For track-circuit operation, the voltage depends on the length of track circuits, and varies from 1½ volts for circuits of 200 to eight volts for circuits of 5,000 feet. The reduction from 50 volts to the track voltage is made by a transformer provided with four taps, which will permit of one type of transformer being used on all track circuits.

Track circuits are of three types. Where they are 500 feet or less in length, and where the drop in potential in the length of the track circuits is not greater than 50 volts, the "one-rail" system is used, and one rail of the track is given up for signaling purposes. There being no direct current on the signal rail, it is not necessary to use any reactance bonds.

On all track circuits over 500 feet in length, the "two-rail" system is used, and both track rails are used for the return of the direct power current, and on all of these circuits it is necessary to use the reactance bonds, by which the connection is made around the insulated rail joints, permitting the direct current used in operating to pass, while impeding the alternating current used for track-circuit work. (See Fig. 1.)

On track circuits between 500 and 1,600 feet in length the "two-rail" system is also used, and the reactance bonds consist of a copper bar one inch in cross-section and 30 feet long, coiled in eight turns around an iron core.

For track circuits over 1,600 feet in length, a reactance bond formed of a coiled copper bar without any iron core is used, the circuit being illustrated in Fig. 2.

The use of two styles of bonding was determined by the cross-bonding for the electric traction system. The engineering department of the railroad company determined that the distance between such cross bonds should not exceed 1,000 feet.

The track relay is of the induction-motor type with two field coils. One coil is energized by the 50-volt signal-operating current, which gives the greater part of the energy required to magnetize the fields and armature. The other coil is energized by the current from the track rails, and this current need only be strong enough to give sufficient magnetism to rotate the armature.

Signals are to be of the General Railway Signal Company's motor-operated type, with mechanism placed in the base of the signal mast, and worked by a single-phase alternating motor of one-fourth horsepower, using current at 50 volts.

The general arrangement of the mechanism is exceedingly simple, and under alternating-current operation is very quick in releasing. The signals are of the 60-degree two-position type, using New York Central standard spectacles and blades, which impose on the signal motor a load equal to the lifting of a 17-pound weight, at a distance of four feet from the center of the shaft. With this load the motor will clear the signal in from two to three seconds. The signal lamps are New York Central standard pattern, and are provided with an electric-light attachment.

The interlockings are of the standard type, manufactured by the General Railway Signal Company, in which direct current furnished from storage batteries is used to operate the switch movements and signals. As usual with this type of apparatus, the indication is given by the current formed by the motor, which, on completing its stroke at the signal or switch movement, is changed to a generator and gives sufficient current to release the lock of the lever of the machine.

The current to charge these storage batteries is to be obtained from a motor-generator set, taking current from a transformer fed from the 3,000-volt

signal transmission line and furnishing current of 150 volts.

The interlocking machines are provided with a latch for each lever to require a definite action on the part of the operator to change the position of the lever. The lever handles are colored according to their functions. There will be a separate lever for each high signal arm, and no selector will be used. Two switches may be controlled on one lever.

The interlocking signals will be provided with dynamic indication current return. These signals, [illegible] locking operating coils, there [illegible] number of [illegible] each having one [illegible] point in a track [illegible] present instance [illegible] subdivided into [illegible] The second terminal of the [illegible] inclusive, are all connected together [illegible] ing plate (d), while one [illegible] (B) is connected to a point [illegible] track between the [illegible]

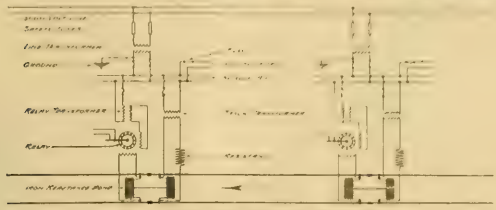


Fig. 1. Two-rail Return Using Iron Reactance Bond

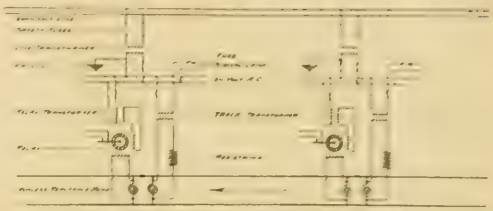


Fig. 2. Two-rail Return [illegible]

SIGNALING IN THE ELECTRIC ZONE OF THE NEW YORK CENTRAL.

where slotted, will return to the stop position when the current through the slot magnet is open, but the return indication from the signal motor is not received at the lever until the lever is first restored to the normal position.

The operating circuits for the signals are run through controllers on all facing switches in the main line, insuring that the switches are properly set before the signals can be cleared.

Block signals on the same mast with distant signals are controlled by a lever in the machine requiring the block signal to be changed to the stop position before a signal can be cleared for a reverse movement on the main line.

Advance signals for each track, although operating as automatic block signals, are controlled from the interlocking and are provided with a square-end blade to enable the signalman to hold a train, if it is desired to do so.

Approach locking will be provided for all main-line switches. This locking becomes effective when a train has reached a point at least one mile in the rear of the distant signal.

In order to permit the signalman to change the route for a train in case of a mistake in setting it up, a mechanical screw release is provided. This will allow the releasing of the lever and changing the route on the expiration of a time interval of 1½ minutes after the signals have been restored to the stop position.

A counter reading to five figures is to be placed on all high signals to register the number of movements.

The movement to be used to operate the switches is of an entirely new type. With the small clearance under the third-rail contact shoe, a mechanism that will not project above the top of the running rail is absolutely necessary. This movement is enclosed in a neat casing, with the gear and escapement crank horizontally arranged. The reversible pole-changer and indication switch box are also enclosed in the casing with the switch mechanism, protecting these parts, and giving an exceedingly neat appearance to the apparatus.

Improved Arc Welding Apparatus.

Electric welding apparatus is sometimes dangerous to handle on account of accidental burning of the operator, which may take place with only momentary contact with the arc. The arc should also be so designed that the current consumed in the process may be regulated by methods easily under the control of the operator. Arthur C. East-

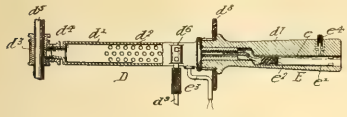


FIG. 2. IMPROVED ARC WELDING APPARATUS.—ELECTRODE HOLDER.

wood of Cleveland, Ohio, has invented an arc welding device upon which he has received a patent, and which is designed to overcome the defects which have been heretofore evident in this class of apparatus.

The apparatus embraced in the invention affords protection to the operator from accidental burns and also avoids short-circuiting. Another advantage arises from an arrangement of the component parts, whereby a given operation may be carried on with dispatch, as is requisite for successful welding.

Consulting the diagram, Fig. 1, (A) is a main hand-operated switch of the double-pole type, while (B) and (B′) illustrate two electromagnetic switches also to some intermediate point of the series of resistance (c^1).

The second terminal of the switch (B) is connected to one terminal of the main switch, whose second terminal is connected to a terminal of the switch (B′). The second terminal of this latter switch is in electrical connection with the metallic body of the carbon holder (D). This holder (see Fig. 2) consists of a hollow body, preferably of aluminum, in which are a number of perforations, provided to permit of the circulation of air through the interior thereof, and carrying at one end a tubular holder (d^2), in which fits a tapered bushing adapted to receive the carbon rod. There is a suitable terminal plate (d^6) upon the holder for the connection of a flexible cable, which extends between it and one terminal of the switch (B′), while on the end opposite that having the carbon rod is a wooden handle and a relatively large

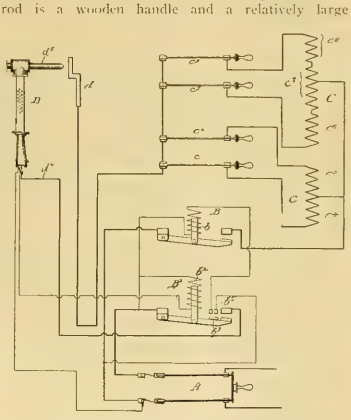


FIG. 1. IMPROVED ARC WELDING APPARATUS.—ELECTRICAL CONNECTIONS.

protective shield (d^3), interposed between it and the body (d′). The handle is hollow, and within it is carried any convenient form of push button or equivalent switch.

One of the wires of the cable (e^3) is connected directly to one terminal of the main switch, while the second terminal is connected to the coil of the switch (B′). The second terminal of this coil is connected to the second terminal of the main switch and to one terminal of the coil (b) of the switch (B). Between the second terminal of this latter coil and the positive side of the main switch (A) is interposed an auxiliary switch (b^2), whose movable element (b^3) is carried by the blade of the switch (B′). The auxiliary switch is adapted to be closed by the closing of the switch (B′) as well as opened by the opening of the switch.

In order to make a weld, the plate (d) is clamped to the metallic piece to be repaired, and the operator grasps the carbon holder in such manner as to depress the push button. This depression causes closure of the switch (E), thereby supplying current to the coils of switches (B) and (B′), so that these close one after the other.

Assuming that all of the switches (c) to (c^5), inclusive, are closed, the operator touches the piece

[illegible] and a glimpse of the interior of [illegible] wagon recently constructed for the [illegible] tric light department of Mannheim, Germany. A galvanometer, standard and cells are provided with this equipment, which are suspended in the wagon when not in use. When electrical tests are being made the apparatus is let down on to the ground or pavement for a foundation, the adjusting screws being manipulated until the proper level is attained.

With this interesting equipment tests are made of the resistance of conductors, the insulation of

UNIQUE GERMAN ELECTRICAL TESTING WAGON.

cables and other apparatus, and of the underground service of the electric-light and power system of the city.

In case of trouble in any section of the city the testing wagon can be dispatched at once to the seat of difficulty, and the operators can determine where the fault is and remedy it within the shortest space of time, as the electrical-testing equipment is very complete and arranged with the idea in view of making the measurements accurately and with rapidity, in order that no time be lost when the service is in trouble.

The wagon is also provided with a marble switchboard on which are mounted instruments for insulation and capacity measurements, shunt rheostats, resistances of various sizes and condensers. Numerous testing cells are also provided. The mirror galvanometer is constructed with two windings, and is arranged for ballistic measurements. The other electrical apparatus includes 120 elements for a measuring battery, telephones, wall thermometers, earth thermometers and earth contacts.

Although electrically lighted, the wagon is also equipped with petroleum lamps and lanterns as well as electric-heating apparatus. These German measuring cars are also constructed for self-propulsion, with storage batteries and motors. P.

Unique German Electrical Testing Wagon.

WESTERN ELECTRICIAN

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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CONTENTS OF THIS NUMBER.

An 800-horsepower Motor for the Operation of a Pulp Mill. By Orrin E. Dunlap. Illustrated 463
Distribution System of Great Northen Power Company in Duluth, Minn 463, 464
Power-transmission Line and Third-rail System of the Long Island Railroad. Illustrated 464, 465, 466, 467
Large Generators Operating at 18,000 Volts 467, 468
New Public Service Building of the Milwaukee Electric Railway and Lighting Company. Illustrated 468
Signaling in the Electric Zone of the New York Central. Illustrated 468, 469
Improved Arc-welding Apparatus. Illustrated 469
Unique German Electrical Testing Wagon. Illustrated 469
Editorial 470
National Electric Light Association. Annual Convention 471, 472
Opening Proceedings and President Blood's Address 471, 472
Chicago "Special" 472
Mercury Arc Rectifier System with Magnetite Lamps for Street Illumination. By W. S. Barstow. (National Electric Light Association) 472, 473
Electrical Trades Exhibition for Canada 473
Fuel Economy. By J. Henry Hallberg. Illustrated. (National Electric Light Association) 473, 474
Institute Convention at Milwaukee. Annual Convention. Illustrated 474, 475, 476
New York Cities Want Cheaper Niagara Power 476
The Self-synchronizing of Alternators. By Morgan Brooks and M. K. Akers. (American Institute of Electrical Engineers) 476, 477
Shunt and Compound-wound Synchronous Converters for Railway Work. By W. L. Waters. (American Institute of Electrical Engineers) 477
Equipment for Winona (Ind.) Interurban Railway Company. 477
Signs and Symbols in Preparing Drawings 477, 478
Poster Advertising of Incandescent Lamps. Illustrated 478
Duration of a Lightning Flash 478
A Producer-gas Power Plant in Worcester 478
Electric-light Fraud in England 478
Portable Wright Demand Indicator for Transformer Testing. Illustrated 478
New Electric Plant in Greeley, Colo 478
Indiana Telephone Items 479
Ohio Telephone Notes 479
Canadian Telephone Items 479
Telephone News from the Northwest 479
New Companies 479
General Telephone News 479
Inaccuracies of the Thermo-electric Pyrometer 479
Books Received 479

DEPARTMENTS.

Correspondence 480, 481, 482
Great Britain 480
New York 480
New England 480
Dominion of Canada 480, 481
Ohio 481
Indiana 481
Michigan 481
Illinois 481
Southeastern States 481, 482
Pacific Slope 482
Northwestern States 482
Personal 482
Electric Lighting 482, 483
Electric Railways 483
Power Transmission 483
Publications 483
Societies and Schools 483, 484
Miscellaneous 484
Trade News 484
Business 484, 485
Illustrated Electrical Patent Record 485, 486

DATES AHEAD.

Illinois Independent Telephone Association (annual meeting), Coliseum, Peoria, Ill., June 19th and 20th.

Canadian Electrical Association (annual convention), Clifton House, Niagara Falls, Ont., June 19th, 20th and 21st.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Hollenden Hotel, Cleveland, Ohio, July 18th to 20th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

DISCUSSING the long-flame arc lamp at a recent meeting of the Institution of Electrical Engineers in London, a member remarked that he had been struck by the fact that there are no flame arc lamps in the United States. Perhaps that gentleman has not visited this country very recently—within the last six months or a year—as he certainly would have seen examples of the flame arc lamp burning in our larger cities, where it has ceased to arouse comment, unless it is from those who are unversed in electrical matters. It is true that the flame arc lamp in this country has not attained to anything like the popularity that it has in Europe, being used here principally as an agent for the attraction of public notice, as in front of theaters, etc. It cannot be said, however, that it is not used in this country, for it is of no uncommon occurrence, and we are aware of several different types that are on the market and are being pushed by energetic agents.

WHAT BIDS FAIR to be one of the most successful conventions in the history of the National Electric Light Association is being held in Atlantic City, N. J., as the Western Electrician goes to press. On Tuesday, June 5th, the opening day, 1,000 delegates were already registered. The weather was delightful, and everything promised well for a valuable and entertaining meeting. Probably the best exhibition of electrical appliances ever gathered together under auspices of the association is to be seen at the entrance to Young's Pier. Outside attractions of a varied nature are offered for the delegates, when they are not occupied with things of a more serious nature, but these attractions do not prevent a large attendance at the sessions. In this issue are given a telegraphic report of the first day's session, together with President Blood's address and several of the papers which were read. Next week a complete report of the proceedings of the convention will be given.

PROCURING a patent in Germany involves many difficulties, and American inventors, especially, believe that in that country a too severe definition of the term "invention" obtains. These difficulties led a foreign patent attorney in New York city to take up the matter with the German Patent Office. This resulted in a reply from President Hauss of the German Patent Office, who made some explanations to the effect that the regulations there are not so strict as they are thought to be, or as they really should be, and that American inventors are no worse off than those in Germany. He said that proof of a "new technical effect" is more often acquired than is advisable, according to the circumstances. He also pointed out the fallacy of the statement in the German regulations that "every invention must contain a new principle." The very fact that about 10,000 patents are granted yearly in Germany shows that this clause is very liberally interpreted, and that it is not remotely possible that so large a number of fundamentally new inventions could be made in a single year.

IN THE CONGESTED districts of the larger cities, building construction is continually under way, and oftentimes several large steel structures are going up simultaneously within the area covered by a few blocks. Connected with this construction work there is always a deafening racket, which is a source of great annoyance to the thousands of people who are compelled to work in close proximity to the source of the noise. One of the most enthusiastic contributors to the tumult is the energetic little donkey engine, which puffs and blows off steam and pours forth clouds of smoke that would put to shame a locomotive. The hammering on the steelwork of the buildings is, of course, necessary, but the nuisance of the engine might easily be obviated by the use of electric hoists and cranes. Such apparatus has been used to good effect in this class of work, and there is no doubt that the motor has many points of advantage over the donkey engine. It is more portable and more compact, temporary connections can be made to it as easily as coal can be drawn to the engine, and it is easier to operate. With all its numerous advantageous features, it seems strange that its adoption has not become universal, but still the engine goes on puffing, though there is a much better substitute for it at hand.

ELSEWHERE in this issue is given the paper by Messrs. Morgan Brooks and M. K. Akers on the subject of "The Self-synchronizing of Alternators," which was presented at the convention of the American Institute of Electrical Engineers in Milwaukee last week. This paper sets forth clearly the results of some highly interesting experiments made by the authors, results which if borne out in practical working are very important in the field of station operation. In brief, what they propose to do is this: To devise an apparatus, which, when connected in circuit with the machines to be synchronized, will allow of the paralleling switch to be closed at any time, regardless of equality of speed or excitation, without harmful results. They first tried an impedance in the circuit between the machines, to obtain a lag in the current circulating between them. This operated with but indifferent success. They next tried pure resistance, which of course resulted in loss of synchronizing power. After many experiments and much study, an inductance without iron core was tried, and it was found that the desired lagging current was obtained, while the pure inductance would not allow of an impulsive rush of current.

It is believed that the coreless inductance method of synchronizing alternators would be particularly adaptable to synchronous frequency converters, though no experiments were made to determine its applicability for this work. Though it is not recommended that the operator throw the switch at random, the only result of such an act would be a slight momentary disturbance on the system. However, by using a little care and not closing the switch until the synchronizing lamps show approximate synchronism (no other synchronizer is necessary) a refinement of operation may be attained.

MILITARY METHODS of long standing have been very materially modified by the development of electricity. Wherever a large gun or mine is used, or where torpedoes and other protective appliances are to be relied upon, the use of electricity is now a necessary adjunct. So important has electricity become in this field that a competent authority, First-lieutenant Frank T. Hines of the Artillery Corps, points out that the full defensive powers of our modern seacoast fortifications, which have so far cost the government $98,000,000, have been made possible only by its application. Assuming that the complete cost of our proposed coast defense reaches $150,000,000, as seems entirely reasonable, the same authority puts the cost of the electrical equipment at $5,000,000, which includes accessory apparatus such as boilers, engines, etc., for the generation of electric current.

Discard the electrical parts of the coast-defense system, and the effective use of the large-caliber guns would be impaired 50 per cent. Eliminate range finders, telautographs and firing appliances, which are all operated electrically, and the efficiency of the coast defense would be depreciated nearly 75 per cent. At first thought these statements may seem somewhat to exaggerate the importance of electricity. But when it is considered that failure of the generators or storage battery would mean failure of the lighting of the implacements, and failure of the telephone or telautograph to convey orders and ballistic data would mean demoralization of the system of directing and firing the guns, it will readily be seen that electricity is really the brain power of the activities of a coast-defense station.

Officers are now required to be familiar with the practical application, at least, of electricity, and the service schools have been modernized so as to give thorough rudimentary training in this important branch of technology. Eighteen years ago no departments were given up in these schools to the study of electricity as a separate branch, it being combined in the department of artillery, with ballistics, gun construction, etc. No more significant example of the progress of the art can be given than a comparison of the importance given the subject in the service schools of 18 years ago and those of today. The chief of artillery in his report of 1901 recommended the employment of expert civilian electricians, one for each artillery district, but it is probable that with the aid of the service schools this step will not be resorted to.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

Opening Proceedings.

Atlantic City, N. J., June 5.—The twenty-ninth meeting of the National Electric Light Association, is a convention by the sea. It is held in a meeting room on Young's Pier, over the very water's edge, and the surges of the Atlantic, soothing or turbulent, as the case may be, are a constant reminder of the fact. The exhibition of electrical appliances is found on entering the pier, which extends seaward from the Board Walk, and is undoubtedly the best collection of electrical exhibits ever gathered under the auspices of the association. It was formally opened by President Blood last evening. Here, also, are a thousand easy chairs for the weary, and a good band of music. The whole convention, with a present attendance of 1,000, and constant arrivals, with four or five hundred attending sessions in the hall, with a good programme, delightful weather and a multitude of outside attractions, is proving a brilliant success.

The opening session was begun promptly on time this morning, with President William H. Blood, Jr., of Boston in the chair and Secretary W. C. L. Eglin of Philadelphia in his place. Mayor Stoy welcomed the association to Atlantic City, and then Mr. Blood delivered in a pleasing manner the presidential address.

President Blood's Address.

It is with great pleasure that I call to order this, the twenty-ninth convention of the National Electric Light Association. To preside over this dignified assembly, composed as it is of the leaders of the electric-lighting industry, the progressive manufacturers, the enterprising engineers and the successful salesmen, is a privilege highly esteemed by your president.

Last year we enjoyed the hospitality of the West, and the trip to Denver and Colorado Springs in special through trains was a feature of the gathering. This year you have come to the extreme East, where you may admire the Atlantic Ocean with its tempestuous waves, and contrast its vastness with the royal splendor of the mountains you saw last year.

The association is to be congratulated upon its continued growth and prosperity. Two years ago, when we met in Boston, the total membership was 588. To-day, we have nearly double this number, for we have enrolled 1,024. The vigorous campaign for new members, inaugurated two years ago, has been continued in a less expensive manner but with most satisfactory results by our efficient assistant secretary and treasurer.

The question of annual dues should receive the prompt consideration of the incoming administration. It may be expedient to increase the fees of the companies operating in the largest cities. It is desirable, your president believes, so to adjust the dues in cities of 10,000 population or under that companies operating therein cannot afford to stay out of the organization. We need the co-operation of just such members, and the affiliation with the stronger companies, through the association, will enable them to get information or assistance which, if operating alone, might be expensive if not impossible to obtain.

The Class "C" members—college professors—have received the careful consideration of your president during the past year, and as a result of his investigations he unhesitatingly recommends that they be treated as an honorary class, that no fees be exacted, and that they be admitted upon invitation only, and that each case be passed upon annually by the executive committee. We desire the fellowship of many earnest educators for their own sake and because of the influence which they have over the hundreds of young men they are sending out each year from the technical schools. On the other hand, this association has no place for the instructor with only academic ideas as to corporate management, who in his capacity as consulting engineer either ignorantly or wilfully misrepresents the facts.

In 1904 President Edgar called your attention to the construction of the Union Engineering Building, founded by Mr. Andrew Carnegie, which was to be built on Thirty-ninth Street, New York city. This building is now nearing completion and your executive committee has agreed to take quarters in it as soon as it is finished, which will be within a few months. The present offices of the association are crowded, and by our removal to this location we shall be identified with that which is sure to become the greatest center of engineering life in this country, if not in the world.

Our relations with the underwriters have, during the past year, been pleasant, partly because there has been no question at issue between us and also because we are becoming better acquainted with each other. The policy of having a representative of the association devote the larger portion of his time to insurance interests and to settling differences between the members of the association and the underwriters has been approved by the executive committee, and is now referred to the incoming board for early action.

It is my pleasure to [illegible] leaders of the electrical [illegible] directors for the [illegible] tions before meeting the [illegible] Early this year the [illegible] that by making it [illegible] looking to the local [illegible] the meeting, the [illegible] pendent and the [illegible] not be a burden to any [illegible]

For many years the manufacturing [illegible] other have had small [illegible] throughout the hotel. [illegible] experiment of having a central [illegible] from the interest shown [illegible] and from the attractive [illegible] made, I think we may [illegible] novel attraction of the exhibit is the [illegible] advertising display, which tends to emphasize the fact that "business-getting" [illegible] important parts of the successful electric-lighting enterprise.

The year has shown a healthy growth of the electric-lighting business, but it is not notable as having given birth to any marked innovation in the physical part of the business. The use of generating units continues to increase, distribution by high tension alternating current is becoming more and more general, and minor improvements all along the line are extending the utility of the system. Undeveloped waterpowers, which a few years ago were valueless, are to-day being eagerly sought out, and by means of improved waterwheels and high tension lines are being made available for large sections of the country. Gas engines, steam turbines and other prime movers are receiving the careful attention of enterprising engineers, because we are all beginning to realize, more and more forcibly each year, that the great losses between the coal pile and the dynamo must be cut down.

There has been a marked increase in centralizing the ownership of electrical undertakings. This has benefited the communities served, by bringing to their service better managerial as well as improved operating methods. This centralization is causing electrical managers to look more closely to their markets, and today the company that has not a new business-getting department is sadly behind the times.

For many years by far the largest portion of the manager's time was spent in trying to better the physical condition of his plant and in reducing operating expenses to a minimum. Today he is reaching out to supply all possible demands, and through his corps of trained solicitors is endeavoring to load the plant with long-hour users of current, thus giving to the customer a low rate, while the company is better enabled to make a fair return upon its investment.

Allied with the question of rates is the problem of government supervision or regulation. This matter is demanding serious consideration at the present time: Witness the Massachusetts Gas and Electric Light Commission, which has been in existence several years, the newly formed New York State Lighting Commission, and the bill just passed by the Massachusetts Legislature, adopting the English automatic method of control called the "sliding-scale system."

A study of the municipal undertakings in Great Britain and the constantly growing list of municipal failures in the United States shows that municipal ownership is, in fact, no longer as popular as it once was. Some agitation, however, is being kept alive by the socialist, by the unscrupulous political agitator and by the "yellow journal," whose whole fabric is based upon class hatred, whose teachings are that all riches come through stealing from the poor, and whose very existence depends upon its ability to pervert the facts and to "fake" reports so as to make interesting reading for that part of the public loving sensation.

The proper treatment for the wilful perversion of public opinion by the press is a difficult problem. Our laws as to the deliberate publication in newspapers of false and wilfully misleading statements are not sufficiently severe. However, there still remains a powerful antidote in the hands of the public. The main support of the newspaper is its income from advertising. Its value as an advertising medium depends upon the quality and quantity of its circulation, and if those who advertise will exercise a healthy discrimination between those journals whose policies and performances are calculated to promote or to destroy the interests of their advertisers, the power for evil of some of them will be reduced.

A general reduction in price for current and a readjustment of rates is constantly taking place all over the country. Flat rates are fast becoming things of the past, and wattmeters, in conjunction with various kinds of demand systems, are now almost universally used. Although the public has been for years trying to understand the "demand system" of charging, it still objects to it, and there is a feeling in some quarters that we may have to return to the straight meter rate, which, although admittedly unjust and unfair, still has a decided advantage in its simplicity.

Along with the general reduction in rates is a lowering of the charges for street lighting, and in

[illegible]

if anything, Mr. Marks was too charitable to the new lamp in comparing it with the enclosed arc.

After the luncheon adjournment the report of the steam-turbine committee was presented by Chairman W. C. L. Eglin. This is the third report of the committee, and as the necessity for the investigation has passed, the turbine having become a standard piece of apparatus, the committee, which has done excellent work, was discharged with the thanks of the association. I. E. Moultrop of Boston, the second member on the committee, made an abstract of his supplementary report on turbine practice in Europe.

"Mechanical Refrigeration" was the subject of a good paper by John Meyer of Philadelphia. He said that the cost of operating the small refrigeration machines by the electric motor at usual rates compares favorably with the cost of ice. This subject aroused much interest. For one thing, it was shown that it was difficult to get the refrigerating plate, owing to the great demand for small machines. Deliveries are not promised by the refrigeration people within 90 days. In answer to S. B. Storer of Buffalo, Mr. Meyer said that the business should be considered a part of the general power proposition at the station. It is a mistake to think the refrigeration load does not interfere with the peak. D. F. McGee of Red Oak, Iowa, said that they made a low rate for refrigeration business on condition that the power should not be used during peak hours. L. H. Scherck of Birmingham, Ala., Mr. Freeman of Brooklyn and Fred E. Matthews of Hartford also discussed the paper briefly.

In a paper on "Fuel Economy," J. Henry Hallberg of New York advocated the use of the Arndt automatic carbon-dioxide recorder, to show by continuous test of flue gases whether the boiler firing is properly done. The apparatus is made in England and costs $375 on the dock in New York. It is advisable to have one for each furnace, but it is possible for one recorder to be connected to four or six furnaces. The speaker said that three of these recorders in New York saved $300 a day.

James I. Ayer of Boston read a sensible report on electric heating, particularly for residences. He repeated to some extent his well-known views on the subject. Max Loewenthal of New York opened the discussion. He said the apparatus can be sold only by demonstration. Education is needed more than solicitation. Central-station men should believe absolutely in electric heating and cooking. Actual bills show that a family of four can cook by electricity at a cost of less than seven dollars a month at the five-cent rate for current. Heating circuits in houses should be separate from lighting circuits.

W. S. Partridge read the paper of Paul Spencer of Philadelphia, on "Overhead Line Construction." This was a thoroughly practical paper. In answer to Mr. Murdock of Terre Haute, the speaker said that he had heard of McIntyre sleeves, such as are used in telephone work, being used on a short transmission line. Answering the question of Mr. McCabe of Lewistown, Pa., Mr. Partridge said that high-tension strain insulators are hardly satisfactory. After some other discussions, adjournment was taken for the day.

Tonight there is a reception and dance at the Marlborough-Blenheim. President Blood is adhering to the programme closely, and the order of events as given in the Western Electrician of last week will probably be carried out. While it is impossible to forecast the election of officers, it is proper to say that if the precedent of former years is followed, Arthur Williams of New York, now first vice-president, will be promoted to the presidency.

W. E. K.

The Chicago "Special."

Seven cars made up the special train which the Pennsylvania Railroad Company ran from Chicago to Atlantic City. It included a baggage-buffet car, a diner, a compartment-observation car and four standard sleepers. It left Chicago at 3 p. m. on Sunday, June 3d, and arrived in Atlantic City about five p. m. on Monday. Before leaving Chicago each lady in the party was presented a long-stemmed American Beauty rose by the Western Electrician. Hand-painted souvenir menu cards, with electrical skits, were also provided. These were designed by Mr. and Mrs. Frank L. Perry, Mr. Perry being the western master of transportation. George G. Beltzhoover, district passenger agent of the Pennsylvania in Chicago, also accompanied the party and looked out for the comfort of all. Following is a list of the names of those on the Chicago special train:

Louis R. Alberger, Alberger Condenser Company, New York; Harold Almert, Constantine (Mich.) Hydraulic Company, Chicago; G. H. Atkin, Electric Storage Battery Company, Chicago; Frank J. Baker, North Shore Electric Company, Chicago; R. H. Ballard, Edison Electric Company, Los Angeles, Cal.; Mrs. R. H. Ballard, Los Angeles, Cal.; Ernest J. Bechtel, Toledo Railway and Light Company, Toledo, Ohio; G. C. Beltzhoover, Pennsylvania Railroad, Chicago; J. A. Bendure, Lima, Ohio; Mrs. J. A. Bendure, Lima, Ohio; Alexander H. Boyd, Fort Wayne Electric Works, Fort Wayne, Ind.; William G. Brown, Ewing-Merkle Electric Company, St. Louis; T. Douglas Buckwell, Toledo Railway and Light Company, Toledo, Ohio; George R. Carr, Dearborn Drug and Chemical Works, Chicago; W. H. Colman, General Electric Company, Chicago; J. R. Cravath, Electrical World, Chicago; S. F. Dibble, General Electric Company, Chicago; W. S. Doran, Allis-Chalmers Company, Milwaukee; W. H. Fellows, Leavenworth Light and Heating Company, Leavenworth, Kan.; W. J. Ferris, Illinois Traction System, Danville, Ill.; George B. Foster, Allis-Chalmers Company, Chicago; Mrs. O. C. Foster, Chicago; Edwin J. Fowler, Chicago Edison Company, Chicago; H. B. Gear, Chicago Edison Company, Chicago; John H. Gulick, Chicago Edison Company, Chicago; C. F. Hewitt, St. Joseph Railway, Light, Heat and Power Company, St. Joseph, Mo.; C. A. S. Howlett, Western Electric Company, Chicago; Eugene W. Judge, Tyler Electric Light and Power Company, Tyler, Texas; W. E. Keily, Western Electrician, Chicago; E. F. Kirkpatrick, McRoy Clay Works, Chicago; W. C. Knight, Fort Wayne Electrical Works, Fort Wayne, Ind.; P. H. Korst, Janesville Electric Company, Janesville, Wis.; John G. Learned, North Shore Electric Company, Evanston, Ill.; E. C. Little, Duluth, Minn.; Mrs. E. C. Little, Duluth, Minn.; E. W. Lloyd, Chicago Edison Company, Chicago; W. B. MacDonald, Evansville Gas and Electric Light Company, Evansville, Ind.; D. F. McGee, Red Oak Electric Company, Red Oak, Iowa; T. W. McNamee, Wabash Water and Light Company, Wabash, Ind.; L. D. Mathes, Union Electric Company, Dubuque, Iowa; Mrs. L. D. Mathes, Dubuque, Iowa; E. J. Mock, Telephony, Chicago; Charles T. Murdock, Terre Haute Traction and Light Company, Terre Haute, Ind.; Frank L. Perry, Western Electrician, Chicago; Frank B. Rae, Jr., S. W. Lee Company, Newark, N. J.; Francis Raymond, Chicago; Charles Retallic, Light and Power Company, Marquette, Mich.; P. B. Sawyer, Des Moines Edison Light Company, Des Moines, Iowa; S. E. Schweitzer, Omaha Electric Light and Power Company, Omaha, Neb.; H. Scribner, General Electric Company, Chicago; Mrs. J. Scribner, Chicago; A. A. Serva, Fort Wayne Electric Works, Fort Wayne, Ind.; W. G. Shelton, Shelton Electric Company, Chicago; Mrs. W. G. Shelton, Chicago; Edward P. Smith, N. W. Harris & Co., Chicago; H. C. Sterling, Municipal Electric-light Plant, New London, Wis.; William I. Sturtevant Paducah Light and Power Company, Paducah, Ky.; H. F. Tate, National Conduit and Cable Company, Chicago; Elmer E. Themes, Economy Light and Power Company, Joliet, Ill.; Mrs. George B. Tripp, Colorado Springs, Colo.; George B. Tripp, Jr., Colorado Springs, Colo.; Samuel B. Tuell, Terre Haute Traction and Light Company, Terre Haute, Ind.; C. E. Van Bergen, Duluth Edison Electric Company, Duluth, Minn.; Mrs. C. E. Van Bergen, Duluth, Minn.; R. S. Wallace, Peoria Gas and Electric Company, Peoria, Ill.; J. R. Wiley, Standard Underground Cable Company, Chicago; Miss Wiley, Chicago.

Mercury Arc Rectifier System with Magnetite Lamps for Street Illumination.[1]

By W. S. Barstow.

Many times in the history of the electrical industry the end of a particular commercial development appears to be near at hand, only to be indefinitely postponed by a new discovery in this or some other allied science, which accidentally opens up new possibilities. Often, again, the failure in some special line is caused by the absence of a single element, which, when forthcoming, turns the failure into an important success. Sometimes all the elements are present, but scattered through different industries, so that there is not a sufficient familiarity or knowledge in the hands of any one person or group of persons for a combination to produce the desired result.

Among all the radical changes in the details of the industry during the last years, the electric arc lamp has shown but little material progress. It is true that there have been evolved the high-tension, the low-tension, the open, the enclosed, the direct and the alternating-current systems, with their many modifications, but in none of these has there been any departure made from the carbon arc and its relatively uniform efficiency for a given illumination. From the day of Sir Humphrey Davy, in 1808, when, with a battery of 2,000 elements, he produced his four-inch flame between charcoal points, to the present refinement of the 150-hour enclosed lamp, progress has been confined more or less to mechanical improvements. The commercial arc lamp of the early day was of open-arc type, requiring 500 watts at the arc to produce what was then termed a "nominal" 2,000-candlepower light or a certain illumination. After passing through the series and multiple stages, the enclosed lamp was evolved, economical in maintenance, but with no improvement in consumption of energy. This, in the direct and alternating-current form, is the type in general use today.

There has during the last two years been in course of development a new system (if it may be so called) for outdoor street arc lighting, which not only promises to take an important place in the history of the art, but in many instances to replace the carbon arc. It is actually the first successful effort to increase commercially the efficiency of outdoor arc illumination, while at the same time it opens up new fields where the present-type lamps cannot be used. The magnetite mercury arc-rectifier system requires not only 35 per cent. less energy at the lamp than any existing system for the same illumination, but makes it possible to do outdoor street arc lighting from transmission systems of 35 cycles and under without the use of motor-generator sets or other moving apparatus. In the city of Portland, Ore., about two years ago, this system was installed on a small experimental scale. The street-lighting system at that time had been in successful operation for many years and was of the old-style open-arc type, supplied with direct current.

In the very early days current supplied to Portland was generated by waterpower at Oregon City, about 17 miles south of Portland, and was transmitted to Portland for arc and incandescent lighting. As all arc lighting was done on the high-tension system and incandescent lighting on the high-frequency, single-phase system, each machine had a separate set of feeders from Oregon City to Portland. (This was one of the first instances where, previous to 1892, single-phase high-frequency machines were operated at a direct pressure of over 4,000 volts.) The business increased so rapidly that in 1891 there was transmitted in actual commercial capacity energy for 7,200 incandescent and 650 arc lamps by means of the systems above mentioned. As business grew and electric railways were installed in Portland, a second power plant was built at Oregon City, and a 33-cycle three-phase 5,000-volt system installed, with direct-connected vertical wheels, especially arranged for a head varying from 15 to 45 feet, and current was transmitted from there by rearranging the original arc and incandescent circuits, each generator being connected to a single three-conductor three-phase feeder. To each feeder in Portland were connected a set of statics and a rotary transformer, so that there were practically a number of independent generating and transforming plants. To provide for the city lighting, motor-generator sets were installed in Portland, each set consisting of a direct-current Thomson-Houston motor, directly connected to two direct-current arc machines. Thus, in these early days several transformations were necessary before the alternating current delivered to the sub-station was finally distributed to the system, and it required 806 watts per lamp of the transmitted energy in the form of 33 cycles, 5,000 volts three-phase to supply each 500-watt lamp installed in the city. In remodeling the system, as no arc lighting could be taken from the transmission frequency of 33 cycles, it was either a case of using alternating-current high-tension motor-generator sets, changing the frequency from 33 to 60 cycles, or a high-tension motor directly connected to direct-current arc machines. Under these conditions, and with the original idea of reducing motor-generator capacity and the investment in generating system, several magnetite lamps were installed as an experiment about two years and a half ago, and from that time to the present modifications and improvements were made until now the lamps are equal in all respects to any arc lamp of either alternating or direct-current system. In the meantime lengthy experiments were made with the mercury arc rectifier. About one year ago the results appeared so promising and so much progress had been made in such a short period that an order was placed to install the entire system of over 1,200 lamps in Portland with mercury arc rectifiers and magnetite lamps. There have now been in operation in Portland for several months over 800 lamps with rectifiers, and the installation is being rapidly increased as fast as deliveries can be made. The system has proved successful and has fulfilled expectations. Considerable difficulty in the form of static discharges and short life was at first experienced with the tubes. The tubes, which were of small size, were subjected to very rigid requirements on account of the alternating-current pressure of 18,000 volts, a pressure which was very much higher than anything yet attempted with mercury arc rectifiers. The tubes have now averaged over 650 hours, and several have exceeded 730 hours, 500 hours being the economical requirement, and anything above this being in the nature of a gain in the original calculated efficiency of the system.

A simple description of the system as installed is as follows: The transmitted energy in the form of 10,000-volt three-phase 33-cycle current enters constant-current transformers, each transformer being of single-phase design, the primary of which is wound for 10,000 volts and the secondary for 16,000 volts. In the secondary is a center connection for the rectifier. The mercury arc rectifier is mounted upon a switchboard panel directly above the oil switch. It is excited by a small amount of 115-volt alternating-current energy. This is sufficient to start the rectifier after the same has been moved slightly with a handle for that purpose in order to establish the mercury arc. It requires but a few seconds to start up a circuit, and, when once started, it is not necessary to maintain the exciting circuit in operation, although this has been the practice up to the present time. In each side of the alternating current of the transformer is placed a reactance and another in the direct-current side. The lamps themselves require four amperes at an average of about 80 volts, or 320 watts, and give an equal illumination to the old-type open lamp, requiring 500 watts. As the original distributing system was installed for 10-ampere lamps, losses in these conductors have, of course, been reduced to a minimum. The present lamps are installed in units of 75 lights. An extra transformer

[1] Paper read before the National Electric Light Association, Atlantic City, N. J., June 5, 1906. Mr. Barstow is a consulting engineer in New York city.

panel with rectifier is provided, so that in the case of any accident happening to the transformer or rectifier the circuit can immediately be plugged in on the pair set. The lamps themselves are, no doubt, familiar to many, having been described in some of the technical papers.

The efficiency of the rotary transformer motor-generator system, as originally installed in Portland to take care of the street arc lighting, from the alternating-current transmitted energy to the direct-current energy distributed to the lamps, was 62 per cent at or near full load (which is the prevailing condition).

The efficiency of the constant-current transformer mercury arc rectifier system from the alternating-current transmitted energy to the direct-current energy distributed to the lamps is at full load 88 per cent (at 10 per cent overload, 89 per cent); at three-quarter load, 85 per cent; at half load, 81 per cent; and at one-quarter load, 80 per cent. This efficiency was obtained by measuring the true watt input of the primary alternating-current energy and the true watt output in direct current, and includes all transformers and reactances, but not the small fan motor used to cool the rectifier tube.

Having thus effected a saving of 26 per cent in the efficiency of the transforming system itself in Portland, the company secured further economy by the use of magnetite lamps, using 320 watts in the lamp in place of the 500 watts, thus obtaining for 364 watts of transmitted energy the same illumination that originally required 806 watts, or a saving of 1,768 kilowatt-hours per lamp per year; or on the total Portland installation a saving in capacity of 531 kilowatts, and a saving in total energy of 2,121,600 kilowatt-hours per year.

The efficiency of a standard motor-generator set using a high-voltage motor and direct current arc generator is about 76 per cent., so that if in a modern installation where low frequency alternating current is transformed by synchronous-motor arc machines into direct-current energy for present type of 500-watt arc lamps, there should be installed the constant-current transformer mercury arc rectifier system with magnetite lamps, the gain in efficiency for the same illumination would amount to 294 watts per lamp, or 1,176 kilowatt-hours per lamp per year.

The high commercial efficiency of the latter system is due to a very large extent to the simplicity and economy of the rectifier tube itself. A tube of a capacity of about 30 kilowatts has a constant loss of but 25 volts, or, at four amperes, 100 watts per hour, while the cost of renewing the tube on the basis of 500 hours' life about equals the cost of labor and renewals on a motor-generator set.

Owing to the fact that both parts of the alternating-current waves are used, the voltage of the alternating current leaving the transformers to the rectifier tube to produce a desired voltage in distributed direct current must be about three times the desired direct-current voltage required by the lamps in circuit. Thus, about 18,000 volts on the secondary of the transformer tubes gives a useful direct-current voltage of about 6,000.

In the use of the magnetite system a commercial question arises which, after very careful consideration, should be definitely answered before the system is adopted to any great extent. I refer to the specifications used in the present public lighting contracts. About 15 years ago considerable thought was given to the subject by this association, resulting in a campaign of public education which produced the proper result at that time of rating street arc lamps by the "watts in the arc" and dropping out of contracts the term "normal candle-power." If the price of public lighting is to be fixed by "watts in the arc" on the same basis as present cost, the public will profit by this lamp (due to lamp efficiency) to the extent of 36 per cent., the company gaining in transformer efficiency to an extent of 17 per cent.

The question as to how the public and the companies should share this gain so as to determine under what specifications the illumination should be furnished is a broad one and is a matter that should be carefully considered at this time, so that the introduction of this new system shall be accompanied by a proper standard form of specifications.

Electrical Trades Exhibition for Canada.

An electrical trades exhibition for Canada is to be held in Montreal during the week of September 17th under the auspices of the Electrical Contractors' Association. The purpose is to gather under one roof in a thoroughly comprehensive exhibit the most important inventions and appliances of the electrical world. These will include the latest and best methods and appliances in the field of electrical science, and diplomas will be given for the best exhibits and for the most useful inventions shown. The awards will be made by a committee of three experts, of which Prof. R. B. Owens, C. E., M. Sc., professor of electricity at McGill University, will be chairman. The importance of Canada as an electrical field is well known, and already the Dominion is alive with electrical development.

Fuel Economy.

By J. H[illegible][1]

It is today an [illegible] that the most reliable [illegible] results of combustion [illegible] furnace is [illegible] determining the percentage of CO_2 [illegible] they contain. Carbon [illegible] chemical combination of [illegible] ingredient of the fuel [illegible] in the atmosphere [illegible]. To effect the complete [illegible] quantity of fuel of given [illegible] of atmospheric air is required [illegible] no more and no [illegible] admitted to the furnace, because the percentage of CO_2 in the flue gases is directly dependent on the quantity of air admitted. It is the percentage of CO_2 which discloses whether or not the proper conditions prevail for such complete combustion.

Theoretically speaking, the presence of 21 per cent of CO_2 in the flue gases would indicate perfect combustion. In furnace practice it is, however, impossible to obtain good results when only the theoretical amount of air corresponding to the above 21 per cent of CO_2 is applied. A certain excess of air is required, this excess, however,

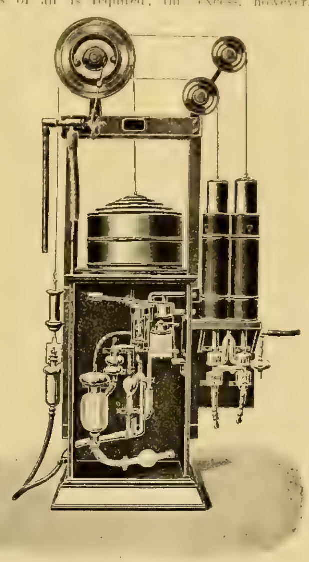


FIG. 1. AUTOMATIC CARBON-DIOXIDE RECORDER.

should not be more than about 35 or 40 per cent. over the theoretical amount, and the percentage of CO_2, therefore, that would indicate the best practical results—that is to say, the highest attainable heat from the smallest amount of coal—is about 15 to 16 per cent.

It is a remarkable truth that even the best equipped but uncontrolled furnaces hardly ever show anything like this percentage, in fact, the great majority never reach more than about seven or eight per cent., corresponding to about 20 to 21 per cent. loss in fuel.

This applies alike to mechanically and to hand-fired furnaces. Then there are in addition the great bulk of old type of boilers and furnaces in which the average result is not more than five per cent.

The enormous quantity of fuel thus continually being wasted is vividly revealed by a study of the following figures:

When the percentage of CO_2 is 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 per cent.; then the percentage of loss of fuel as compared with the theoretically lowest possible quantity is 90, 60, 45, 36, 30, 26, 23, 20, 18, 16, 15, 14, 13, 12 per cent.

Now, it is in the power of every engineer to improve considerably the working results of the particular installation under his care and to raise it to the highest standard of economy within the possibilities of the particular plant by means of keeping continuous records of the percentage of CO_2 obtained in the furnaces.

A few days of experiment will determine the exact draft pressure necessary for the highest attainable combustion, and the dampers will be regulated accordingly.

It will be easy to ascertain what method of firing will bring the best results and what thickness of fire should be maintained. Should there be any flaws or cracks in the brickwork, or "holes in the

[illegible]

Some months ago the recorder [illegible] this country and [illegible] power plant in New York [illegible] the recorder was so [illegible] additional instruments have been ordered [illegible] users of boilers in the [illegible] orders within the past few months [illegible] recorders are now installed and are giving excellent service.

The accompanying illustrations, Figs. 1 and 2, show the automatic CO_2 recorder referred to and the following general description may be of interest.

The working of the recorder is based on the well known fact that a solution of caustic potash absorbs CO_2 gas (carbonic acid gas). The recorder consists of an air meter, gas pumps and analyzing and recording apparatus.

The motor consists of tank, bell and fittings. The interior of the bell is connected with the chimney by means of a tube. The draft in the chimney creates a vacuum under the bell, which is pressed into the tank by atmospheric pressure. Air is then admitted into the bell by the automatic action of a valve and the bell rises again.

This motion recurs about every five minutes and it is utilized to raise and lower a bottle filled with glycerine and to drive a pair of specially designed pumps, which pump flue gases through a tube from the chimney through the analyzing and recording apparatus.

So long as there is any draft in the chimney the motor will work without any further aid or super-

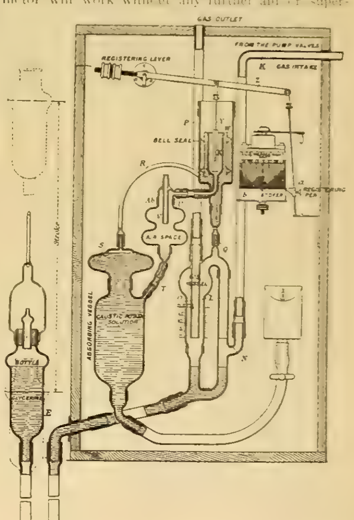


FIG. 2. DIAGRAM OF MECHANISM OF AUTOMATIC CARBON-DIOXIDE RECORDER.

vision. A chimney draft of half an inch on water is quite sufficient for driving the motor.

The gas pumps consist of two cylinders which dip into oil tanks and rise and fall alternately, drawing the flue gases from the chimney and forcing them through the recorder. As the pumps deliver about 20 times the volume of gas required for an analysis, the same gas is never analyzed over again.

1 Abstract of a paper read before the National Electric Light Association, Atlantic City, N. J., June 5, 1906. Mr. Hallberg is a consulting engineer of New York City.

Analyzing and recording apparatus consists in the main of a glass tube, which serves as a measure to bottle up 100 cubic centimeters of gases, of a bottle containing a solution of caustic potash, which absorbs the CO_2 gas, and of a pen which records the percentage of CO_2 gas ascertained. The pen draws ink lines on a clock-driven chart in the usual way.

The gases that are to be analyzed are forced into the record cabinet by the gas pumps through the tube (K), which is shown in Fig. 2.

Bottle (E) is periodically raised and lowered through the action of the air motor, and is in communication with the system of measuring tubes (L) by means of a flexible pipe (M). The bottle (E) is filled with a mixture of glycerine and water in the proportion of one part of the former to three of the latter; and when the bottle rises the liquid in the tubes (L) rises at the same time, and when it reaches the point (N) it closes the inlet for the gas from (K). Contained in (L) is an inner gas-escape tube (O), which is connected with the atmosphere by the pipe (P). When the liquid reaches the bottom end of the tube (O), exactly 100 cubic centimeters of flue gases are contained in the glass vessel (L).

As the bottle (E) rises farther the gases in the vessel (L) are gradually forced through the tube (R) into the vessel (S), which contains a solution of caustic potash 1.27 specific gravity. The whole of the 100 cubic centimeters of the gases have been forced over when the liquid in (L) reaches the mark (Q), this being the point at which the air motor reverses.

The moment the gases come in contact with the caustic potash in the vessel (S) the CO_2 is absorbed. The pressure of the remaining gases displaces the potash in (S) and forces it up the tube (T) into the air vessel (U). When the potash reaches the bottom of the tube (V), which connects (U) with the atmosphere, a certain quantity of air is bottled up in the space above. When the potash has risen to the bottom of the tube (V) it has driven 60 cubic centimeters of air at atmospheric pressure out through the tube (V); but on the potash rising further, it compresses the air in the upper part of the vessel (U) and raises the bell (W), which floats on a glycerine seal, clearly shown in Fig. 2. In the bell (W) is inserted an inner tube (X), which is closed at the lower end. To raise (W) to the point where the lower end of (X) touches the rod (Y), 20 cubic centimeters of air are taken up, and the remaining 20 cubic centimeters (making up the 100 cubic centimeters) serve to raise the registering lever (Z). To this lever there is attached the pan (a), which draws lines on the chart carried on the drum (b).

The chart is calibrated in per cents. from 1 to 20, and the time is marked on it. For every per cent. of CO_2 absorbed, one cubic centimeter of air less is displaced, and the registering lever is made to rise one per cent. less on the chart. It will therefore be seen that when there is no CO_2 present the pen will rise to the top of the chart.

In general it is advisable to have one recorder for each furnace. Where it is, however, desired to test several furnaces by one recorder only, the recorder may be connected with each furnace by means of a system of tubes, and the furnace to be tested is to be switched on. As a matter of fact, one recorder may take care of four to six furnaces in actual practice, where the firemen are accustomed to work by the recorder.

The recorder occupies about four by three feet of floor space and stands six feet high. The chart must be changed and the clock wound each day. The caustic-potash solution must be renewed every week when working night and day shifts, or every fortnight when working day shifts only.

The caustic-potash solution is made as follows: Three hundred and ninety-five parts by weight of caustic potash, 875 parts by weight of distilled water and 1,270 parts by weight of caustic potash, which gives a solution of 1.27 specific gravity. The cost of the solution required for one filling is about 30 cents.

Metal valves and other parts requiring fitting and care are not required for this recorder, as all inlets and outlets are opened and closed by means of glycerine, water and oil seals.

Where the load on the boilers fluctuates, as it will in lighting and railway plants, the recorder instructs the fireman how to handle the dampers.

The use of the CO_2 recorder enables the manager to get better service from his firemen, and in case of a strike it is possible to get fair results from inexperienced operators. The distribution of premiums to the fireman who maintains the highest CO_2 record will also suggest itself with the introduction of this recorder.

The automatic recorder may also be used in connection with gas-fired boiler installations, and several recorders are working in conjunction with producer gas plants.

When it comes to putting electric light in competition with the "Gold Dust Twins," the "Childs" cigar, and that other cigar which is for men, it may be said that some distance has been traversed along the road toward general publicity. Yet it appears that one enterprising manufacturer of electric lamps has entered this field co-operating with several equally enterprising managers of central stations.

The Institute Convention at Milwaukee.

[Proceedings of Monday and Tuesday, May 28th and 29th, were reported in the Western Electrician last week.]

Shunt and Compound-wound Converters.

On account of Wednesday being Decoration Day, and hence not a good day for inspection trips to the various industries in the city, it was decided to complete the reading of the papers scheduled for Wednesday and Thursday on Wednesday, thus giving an opportunity for the delegates to visit the various plants on Thursday.

The first paper to be taken up Wednesday morning was that of Mr. W. S. Waters. This paper, "Shunt and Compound-wound Converters for Railway Work," was abstracted by its author. It is a paper which balances the advantages and disadvantages and the cost of the two types of machines for railway work, and concludes as follows:

"Thus, with the shunt-wound converters instead of compound-wound machines with reactance coils, there results a cheaper, more efficient, and less complicated outfit, an outfit less liable to give trouble and which will give better results both in large and small stations. It is hardly to be wondered at then that the present tendency is to make all converters shunt wound. And I think the time is not far distant when the compound-wound converter will be considered as a special type of machine, to be used only to meet exceptional requirements. The shunt-wound converter will then be standard for all railway work."

J. B. Taylor of Schenectady, in taking up the discussion of Mr. Waters' paper, said that the statement that shunt-wound converters are the general tendency, is either a prophecy or else the ratio of the number of compound-wound rotaries to shunt rotaries have been incorrectly determined. In large cities, where the load is fairly well concentrated and uniform, shunt-wound machines are often used, and they have their advantage. In small stations, or where the load is far from uniform, there are very decided advantages in the compound-wound rotary converter. Their installation has been in good practice for years, is the present practice, and, in the opinion of Mr. Taylor, will be the practice for a good many years to come. The advantage of the compound winding is an automatic compensation for line drop, and in order to make the machines divide the load properly, an adjustment of the shunt to the series field is all that is necessary. Incidentally, the series winding is used to fix the polarity of a machine in starting.

Mr. Taylor was unable to state the difference in cost of the two machines, but believes that there is very little difference and that the efficiencies are practically the same. The reactive coils have a small loss compared with the output of the rotary.

Small systems operate very well with the compound winding, on account of a change of power factor with increasing load, the effect of which is to raise the generator pressure, and hence this generator pressure does not need to be watched so closely as only fairly constant voltage is required for the railway work. Regulation within limits is required, however, to keep down the power consumed by the motors for a given schedule. A special case of load distribution by means of reversing the series winding of a converter was cited, but this practice is very uncommon.

P. M. Lincoln agreed with Mr. Taylor in his remarks regarding the use of a compound-wound rotary. The characteristic of a shunt-wound rotary is the same as that of a shunt generator, but drooping to a less extent in the rotary. A rising characteristic is desired for railway work, so that compound winding is necessary. The compound winding does not add appreciably to the cost or complication of the machine, but a very slight cost is added to switching apparatus. The necessary reactance for the circuits may be obtained from the transformers and the cost of the active coils is saved. This is the standard practice in many cases.

Load distribution is not a function of the compound winding. If, in the connections between the high-tension lines and rotaries there is sufficient reactance, say, a separate bank of transformers for each machine, the difficulties in load distribution will practically disappear.

Mr. Lincoln cited the change of shunt-wound converters to compound-wound machines recently made by the Manhattan Elevated company, as an example of the tendency in the opposite direction to that stated by Mr. Waters.

In reply to the statements of Messrs. Taylor and Lincoln, Mr. Waters said, first, that he was sure from the design of compound-wound rotary converters that, in order to have control of the power factor, 50 per cent. more copper is required in the fields, and hence the cost of this machine is considerably greater than that of the rotary with a shunt winding; second, the use of transformers with the necessary reactance to do away with the reactance coils make the transformers special and not standard.

"The Self-synchronizing of Alternators."

This paper, postponed from Tuesday, was now read by Professor Brooks. By the use of properly designed inductances, using air cores, Professor Brooks has succeeded in synchronizing alternators in the laboratory of the University of Illinois, the switches being closed when the machine to be started was at rest. This machine being brought up to speed synchronized perfectly without any disturbance whatever on the system. This plan is suggested for use in paralleling synchronous frequency converters, though tests on such machines have not as yet been made. There was no discussion of this paper.

Magnetic Properties of Electrolytic Iron.

Prof. C. F. Burgess of Madison, Wis., next presented his paper on "The Magnetic Properties of Electrolytic Iron." This paper introduces some special precautions used in the magnetic tests as made by Prof. A. H. Taylor of the University of Wisconsin, and gives the results of tests made upon rings ground out of electrolytic iron, before and after heating. Such curves show a remarkable change in the hysteresis cycle. After heating the iron has good permeability, high magnetic viscosity and remarkable low hysteresis losses. That the magnetic properties of materials is a very live subject was shown by the discussion brought out by the reading of this paper.

Mr. E. F. Northrop made inquiries regarding the theoretical explanation of certain phenomena, which inquiries Professor Burgess referred to his colleague, Professor Taylor, who is making all of the magnetic tests. The deposits of iron have been successfully made only from solutions, not from fused salts, though Professor Burgess was unable to say why experiments with these salts were not successful. Mr. Northrop believes that a properly designed D'Arsonval galvanometer can be used for these tests. Such a galvanometer should have a narrow coil heavily weighted and the series resistance should be of manganin, so as to have a low temperature coefficient. Such a galvanometer will have a "constant."

Prof. D. C. Jackson called attention to the fact that this paper shows but a small amount of the work that has been necessary to get electrolytic iron in quantities of sufficient amount and sufficient purity to make such tests. The matter contained in this paper may seem highly theoretical, but it may have great practical applications. The metallurgy of iron and steel has been handicapped by the lack of sufficient quantities of pure iron for investigation purposes, and now, with electrolytic iron available, the systematic study of the effects of impurities in different quantities upon the properties of iron for different purposes may be carefully studied.

So far, it has not been found practical to melt this electrolytic iron and keep it pure, and Professor Burgess has before him the problem of making refractory crucibles which may be used for this purpose that will not introduce impurities into the melted mass.

C. F. Scott spoke of the great amount of energy lost yearly in hysteresis of iron. If a magnetic material can be obtained that will reduce this loss it will be a great step in electrical design.

Mr. Steinmetz referred to experiments made by him 13 or 14 years ago in which he obtained electrolytic iron by using mercury as a cathode, obtaining an alloy which was heated to a temperature at which the mercury was distilled and a spongy mass of iron resulted. This iron showed many of the characteristics of the electrolytic iron produced by Professor Burgess.

A study of this nature is important, as shown by the change in the conception of magnetism during recent years. Certain materials, such as iron, cobalt, nickel and magnetite, have long been known to be magnetic. Cr_2O_3 is also known to be magnetic, and an alloy of copper, aluminum and manganese was found to be magnetic by Mr. Steinmetz. It showed a high magnetic permeability and can be permanently magnetized. Strange to say, manganese steel is almost non-magnetic. The alloy of

copper, aluminum and manganese, referred to above, must be heated and then cooled in order for it to obtain magnetic properties, but when so treated is as magnetic as a bar of nickel. This alloy possesses an average atomic weight nearly the same as that of iron.

If antimony, three parts, is powdered and mixed with one part of powdered manganese and the two heated, after cooling it the mixture is magnetic, showing that a small quantity of manganese, heated in the neighborhood of antimony, makes the mixture magnetic. Melting zinc in the presence of manganese does not produce magnetic results, but dropping a piece of manganese into molten zinc has caused the mixture to become slightly magnetic. Manganese tin is found to be magnetic. All of this shows that manganese, in itself not magnetic, when used in alloys may produce magnetic properties, and such alloys need contain neither iron, nickel nor cobalt. Knowing this fact, it may be possible to find an alloy that will be an improvement over iron.

Professor Burgess closed the discussion by answering certain questions which had been raised. Forged electrolytic iron is being investigated. Professor Burgess found that manganese boride is strongly magnetic.

Measurement of Temperature by Electrical Means.

An excellent paper of the above title was read by its author, E. F. Northrop. Mr. Northrop very carefully described the design and construction of resistance thermometers for different purposes and took up the instruments used in measuring the resistance of these thermometers, including the instrument called the "ratiometer," as designed by himself. This instrument may give by direct deflection the ratio of the unknown to a known quantity, irrespective, within limits, of the current used, and it is as portable as a voltmeter or ammeter. This instrument was exhibited at the close of the session. The resistance thermometer is recommended for temperatures below the range of the mercury thermometer and above its range up to 1,000° C., as well as where automatic recording of temperature is desired.

In reply to a question asked regarding the use of the resistance thermometer for the measurement of the temperature of steam, Mr. Northrop said that he had designed instruments for that use, but did not know what satisfaction they were giving. In his opinion, there ought to be no difficulty in applying resistance thermometers to such work.

A motion was made by Dr. Steinmetz to the effect that a committee be appointed to take up the question of a code of ethics for the profession of electrical engineering. This question was suggested in President Wheeler's address. Prof. D. C. Jackson seconded this motion, and it was unanimously carried. The idea is to draw up a tentative code and submit this to the different members for changes and criticisms, and then take up such a revised code at the annual convention in 1907.

Educational Value of the Electric Test Car.

Thomas M. Gardner's paper, "The Educational Value of an Electric Test Car," was read, in the author's [illegible] by [illegible] a description of the [illegible] car [illegible] equipped by the [illegible] line of the test [illegible] with the same.

P. M. Lincoln made inquiry regarding the accuracy of the acceleration [illegible] Mr. [illegible] was not able to [illegible] believed it to be fairly accurate.

Prof. D. C. Jackson [illegible] two advantages, though from the p[illegible]tional point, as far as the [illegible] does not have any great advantage. It [illegible]vantage is in the fact that the [illegible] tain such apparatus [illegible] done and results published [illegible] were done by a private company, the results obtained would seldom be made public, [illegible] the college is brought into intimate contact with operating companies, which is always desirable.

The Art of Inventing.

"The Art of Inventing," a paper by E. J. Prindle, was next read. This paper dealt with the art of making technical and patentable inventions. After considering the rights given by patents and the question of invention in general, Mr. Prindle took up two very interesting examples of the way inventions are worked out logically from a problem presented to the inventor.

Mr. Steinmetz, in discussion, said that he did not believe in the "art" of inventing. It is the regular duty of the engineer. In any problem the engineer collects the knowledge and data available up to date, selects what is desired, puts it together, and then, in looking over the finished job, he sees something that has not been done by someone else, and obtains a patent just to prevent someone else from patenting this same feature and thus keeping him from again using it in case he so desires. He considers invention and patents as merely incidental steps in everyday engineering work. The question of credit for inventions is always accorded to the man who makes the last step, though there is nothing really new developed. Mr. Steinmetz believes the professional inventor only one step in advance of the professional promoter.

President Wheeler agreed with Mr. Steinmetz in his discussion. He gave an interesting account of his personal efforts to secure a certain "multiplying printer."

In reply Mr. Prindle stated that he did not believe Mr. Steinmetz a competent judge of inventions, inasmuch as it is so very easy for him to invent things himself. A man who brings things before the public in a useful way is the man who should have the credit, although the principle involved is not always new.

Branch Organizations.

The question of local organizations was informally discussed by many of those most interested at a dinner Tuesday evening, and C. F. Scott, chairman of the committee on local organizations, brought the matter up for additional discussion. Mr. Scott called attention to the following points which seemed to sum up the sentiment of the discussion previously held: First, each branch should be [illegible] [illegible]mmunity.

[illegible]

Mr. Steinmetz [illegible] of branch organizations [illegible] the [illegible] branch and, second, the [illegible] branch. He suggested [illegible] that a representative of local organizations be allowed to meet, for consultation, with the board of directors.

Dr. Sheldon closed the discussion by saying that he believed all members had the welfare of the institution at heart, but that there were various opinions as to what constituted the success of the society. When the movement of branch organizations started, it was stated that the possible membership of the society was 25,000, and the local branches can assist much in increasing the present membership. Dr. Sheldon believes there should be more full members, and invited applications on the part of those eligible for transfer. The volume of the transactions can be made large or small, but the quality of the papers is of utmost importance. The paper committee is called upon to solicit 90 per cent. of the papers published, and it is believed that the branches may be of considerable aid in obtaining suitable papers. He suggested that there be social as well as instructional elements for the younger members.

Concluding Papers.

The afternoon session opened with the reading of a paper on "Economics Derivable from the Use of Relatively Small Waterpowers of Low Head in the Middle West," by Prof. D. C. Jackson. This paper is a summary of what may be accomplished by the proper utilization of small waterpowers, as illustrated by the developments made by the Janesville Electric Company. There was no discussion of this paper.

"Some Fundamental Characteristics of Mercury-vapor Apparatus" was the title of a paper presented by P. H. Thomas. Mr. Thomas gave a resume of the knowledge of mercury-vapor apparatus up to date, and gave the detail of the more recent developments. He also stated in this paper his own tentative theory of the nature of the phenomena occurring in this type of apparatus.

Mr. Steinmetz prefers to find in the action going

SOME OF THE MEMBERS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS WHO ATTENDED THE CONVENTION IN MILWAUKEE.

on in mercury apparatus a physical conception rather than a metaphysical theory, and believes that the phenomena is not different from that exhibited in any arc, and he has given considerable time to the study of the arc in general. He has been successful in measuring the candlepower of mercury arcs by the usual method of measuring the intensity of light sources, utilizing a paraffin screen.

Measurements of reading distances taken by the illuminometer show that the illumination of a series mercury arc taking 160 watts, is the same as that for a 450-watt enclosed direct-current carbon arc lamp.

The series connection of converters does not seem necessary, since Mr. Steinmetz has succeeded in getting 25,000 volts direct current from one tube, and 4,000 to 7,000-volt tubes are now in operation on arc-lighting circuits.

Mr. Thomas agreed that many of the characteristics of mercury-vapor apparatus are the same as those of an arc in air, and yet in some ways they are essentially different. The starting resistance is only one point of difference.

The paper of C. M. Heminway on "Safety Devices for Steam Engines, Turbines and Motors" was read by title.

W. L. R. Emmet gave a description of the speed-limit device now used on all Curtis steam turbines manufactured by the General Electric Company.

David B. Rushmore's paper on "Electrical Connections for Power Houses" was also read by title. There was no discussion of this paper.

In the absence of Edwin R. Weeks, the paper entitled "Some Notes on the Lighting of Churches" was read by Mr. A. S. McAllister. There was no discussion of this paper, and the convention was adjourned by President Wheeler.

ENTERTAINMENT FEATURES.

Immediately after adjournment, the delegates were taken by boat and by special trolley cars to White Fish Bay, where a dinner was provided by the local management. Impromptu toasts were responded to by several of the prominent engineers present. A vote of thanks was given to the Milwaukee committee for the excellent way in which it had looked after the business as well as the social details of the convention.

Thursday was reserved for visits to the various industries in the city, the delegates being left to go to whatever plants they desired to inspect, no special trips being organized. On account of the fact that several delegates left the city on Thursday, the banquet scheduled for Thursday evening was omitted.

The accompanying group illustration shows a party of the Institute members who visited the works of the Allis-Chalmers Company. The picture was taken by Mr. A. L. Cross of Milwaukee, the party being grouped in one of the large factory buildings. Total attendance was about 225.

The convention seems notable for the large number of very excellent papers read and the high order of the discussions. The entertainment afforded by the local committee well sustains Milwaukee's reputation as an excellent convention city.

Aside from the reading of papers, the important business was a consideration of the new standardization rules, the appointment of a committee to draw up a code of professional ethics, and a more thorough discussion of the importance of branch organizations.

G. C. S.

New York Cities Want Cheaper Niagara Power.

Following the idea developed on the Canadian side of the river at Niagara to establish a municipal power league, the Referendum League of Erie County, New York, is engaged in a movement to obtain cheaper power on the Western New York side of the Niagara by organizing the various municipalities. With this object in view the mayors of Elmira, Rochester, Auburn, Lockport, Batavia, Dunkirk, Jamestown, the Tonowandas and Niagara Falls have been solicited to give the subject attention. A preliminary meeting was held at the University Club in Buffalo on the evening of June 1st. It was not over well attended, but letters from the mayors of several cities stated they would attend a general meeting when called. A committee of 25 was appointed to perfect arrangements and fix the date of the conference. It was stated at the meeting that Mayor Adam of Buffalo is about to ascertain the cost of electric power from Niagara through an investigation to be prosecuted by the Gas and Electricity Commission of New York state.

The Trenton-Clarkston Mill and Electric Company of Trenton, Utah, has been incorporated with a capital stock of $25,000.

The Self-synchronizing of Alternators.[1]

By MORGAN BROOKS AND M. K. AKERS.

The dexterity required for successfully connecting in parallel two synchronous machines, and the apprehension that is felt by the operator lest disaster result from the slightest inaccuracy of manipulation, suggested a study of methods of synchronizing in the hope of diminishing the hazard involved.

When two alternators are controlled as to speed and excitation preparatory to closing the switch between them, it may not be possible to adjust the speed with sufficient exactness to allow reasonable time for closing the paralleling switch at the proper instant. If the switch be closed at or very close to the zero-phase position, and there be no appreciable speed difference between the machines, no disturbance of the system is caused. A moderate speed difference is not serious, provided it is possible to close the switch at the proper moment, and automatic arrangements for so closing the switch have been devised. When there is a phase difference the existing vector difference in voltage is short-circuited through the two machines. The short circuit caused by closing the switch offers momentarily less impedance than the sum of the synchronous impedances of the two machines, because the resultant voltage cannot be in proper phase relation with the magnetic induction of both machines, and may not be with that of either. There will be an impulsive rush of current greater than one would be led to expect from dividing the vector difference voltage by the synchronous impedances of the two machines.

The actual momentary current is governed by the resistance and the reactance of the armature windings considered as inductance without iron core, rather than by the synchronous impedance as ordinarily measured. The iron core has not time to become magnetized and to react against the applied voltage before great damage may have been done with even a moderate phase difference. With large machines whose resistance and pure or non-iron reactance is relatively low, damage by even slightly inaccurate synchronizing will be more probable, as well as more costly, than with small machines, since the impulsive rush of current is proportionately greater. A moderate phase difference such as 10 degrees may be dangerous. If 10 degrees (in either direction) be taken as the limit of safety, in closing the switch at random the chances will be 17 out of 18 that damage will be done.

We propose to eliminate this great chance for damage by making it safe to close the paralleling switch at any time, regardless of equality of speed or of excitation. It is evident that the maximum circulating current may be reduced in any desired degree by the insertion of sufficient impedance between the machines to be synchronized. It is equally evident that the synchronizing power, or force tending to keep the alternators in step, will be affected; and it remained for experiment to show that it is possible satisfactorily to limit the current, while retaining sufficient synchronizing power. No compelling force exists so long as phase equality is maintained, and for small angles the force may be assumed to be proportional to the phase difference.

Steinmetz has shown that the synchronizing power of the current that may circulate between two machines in parallel under the normal condition of equal voltage depends upon the lagging of the current due to the inductance of the short-circuit path through the armatures of the alternators. To retain this lagging current and its desirable effect the impedance to be connected in series between the machines should be highly inductive. We tried various inductances such as transformer coils and arc-lamp regulators, but with indifferent success. If enough inductance was used to prevent too great an impulsive rush of current, the synchronizing current desirable at slight phase differences was too weak. If the inductance was adjusted to get fair synchronizing power, it was not safe to throw the switch at a very much greater angle of phase difference than without it. The range of safe angle was, however, perhaps doubled.

We next tried pure resistance, resulting, as might be expected, in loss of synchronizing power, since the circulating current did not have the required lag. The use of condensers in series confirmed the theory above outlined; for the alternators now assumed the 180-degree phase relation, and retained it with such persistence as to suggest easy synchronizing by using a reversing switch to connect the machines together in the zero-phase relation. At this point we proved by experiment that it was a simple matter to synchronize two alternators through the armature of a third alternator not running, and then by bringing this third machine up to synchronous speed to observe that it automatically fell into step, forming a delta-connected, three-phase system. The oscillograph showed that with equal excitation the electromotive-force curves were properly spaced in 120-degree positions, and that by varying the excitation it was easy to obtain a distorted delta of any desired shape, within reasonable limits, giving a simple means for obtaining any required vector difference of voltage or current, especially if one of the machines were a polyphase machine but used as a single-phaser in a delta arrangement. The connection was fairly stiff, it being possible to cut off the driving power from two of the machines, when they became alternating motors and carried their previous driving motors as load. The oscillograph showed that the experiment was successfully performed.

Having control of the synchronizing angle at the 180-degree and the 120-degree positions we felt that some way to secure the desired zero-degree angle must be available. A final idea of trying an inductance without any iron core came opportunely. This would secure the desired lagging current, and the pure inductance acting instantaneously would not permit an impulsive rush of dangerous value, even at maximum difference of phase. A trial met with flattering success; and by adjusting the amount of inductance we found that for a 7.5-kilowatt machine a value limiting the maximum current to about half its full-load amperes seemed the best, having due regard to objectionable reaction upon the system, as well as to synchronizing effect.

The experiments were tried at 60-cycle frequency, and the results were all that could be desired. We could close the switch paralleling two machines, while the machine to be brought into step was at a standstill, and then with approximate excitation it could be started and on reaching synchronous speed it would automatically fall into step smoothly, and with unexpected force, when the excitation could be adjusted and the inductance cut out.

It might be noted here that the circulating current between two machines connected together directly, and with a difference of phase-relation, is by no means equal to the current that would momentarily flow if the machines were switched together at the same vector difference; that is, there is not the danger to the machinery in having two alternators pull apart that there is in throwing them together with a large phase angle. The almost non-inductive character of the synchronous impedance of two large alternators at the first moment of closing the switch is the critical point of synchronizing.

In the case of a synchronous converter, started from the direct-current side, the use of coreless inductance to permit the closing of the connecting switch at any instant is found to introduce a difficulty not present when the converter is otherwise started. This is the occasional tendency of the converter to race as a direct-current motor, owing to the weakening of its field and consequent increase of armature current. This objectionable tendency is easily overcome by the use of a second inductance connected in series with the direct-current armature and additional to the starting box. This inductance should be with iron core, and it will act to prevent the rush of current due to any weakening of the field. This effect need be only momentary, as the converter does not tend to race; once forced into proper phase relation. We found it desirable to have the speed of the converter brought into step slightly below synchronous speed, or at least not greater, when random closing of the switch was uniformly successful, as with synchronous generators. As this condition is a perfectly normal condition of operation it adds no complication. It may be stated that when synchronizing by means of condensers with the 180 degrees phase relation, there is no tendency for a converter to race with any reasonable difference of speed either above or below synchronism.

We believe the coreless inductance method of synchronizing particularly applicable to synchronous frequency converters, although we have had no opportunity of testing it. The inductance should be arranged for connection in series with both frequencies. Using a large inductance, or purposely regulating the speed so that the synchronizing power is not quite strong enough to enforce falling into step at either frequency alone, the combined synchronizing power of both sides will exert enough force to draw the machines into step promptly and with certainty. The customary slipping of one or more poles would not require positive manipulation of any kind. Some adjustment might be necessary to attain the best results.

We would not wish it understood that in using coreless inductances for safe synchronizing of alternators we recommend closing the switch at random. If the operator closes the switch as heretofore at approximately the moment of least disturbance, a refinement of operation will result. The operator will know that any error of judgment will at worst cause an almost imperceptible disturbance of the system, instead of a possible disaster. A considerable difference in the excitation of two machines will not interfere in any way, since the voltage can be adjusted after synchronizing. Relieved from all anxiety, the operator will work more easily, and score a higher average of perfect manipulations. Less time is needed and the use of a synchroscope is not required, the indications of the lamp being quite accurate enough. The proposed inductance may be connected either in the primary or in the secondary circuits of alternators as desired, and while its value in henrys is different, the weight of wire in the coils would be approximately the same in either case; just as in a transformer the weights of primary and secondary windings are nearly equal.

The cost of a suitable coreless inductance is sur-

1. Paper presented at the convention of the American Institute of Electrical Engineers, Milwaukee, Wis., May 30, 1906. Mr. Brooks is professor of electrical engineering at the University of Illinois and Mr. Akers is a student at the same institution.

prisingly small, since a high current density may be employed, the heating effect being of secondary concern. It is impossible for the machines to maintain a sensible vector difference under normal conditions. Our tests indicate that a flat coil of large diameter for self-synchronizing need not cost more than one per cent of the value of the machine to be synchronized, and one coil might be sufficient for an entire station. Considering the advantages of its use, the cost of such an arrangement is negligible. The inductance for use in the direct-current side of a converter to be synchronized is of the same order as for the alternating-current side, but it is not quite safe to predict its proper value.

Our experiments have been made with equal success upon various types of converters and alternators, including the inductor type. Dissimilarity of wave form entails no difficulties. A certain hunting action that was always present with regular synchronizing in one series of tests was entirely absent with the new method. It is decidedly easier to connect in parallel two alternators by means of coreless inductance in series, than it is in direct-current operation to connect a second generator to the bus bars. Our experiments have introduced the inductance in one phase only, although it evidently might be used in all phases, should such method offer any advantage. The behavior of alternators as exhibited in the oscillograph curves while self-synchronizing is beautiful to observe, and we regret that the recent success of the process prevents us from presenting photographic records of the curves at this meeting.

Shunt and Compound-wound Synchronous Converters for Railway Work.[1]

By W. L. Waters.

The question of shunt or compound-wound excitation for synchronous converters has been discussed so much that it is of interest to compare the relative merits of the two. As the shunt winding is obviously the simplest and cheapest and most convenient way of exciting a synchronous converter it would be well to begin by considering why a compound winding is ever used.

In a direct-current circuit it is often an advantage to have a system which is to a great extent self-regulating as regards voltage. This is especially the case where the load changes frequently, and in such cases a compound-wound generator is used. A series winding on the generator field coils tends to make the voltage at the generator terminals rise as the load comes on the machine. This rising tendency is used to counteract the increasing voltage drop in the feeders and mains due to increasing load. By changing the series winding on the generator the rising tendency of the terminal voltage can be varied to almost any extent.

In a synchronous converter the ratio of the voltages at the terminals of the two sides of the machine is approximately constant and independent of the load on the machines or the magnitude of the excitation; that is, when transforming from alternating current to direct current, the direct-current terminal voltage bears an almost constant ratio to the alternating-current terminal voltage under all conditions. So the only way of varying the direct-current terminal voltage is to vary the alternating-current voltage supplied to the machine. If the direct-current voltage is to rise as the load comes on the machine, then the alternating-current voltage which is supplied to the machine must be made to vary in the same way. Assuming that approximately constant voltage is supplied at the generator end of the alternating-current feeders and that the circuit between the generator and the synchronous converters contains sufficient inductance, then the voltage at the synchronous converter end of the alternating-current line can be raised or lowered by introducing a leading or a lagging current into the system. A leading or lagging current can be introduced into the system by over or under exciting the converter. So by putting a series winding on the magnets of the converter the excitation of the machines will be increased as the load comes on, and a leading current approximately proportional to the load introduced in the alternating-current system. This will tend to raise the alternating-current voltage supplied to the converter, and, in consequence, the terminal voltage at the direct-current side. By means of this system a synchronous converter can be compounded in a manner similar to that employed for compounding a direct-current generator. The voltage at the direct-current terminals can be made to increase as the load comes on.

Here, then, is a system that gives automatic control of the voltage as the load varies. Such a system is obviously extremely useful and convenient. Unfortunately, this system presents a number of disadvantages in practice; a series winding is needed on the converter magnets, artificial reactance coils are practically always needed to insert in the alternating-current line, so as to bring its reactance up to the required value, and there is need for extra switchboard arrangements. This [illegible] increased complication [illegible] of efficiency. A compound [illegible] about seven or eight per cent [illegible] wound converter. [illegible] about five per cent [illegible]. The efficiency of the [illegible] one to two per cent. And [illegible] is more complicated and [illegible] ble to break down. There [illegible] trouble in operating the [illegible] winding on a [illegible] source of danger [illegible] its reversing. When starting [illegible] field can be short-circuited [illegible] time avoided, but if the attendant forgets the short-circuiting switch at any time there [illegible] trouble. And if at any time when the [illegible] are in use the alternating-current supply [illegible] cut out, and the machine [illegible] connected to the direct-current circuit the [illegible] and the converter is likely to run away, especially if the direct-current voltage is varying. A speed limit device should take care of this, but as automatic devices usually go wrong when they are most needed, so the fact must be accepted that a series winding introduces a possible source of serious trouble in any synchronous converter system.

The automatic compounding obtained by a series winding and reactance coils is not so satisfactory as would be expected. It is natural to expect that the most useful application of this system would be to overcompound converters in a small sub-station, to compensate for a large feeder drop in case where the load fluctuates violently. The results in such a case are, however, not always satisfactory.

To overcompound a converter and to change the voltage at the direct-current side means that the magnetic flux in the field magnets of the converter must change; as solid steel field magnets are always used in converters, the magnetism cannot change quickly; there is therefore often a considerable time lag before the voltage changes to correspond with the change in load. The result of this is that when the load is varying quickly the voltmeter needle is kept wandering aimlessly about the scale, indicating anywhere from, say, 500 to 650 volts, the voltage apparently not having any relation to the load on the machine. However, when the converter is flat-compounded instead of over or under compounded, the result is more satisfactory, as the natural tendency of the solid poles is to hold the magnetism and voltage constant.

Usually, however, small sub-stations are supplied from comparatively small power stations; and with a varying load on the converters one of the main effects noticed in the sub-station is the fluctuation of the speed of the engine, and consequently the speed of the converters and the alternating-current voltage. The effect of this variation in speed often completely masks all the results of the compound winding.

In addition, this method of compounding is often a nuisance. There must be careful adjustment of the series winding and of the reactance coils at the sub-stations before getting the desired effect. Then, if the converters are changed to another station, or if the line conditions are changed, the adjustment has to be made again. If other compound-wound converters are installed in the same sub-station, there is trouble to adjust them so that they divide the load properly at all loads. Equalizer connections are used, but the results are rarely altogether satisfactory. The different characteristics of the converters and the variation in the brush-contact resistance and the temperature of the machines all tend to upset the adjustment. If shunt-wound converters are not dividing the load properly, varying the field rheostat will quickly adjust the load. And in any case shunt-wound converters, just like shunt-wound generators, have a much greater natural tendency to divide the load properly than have compound-wound machines. With this automatic compounding the power factor of the converter system varies, and often varies widely, with the load. The power factor cannot be interfered with without upsetting the complete system of regulation. A shunt-wound converter tends to keep the power factor the same at all loads. In any case the power factor can be adjusted by means of the field rheostat without in any way upsetting the regulation.

The result of all the complication and disadvantages of a compound-wound converter with reactance coils is that often after the system has been in operation for some time the series magnet coils and the reactance coils are cut out and the converter is run as a straight shunt machine. The machine is then more in the control of the operator and is less liable to give trouble.

Probably the best system for general work is to have shunt-wound converters, standard transformers and no reactance coils. Somewhat over excite the converter, so as to keep the power factor a leading one at all times, and then leave the machines to take care of themselves, only adjusting the excitation in case they fail to divide the load properly.

In the case of a large station, the feeder drop is small and the fluctuations in load are unimportant, so that the voltage keeps fairly constant at all times. The only work then for the attendant [illegible]

[illegible] with shunt-wound [illegible] trouble and which will give [illegible] large and in small [illegible] at the time the present tendency [illegible] make all converters [illegible]. And I think the time is not far distant when the compound-wound converter will be considered [illegible] type of machine to be used only [illegible] requirements. The shunt-wound converter will then be standard for all railway work.

1. A paper presented at the annual convention of the American Institute of Electrical Engineers, Milwaukee, May 30, 1906. The author is a designing engineer of Milwaukee.

Equipment for Winona (Ind.) Interurban Railway Company.

The new trolley line being built for the Winona Interurban Railway Company, Winona Lake, Ind., from Warsaw to Goshen, Ind., a distance of 27 miles, is being rapidly brought to completion by the Electrical Installation Company. The railway company is controlled by the Winona Assembly, a Presbyterian organization in the nature of a "Chautauqua" society for that section. The line is located in a portion of two counties and will include Warsaw, Leesburg, Milford, New Paris and Goshen on its right-of-way. The Assembly organization is said to have spent over $3,000,000 in grounds and buildings, and the number of visitors from all parts of the state and elsewhere during the last summer aggregated more than 300,000 persons in all. The entire power and electrical apparatus is furnished by the Allis-Chalmers Company, Milwaukee, and consist of three sub-station equipments, six quadruple railway-motor equipments, rails, fastenings, etc., in addition to the outfit for the main power house, where one of the sub-station equipments will also be installed.

The main power house, when completed, will have installed in it two heavy-duty horizontal cross-compound engines 20 and 42 by 48 inches, for direct connection to two 600-kilowatt engine-type generators, 25 cycles, three phase, 2,300 volts. Each engine is designed for maximum steam economy at 850 indicated horsepower, and capable of a maximum continuous load of 1,500 indicated horsepower. Jet condensers will be used capable of condensing 20,000 pounds of exhaust steam per hour. One engine-driven and one motor-driven exciter will be installed, each capable of exciting the two 600-kilowatt generators, together with complete switchboard apparatus. Six 200-kilowatt transformers of the oil-filled water-cooled type will be used in the main station for stepping up from 2,300 volts to 10,500 or 33,000 line voltage at 25 cycles, three phase. One bank of three transformers will be installed for each generator.

Equipments for the three sub-stations will each consist of a 375-volt alternating-current rotary converter, compound wound, and two switchboards—one for an intermediate and one for a terminal sub-station. The six car equipments will consist each of four 75-horsepower railway motors complete with gears, pinions and gear cases, together with controllers, rheostats. Two thousand six hundred and forty-three tons of 70-pound rails in 33-foot lengths will be used.

Signs and Symbols in Preparing Drawings.

The National Electrical Contractors' Association at its last convention appointed a committee to draft a set of signs and symbols for use in preparing drawings for electrical work. This committee was instructed to collect data and suggestions on the subject and from this information to prepare a set of symbols, the intention being to ultimately bring about universal adoption thereof.

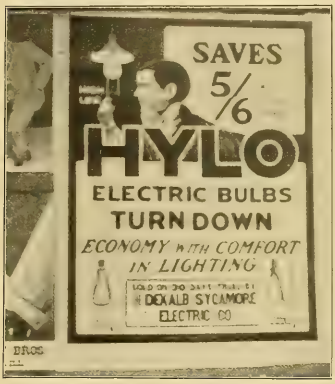
Contractors feel that such a system would be of great assistance in carrying out the requirements of electrical drawings. It is obvious that if the proposed system is practised universally all those having to do with the electrical work will become familiar with the symbols and be much assisted

thereby. Even the workmen actually installing the work would soon learn to know the symbols and thus avoid many questions and errors now occurring.

G. M. Sanborn, Indianapolis, Ind., chairman of the committee, is soliciting suggestions on the subject, and would like to gather as much information and as many ideas as possible by July 12th.

Poster Advertising of Incandescent Lamps.

Among the various forms of central-station business-getting enterprise which have recently been brought to light, none is much more startling than the posters used by the DeKalb and Sycamore Electric Company to advertise the Phelps Company's Hylo lamp, which it is sending out on 30 days' free trial. These posters are in two colors, are seven feet wide by 9¾ feet high and are technically known to the poster fraternity as "eight



POSTER ADVERTISING OF INCANDESCENT LAMPS.

sheets." The accompanying illustration is a reproduction of one of these posters as it is mounted on a billboard, and is a striking illustration of how the electrical business may be advertised to advantage.

Posters have been used by the gas-stove manufacturers for a number of years, but it is rather doubtful whether their use will become general in promoting an article like electric lamps, which appeals first to the upper 10 per cent. of any population.

The outcome of the present poster experiment will be awaited with considerable interest.

Duration of a Lightning Flash.

To measure the length of duration of a lightning flash is no easy matter. The determination is important, however, in that it gives the period of oscillation if lightning is really an oscillatory phenomenon. Mr. K. E. F. Schmidt tells in the Elektrotechnische Zeitschrift of Berlin of experiments made by him with a rapidly rotating disk 10 centimeters in diameter, on which was marked a white cross on a black background. This cross had arms two millimeters in diameter. The disk was rotated at a speed of 50 or 60 revolutions a second by clockwork.

Results of the experiments showed that in the light of certain lightning flashes the cross appeared once only, brilliant and very clear.

In most cases, however, the cross appeared twice, thrice, or even oftener, as a clear image, either with a succession rapid enough to give the impression of simultaneous production or at appreciable intervals. While the first cross was very luminous the intensity of those that followed was progressively weaker. The relative position of the different luminous crosses as well as their succession presented the greatest variability. Often the impression was given of a disk turning in the direction of the hands of a watch, although the actual rotation was contrary to this; or the observer had the impression of an oscillatory movement.

In the case of one extremely bright flash an octuple cross appeared for a moment, all of the arms being equally spaced.

The result of these observations is to confirm the opinion of Walther regarding the extreme variability of discharge phenomena in lightning.

The time elapsing between the partial discharges cannot be evaluated except in the case of images appearing almost at the same instant. According to the physiological investigations on the duration of residual images, the duration of the phenomenon cannot be greater than one-fiftieth of a second, or that of one revolution of the disk. Other observations show that the duration of a discharge is of the order of one-thousandth of a second, while the very brilliant phenomenon mentioned above corresponds to a minimum of eight discharges of equal intensity, following at regular intervals of about one-thousandth of a second.

In the case of the first type of discharge noted above the visible discharge must have ended after less than one-thirty-five-thousandth to one-forty-thousandth of a second; and the other discharges mentioned must have had the same minimum duration.

A Producer-gas Power Plant in Worcester.

Producer gas power has recently been adopted by the Norton Emery Wheel Company for extending its present steam plant at Worcester, Mass. The horizontal double-acting heavy-duty type gas engine built by the Westinghouse Machine Company of Pittsburg, has been adopted, with Loomis-Pettibone producers, using bituminous coal.

The new gas engine will be of 500 brake horsepower rated capacity, direct connected to a Westinghouse 250-volt 300-kilowatt generator, running at a speed of 150 revolutions a minute. This unit will operate in parallel with two belted steam units, the entire plant supplying current to the various motor drives in the factory, and also for lighting.

The Westinghouse engine will be of the tandem-cylinder single-crank style, water-jacketed throughout. Pistons will be supported practically clear from the cylinder by front, middle and rear crossheads. All valves are located directly in the cylinder body in a vertical line; inlet at the top and exhaust at the bottom. A sensitive governing system of the relay type places each inlet valve independently under the direct control of the governor, by which arrangement extremely close speed regulation is secured. Similar engines of this type are now operating the Warren and Jamestown Railway interurban system at Warren, Pa., at the Carnegie Technical Schools, Pittsburg, Pa., at the Standard Steel Car Company, Butler, Pa., and at the Carnegie Steel Works, Pittsburg. Engines of 3,500 horsepower are now under construction for the latter plant, designed to use blast-furnace gas.

At the Norton company's plant the gas used will be a mixture of two gases, averaging about 125 British thermal units a cubic foot. The producer process is intermittent, water gas being made during a short run, and "blast" or "air" being made while the producers are being blown preparatory to the succeeding water-gas run. After a thorough cleansing in wet and dry scrubbers, the gas is sent to a holder of sufficient capacity to secure a thorough mixture of the alternating charges of the two different gases. In this case a 20,000-cubic-foot holder will be used—sufficient to run the engine for about 25 minutes.

Electric-light Fraud in England.

The English papers describe a rather ingenious form of electric-light fraud, which is being worked in various parts of the country, and from its nature is calculated to entrap the unwary electric-light consumer, or even the wiring contractor. There is a London firm of so-called electrical engineers which is approaching various electric-light consumers throughout the country with an offer to reduce their quarterly accounts for electrical energy, and, what is more, to do it on the installment plan, "no saving, no payment." To this end, says Electricity of London, it offers to supply the consumer, free of charge, with incandescent lamps for any period, of not less than 12 months, taking payment for same from the consumer, monthly, in sums to be paid on the cash value of current saved by the lamps as compared with the corresponding period of the previous year.

Should the consumer not desire an easy system of payment, but offer to buy the lamps outright, the firm is prepared to submit any number of its lamps for testing, on the consumer's own meter, to prove what saving in current consumption is effected over the same number of lamps previously used. A condition of this test is that the consumer shall use new lamps in competition with the current-saving variety, in order to make the test apparently more fair. So far as current consumption goes, the offer is perfectly bona fide. The new lamps supplied by this enterprising firm do show a saving as compared with the ordinary 16-candle-power incandescents so largely used for the electric lighting of shops, hotels, restaurants, private houses, etc., but the trick consists in the substitution of a foreign-made eight-candlepower lamp, marked 16-candlepower, for the genuine 16-candlepower lamps already in use. With the aid of an ammeter these traveling salesmen readily convince the layman of an acknowledged electrical fact—viz., that an eight-candlepower lamp consumes less current than one of twice the candlepower, and the result is usually an order for the new lamps, which show a saving of about 33 per cent. on the quarterly accounts of the supply company. The essence of the fraud consists, of course, in showing off a new eight-candlepower lamp against an old one of 16 candlepower. The one takes less current, and is, apparently, more brilliant, hence the trapping of the unwary.

Portable Wright Demand Indicator for Transformer Testing.

Extensive use of the Wright demand indicator for ascertaining the maximum load on transformers calls attention to the fact that this device has found favor with central-station men for accurately determining this important information.

The Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass., has recently placed on the market a special portable outfit for the use of the Wright demand indicator in outdoor work, which is illustrated by the accompanying picture. The outfit includes a weatherproof housing and insulating board fitted with hangers to be attached to the cross-arm of the pole beside or near the

PORTABLE WRIGHT DEMAND INDICATOR FOR TRANSFORM TESTING.

transformer. Mounted at the bottom of the board is a Wood arc-circuit cutout which serves to shunt the indicator and to disconnect it from the circuit without interrupting the latter. The attaching plug is permanently connected to the indicator leads so that the entire equipment is self-contained and may be removed intact.

To test a transformer it is only necessary to install the equipment on the cross-arm and substitute the attaching plug for one of the fuse plugs from the primary fuse box. As the Wright demand indicator records the maximum current which has passed through it any time since it was last set, it may be read at any desired period after being connected—an hour, a day, a week, or a month—and will show with absolute precision the maximum load which the transformer has had to carry since it was connected.

The instrument may be connected in the secondary circuit instead of the primary, if desired, in which case the arc cutout, which is interposed merely for safety in reading and resetting, becomes unnecessary. On the other hand, smaller and cheaper instruments may be used for connection in the primary circuit as well as the operation being more convenient.

New Electric Plant in Greeley, Colo.

The Home Electric Light and Power Company of Greeley, Colo., has just installed and put in operation a new electric-light plant operated by producer-gas engines. The gas is generated by burning coal, and Colorado coal, which is not so hard as the Pennsylvania anthracite, nor as soft as the common bituminous, is the most superior for the gas-making purposes, it is said. Two 65-horsepower Olds heavy-duty gas engines, twin connected, are installed. The gas producer in the plant is said to deliver one horsepower per hour on the consumption of one-quarter of a pound of coal.

The Home Electric Light and Power Company was established through the efforts of Frank Abbott, professor of science in the State Normal School, several other members of the State Normal School faculty and local business men. Besides furnishing electricity for light, it is supplying power to various industries in Greeley.

The King River Electric Power Company of Eureka Springs, Ark., has been incorporated with a capital stock of $75,000.

Indiana Telephone Items.

The Winchester Telephone Company of Winchester has been acquired by the Eastern Indiana Telephone Company, and plans are being made for extensive improvements.

H. S. New, president of the Indianapolis Telephone Company, and Theodore Thorward, president of the South Bend Telephone Company, announce that they have arranged to build a joint metallic copper toll line between the two cities for through service. At present messages to both are transferred at Logansport and South Bend and the business is so heavy delays are complained of.

The Citizens' Automatic Telephone Company, capitalized at $300,000, has filed articles of incorporation proposing to build an automatic telephone system in Grant, Miami, Howard, Wabash, Fulton, Cass, Carroll, Clinton, Tipton, Madison, Delaware, Blackford, Wells, Huntington, Whitley, Marshall and Kosciusko counties. The company has secured a franchise in Marion and will at once build an exchange building and install the Strowger automatic system. The company may acquire and lease other systems and operate them from the Marion exchange.

Work has begun on the construction of a new $45,000 telephone exchange at Columbus by the Central Union Telephone Company. The company is clearing a site for a new eight-story exchange and office building in Indianapolis.

The underground wiring plans of the Cumberland Telephone Company at Evansville have been approved by the Board of Public Works and the company will proceed at once with the letting of contracts for the construction of the conduits. The company proposes to place all new material in its conduit system.

A receiver has been appointed for the Hanna-Jackson Telephone Company. The company was incorporated four years ago and possesses a franchise in Greenfield. The company has used the Central Union long-distance connections and was a competitor to the S. Morrison Company, an Independent. The new Central Telephone Company, with John Q. White president, composed of dissatisfied stockholders, has been formed and will begin the installation of a new plant at once. A contract has been made with the Morrison company for exchange and switch privileges.

James S. Brailey, Jr., of Toledo, while in Indianapolis this week, said the report that there had been a consolidation of interests in the telephone properties which he and his associates had recently purchased is incorrect. While the same men will practically control all the properties they will be managed and operated by different managements and different officers.

The Indiana State Board of Health has sounded a warning against the use of telephones without frequently disinfecting the mouthpieces. A sponge dipped into a five per cent. solution of mercuric chloride and wiping the surface thoroughly, and occasionally unscrewing the tube and immersing the parts in the solution is recommended.

The telephone business in Indiana is dealt with in a bulletin just issued by the Census Bureau. According to the bulletin Indiana has more telephone systems in operation than any other state in the Union, with the possible exception of Illinois. Only six other states reported greater net surplus from the telephone business after deducting all expenses, and these states have larger cities and outclass Indiana in population. S.

Ohio Telephone Notes.

Brokers connected with the Brailey syndicate which purchased a controlling interest in the Everett-Moore telephone properties two weeks ago have issued a circular giving the prices of the various securities that are to be placed on the market at this time. United States common stock to the amount of $2,050,000 par value is offered at $50 a share, par value being $100, and $150,000 par value Cuyahoga Telephone cumulative six per cent. preferred is offered at $45, par value being $50. Common stock of the Cuyahoga to the amount of $325,000 is offered at $28, par value being $50. On or before June 12th Cuyahoga common will be placed upon a four per cent. dividend basis, netting investors 7.14 per cent., and United States common will be placed upon a three per cent. basis, netting six per cent. A majority of the stock will be placed with the Cleveland Trust Company under a voting trust agreement, and voting trust certificates will be issued. These will be negotiable.

The executive board of the Citizens' Telephone Company of Meigs County has turned down the proposition of the Bell people to connect with their long-distance lines. A. B. Kratz, secretary and manager of the Meigs County Home Telephone Company, says that his company will soon build plants in Middleport and Pomeroy.

As a result of a strike of the telephone linemen in Cincinnati the Bell Telephone Company agreed to pay experts $2.75 a day and foremen $3 for a nine-hour day. Heretofore linemen have been paid $2.50 a day for a 10-hour day and foremen $2.75.

The Tuscarawas Telephone Company of Uhrichsville has announced that an increase in rates will be necessary if it is to continue in business. The company has just completed a new plant and has [illegible] telephones. The [illegible] Farmers' telephone [illegible] telephone [illegible].

The [illegible] Telephone Company [illegible] has obtained [illegible] Mansfield [illegible] telephones in operation.

At Portsmouth, the Home Telephone Company will spend $[illegible] for [illegible].

The Republic Telephone Company [illegible] has been incorporated [illegible] $[illegible] to build [illegible] Cumberland. J. C. [illegible] are interested.

It is said that W. [illegible] secretary of the [illegible] Telephone Companies, [illegible] subsidiary companies, to take the place of [illegible] B. Hoge, who resigned [illegible]. H. B. Taylor of Toledo is slated for [illegible] of the two large companies in place of D. H. [illegible], resigned.

The Mile Run Mutual Telephone Company of Marietta has been incorporated with a capital stock of $2,500 by William F. Watkins, L. F. Wynn and others. C.

Canadian Telephone Items

The Bell Telephone Company has received a five-year franchise from Berlin, Ont., on condition that the company removes poles and places wires underground along certain streets of the city.

The granting of permission to the Bell Telephone Company to increase its capital from $10,000,000 to $30,000,000 opens up to the present stockholders an enticing vista of valuable rights from time to time. There has been little of the company's stock sold lately, and it is doubtful if any quantity could be secured by vigorous bidding in view of the chances of handsome profits from future rights.

The decision arrived at by the Dominion government in regard to telephone companies settles a dispute between the companies and municipalities. The latter have been demanding the restoration of their control over their own street rights, to which the companies have replied that such would not only imperil their capital invested on the faith of a Dominion charter but would destroy the efficiency of their long-distance services. The government has compromised by protecting the existing property of companies, but will refer to the railway commission disputes as to renewals and extensions. Telephone rates and questions affecting the interchange of messages will be settled by the commission. W.

Telephone News from the Northwest.

The City Council of Duluth is considering some means of reducing the number of poles on the streets.

Business men of Fargo, N. D., recently voted to petition the council to reconsider the action refusing admission to the long-distance wires of the Tri-state Telephone Company.

A. C. Miller has resigned as secretary and general manager of the Redwood County Rural Telephone Company at Redwood Falls, Minn. He will go with the Vought-Berger Company of La Crosse, Wis., manufacturer of telephone apparatus.

The Hanley Falls Telephone Company has been formed at Hanley Falls, Minn., with $10,000 capital. I. Johnson is president.

The Vought-Berger Company of Lacrosse, Wis., has increased its capital stock from $57,000 to $200,000. W. W. Cargill has been elected president and M. I. Berger secretary-treasurer.

The Western Electric Telephone Company will absorb the Hanlontown (Iowa) Telephone Company and the Fertile (Iowa) Telephone Company.

The fight which has been waged for several months at Webster City, Iowa, between the physicians and the Martin Telephone Company, and which attracted wide attention, has come to an end, the company agreeing to the demands of the doctors.

The North Dakota Telephone Association held a meeting on May 29th at Fargo. A. B. Cox of Valley City was elected president and J. Carmody of Hillsboro secretary-treasurer. The annual meeting will be held at Grand Forks in January. R.

NEW COMPANIES.

Elmer B. Jones and others have been granted a franchise for a telephone system in Butte, Mont.

The Omaha Home Telephone Company of Omaha, Neb., has been incorporated with a capital of $2,000,000. J. E. Baum, N. P. Updike and H. A. Balbridge of Omaha and G. E. Wood of Lincoln are interested.

The following-named telephone companies have been incorporated recently: Boston Telephone Company, Moline, Kan.; West Point Mutual Telephone Company, Yukon, Texas; Garfield County Telephone and Telegraph Company, Panguitch, Utah; Kenton Telephone Cmpany, Clayton N. M.; Farmers' Mutual Telephone Company, Mountain Park, Okla.; Crystal Lake Telephone Company, White Lake, S. D.; Tonquawa Telephone Company, Anadarko, Okla.

GENERAL TELEPHONE NEWS

[illegible]

All of the chief towns of Italy are [illegible] connected by telephone, the [illegible] of Palermo, so that now Palermo [illegible] Turin or Venice [illegible]. It is the intention of the Italian government eventually to take all the telephones of Italy into its own hands. The total expense per [illegible] in Naples of a telephone instrument is $[illegible], a reduction being made to customers who have more than one instrument.

Inaccuracies of the Thermo-electric Pyrometer.

In a paper presented at the recent meeting of the American Electrochemical Society in Ithaca, N. Y., upon the subject of "Errors in Pyrometry," Mr. E. S. Shepard took occasion to point out many which are prevalent in the thermo-electric type. In discussing the paper Frederick F. Schuetz went quite thoroughly into this phase of the subject, pointing out many of the sources of error in the thermo-electric pyrometer and urging the necessity for their correction, for, as he said, this type of temperature-measuring instrument is probably destined to be the most important for measurements up to 3,000° F., being capable of both indicating and recording temperatures.

In regard to the nature of the metals forming the couple, Mr. Schuetz believed that much better results are obtained by using cheaper metals, such as nickel, steel, tungsten, copper, etc., instead of the high-priced elements of platinum with 10 per cent. of rhodium. A convenient method of insulating and protecting thermo-electric couples is to first wind each element with asbestos thread and then coat this with carborundum paint, using sodium silicate as a binder. For protection against 2,000° F. and over special tubes of nickel, plumbago or porcelain are employed. In lead baths and the like asbestos-carborundum insulated couples are further protected by an iron pipe welded together at the exposed end.

Error may arise in this type of pyrometer through variation in resistance in the system, due to temperature changes along the couple. Errors are also apt to arise from variations in the cold end of the couple. An ingenious method devised by Prof. William H. Bristol of Stevens Institute of Technology may be used to correct these imperfections. Professor Bristol employs a "low-resistance system" which does not exceed 10 ohms in total resistance, and in some cases is as low as 4½ ohms. Owing to the greater moving power of the greater current thus obtained, a commercial pivot type of instrument such as a Weston millivoltmeter may be used instead of a delicate galvanometer.

The resistance, which is chiefly located at the measuring instrument, may be provided with a mercury compensator adapted to cut out resistance from the circuit in the same ratio as it is introduced through rise of temperature, and vice versa.

To correct the cold-end-temperature error, a similar compensating device is inserted in series in the circuit and in close proximity to the cold end of the thermo-electric couple so as to be exposed to the same temperature as the cold end. As the temperature rises or falls, the electromotive force produced by the couple will be correspondingly decreased or increased for constant temperature at the hot end.

Books Received.

"Report of the Electric Railway Test Commission." Published by the McGraw Publishing Company, New York. Price, $6.

CORRESPONDENCE.

Great Britain.

London, May 23.—The case for the London County Council electric power bill has now been completed and the opposition of Mr. Merz's scheme is being heard. Were it not for the very obvious partisanship of the majority of the members on the committee it would not do to feel particularly sanguine about the result. To the minds of many engineers the scheme is incomplete, and it cannot be gainsaid that the council has but little sympathy at the hands of a large portion of the manufacturing ratepayers in London. Their position, too, is rendered somewhat anomalous in that it is proposed that the council should have the power to ask the Board of Trade to inquire into the prices charged by existing electric supply authorities, with a view to cheapening the price to the consumer and indirectly forcing the supply authority to take a supply in bulk from the council. This power is to be exercised outside London, where the council admittedly is in the position of an ordinary trading concern. On the other hand, the administrative County of London scheme does not suggest competition with other power companies—the County Council has taken portions of the areas of two existing electric power companies—but it goes further than the council's scheme by proposing to deal direct with the power user, and it also makes adequate provision in its estimates for coping with the possible demand for a supply in order to run the whole of the suburban railways electrically. The promoters of the company's bill strongly criticize the engineering features of the other scheme, such as the comparatively low voltage, viz., 6,600 volts, which is the pressure at the existing tramway power station, the absence of duplicate routes for the mains, etc.. On the grounds of general policy, however, it does seem that there are reasonable objections to the scheme. In the first place, by proceeding under a bill, the council is not bound to take the opinion of the ratepayers before going forward, and second, no powers have ever been granted in Great Britain to trade outside its area in the manner here sought.

In the engineering supplement to the London Times last week there is a warning article against the patronage of the schools which have been founded here for teaching electrical engineering through the mails. It is generally accepted that this system owes its origin to the United States and it is being pushed here somewhat vigorously. Whatever may be the abilities of the actual teachers, the somewhat specious advertisements which are published certainly tend to mislead the uninitiated.

An interesting discussion took place at the Institution of Electrical Engineers last week on the construction of overhead equipment, the theme of the paper which was discussed being that the equipment of the average British trolley tramway was much too heavy and could be made considerably lighter without deleterious effects. One of the reasons put forward for this state of affairs was that American engineers had come across, and without taking into account the difference in conditions, had designed the heavy equipments which the more stringent conditions in America, climatic and otherwise, necessitated. A little piquancy was added to the debate through, on the one hand, the American being credited with the cause of this, as stated above, and, on the other hand, an American charging us with copying American methods without due regard to our own conditions.

The wireless-telegraph bill, which will extend the period of the government supervision of all wireless installations for a further period of years, was considered by the House of Lords a few days ago. Instead of an extension for six years this has now been reduced to three years, but the interesting statement was made that the committee of Lloyds and the wireless telegraph companies were complaining that the government is exercising its monopoly in such a manner as to ignore the shipping and mercantile interests. No reply was made to this on behalf of the government, but the reduction of the period was assented to after the complaint was made.

The big generating station of the London County Council at Greenwich is to be opened on Saturday. At the same time a new bridge will be opened across the River Thames at one of the busiest spots in London. A short time ago this bid fair to be the first bridge over the Thames with a tramway on it, but the London United Tramways Company pushed forward with its lines over Kingston Bridge further up the river and opened them a few weeks back.

The refusal of the large majority of local authorities in Great Britain to set aside anything for depreciation in connection with their electric-lighting and tramway undertakings has been the subject of many a discussion in days gone by, and for that matter it still is. A report has been made by Sir A. B. W. Kennedy to the Edinburgh corporation respecting this matter, and this has been referred to a special committee.

The effort to float a company to run electric omnibuses in London has been a rare fiasco. A number of disgusted shareholders have made application to the courts for the return of their money and the applications have been granted. The methods of the company are deserving of all censure, and it has not been sparing from all quarters.

G.

New York.

New York city, June 2.—As a result of a fire in the subway last Friday evening, in which four cars were destroyed by fire, officials of the Metropolitan-Interborough Railway Company announce that nothing but all-steel cars will be installed for subway service in the future. The cars destroyed were so-called fireproof. They were built specially for the subway and were made of wood covered over with copper sheathing. The accident was the first in which cars were actually destroyed by fire in the subway. A portion of the West Side subway has three tracks, the center one being used for storing cars. Trainmen were backing an empty train onto the storage track. Through carelessness they collided with four cars already on the track and a car was thrown across the third rail, causing a short circuit. Immediately there was a blinding flash and fire broke out under the empty cars. Smoke soon filled a considerable portion of the subway and one loaded train actually passed the burning cars, but all were fortunate to escape. A number of trainmen and firemen were overcome in trying to get to the fire, but the smoke was so dense that the cars were left to their fate. The copper-sheathed cars were ruined, while one steel car was but slightly damaged. Thousands of passengers on the stalled trains were compelled to leave the subway through the various openings and find other means of getting home. Chief Engineer Rice says that he feels sure that before long the subway lines will operate nothing but all-steel cars without a particle of inflammable material in their construction.

Sitting in the Appellate term yesterday, three Supreme Court justices decided that a passenger, in order to obtain a transfer on a street car, need not demand it at the moment of paying his fare. They declare that this rule, which the companies have tried to enforce, does not tend to promote public convenience.

Another national business show is announced for October at the Madison Square Garden under the management of Messrs. Cochrane and Payne. This is the fifth of such shows and if this new one proves as successful both from the viewpoint of the exhibitor and the busy business man as have the previous four similar shows held in New York and Chicago, it will be an epoch maker in commercial history. Arrangements for it are already well under way and the demand for space has been great. Exhibits will be seen from France, Canada, England, Belgium, Spain, Italy and from South American republics. Everything that appertains to the proper and successful conduct of a business enterprise, large or small, and all the inventions, machines and devices, large and small, that help to save time, labor and money for the busy business men will be shown under one roof.

The Atlantic Telephone Company, through John M. Shaw, as president, has formally presented its two-cent telephone rate proposal to the Board of Estimate. Mr. Shaw objects to the requirement of an initial $250,000 payment to the city and with the clause allowing the city to control the capitalization of the company. He insists on $100,000 as a first payment, and wants no restrictions in regard to capitalization. He also wants the city to guarantee the right of entry to the conduits of the Empire City Subway Company.

The New York Telephone Company has announced the details of the new telephone rates which will go into effect July 1st. The city has been divided into zones with rates from five cents to 15 cents. The rate from Manhattan to Brooklyn will be 10 cents and to Staten Island 15 cents. The charge to subscribers in Manhattan and the Bronx will be $48 instead of $60 for 600 local messages. Nearby Long Island and New Jersey territory is also divided into zones. The zones in Kings and Queens counties are Brooklyn, Long Island City and Coney Island. Those in New Jersey are Jersey City, Hoboken and Bayonne. In Manhattan party lines will be $42 instead of $48 for 600 local messages. Direct line service only will be furnished to business houses connecting with central offices south of One-hundred-and-tenth Street. U. N. Bethell, vice-president of the company, said that it has spent $4,500,000 on construction in the last six months, compared with $1,500,000 in the corresponding six months of last year. The switchboards at the central offices have been enlarged, new cables have been laid in many sections of the city, and additional apparatus has been installed.

Yale and Harvard will be the names of the two new turbine steamships that the Metropolitan Steamship Company is building for the passenger trade between New York and Boston. The new vessels are two of the three original turbines that have been contracted for in the United States, and in point of accommodation and speed, it is said, will eclipse anything in the line of coastwise steamships yet built in this country. They are now being built at Roach's Ship Yards, Chester, Pa. W. & A. Fletcher of Hoboken have the contract for the engines.

C. I. C.

New England.

Boston, June 2.—The Rockville, Broad Brook and East Windsor Street Railway Company has established a through car service between Rockville and Warehouse Point, Conn. It is a subsidiary of the Hartford and Springfield Street Railway Company, and the roads of the two companies connect at Warehouse Point.

The Boston Independent Telephone Company and the Metropolitan Home Telephone Company have petitioned for franchises in Boston, and the aldermen will grant a public hearing thereon. It is said that one of these companies will take the property of the Massachusetts Telephone Company, the company which established a service in competition with the Bell company, some six years ago, and which is still in operation, with a few subscribers.

The Massachusetts legislative committee on metropolitan affairs has agreed upon a bill providing for a street-car subway for Cambridge. It provides that the Boston Elevated Railway Company may construct a subway under the supervision of the state railroad commissioners.

The New England Street Railway Club met at the American House in this city, May 24th, and listened to a talk on "The Fascinating Story of Rubber," by George W. Knowlton, who showed samples of rubber grown in different parts of the world, and illustrated his talk with stereopticon views.

The United States government has advertised for proposals for the electric wiring of gymnasium buildings at Fort Andrews at Boston Harbor and Fort Banks at Winthrop, Mass. The bids will be opened on June 12th.

The Atlantic Wire Company of Branford, Conn., has been incorporated in Connecticut. Its authorized capital is $25,000 and it proposes to make and deal in wire, wire goods and other iron and steel products. William E. Hitchcock of Branford and Joseph W. Kent and M. F. Hope of New Haven, Conn., were the incorporators.

The Wright Wire Company is about to build an addition to its wire mill at Palmer, Mass. The addition will be 50 by 40 feet, and will contain a first-class wire galvanizing plant operated by electric motors.

The Enfield Gas Company has applied for legal permission to change its name to the Northern Connecticut Light and Power Company. The new company will control the Enfield Gas Company, the Enfield Electric Light and Power Company of Thompsonville, Conn., and the Windsor Electric Light Company of Windsor Locks, Conn.

The full bench of the Massachusetts Supreme Court has set aside a verdict of $100,000 against the Boston Elevated Railway Company. The action was brought for alleged damages to the Hotel Essex property through the construction and operation of the elevated railway in Atlantic Avenue, in front of the hotel. The company pointed to the benefits enjoyed by the hotel through the near proximity of an elevated station, but the lower court would not permit these benefits to be set off against the damages caused by the structure. The Supreme Court holds that these benefits should be allowed and grants a new trial.

B.

Dominion of Canada.

Ottawa, June 2.—The question of the prohibition of export of electric energy from Canada will come before a conference to be held between the federal and provincial governments at an early date. In the meantime the Dominion government bill has been withdrawn in the House of Commons. This measure proposed to deal with the subject, but owing to the conflict of opinion as to whether the federal or provincial governments had jurisdiction in the matter the bill was dropped for the present.

The Yukon district has asked the federal government to install space telegraphy over the 1,200 miles between Atlin and Quesnelle. This portion of the Yukon telegraph service is subject to frequent interruption during the winter months.

It is the intention of the city of Niagara Falls, Ont., to ask the provincial government for permission to develop 10,000 horsepower to run the city's waterworks pumping plant and electric-light plant and have a necessary surplus on hand for an emergency. When 2,000 horsepower was previously requested it was not known what amount would be necessary, but the city now finds that 10,000 horsepower will be required.

As to the possibilities of cheap electric power being transmitted to the city of Brockville, Ont., Mr. Cecil B. Smith, engineer of the Hydro-electric Power Commission of Ontario, has given it as his opinion that the most feasible point from which to obtain such power is at Waddington, N. Y., a distance of 30 miles away on the American side of the St. Lawrence River, where a generating plant is about to be installed. Transmission could be easily arranged to supply to Canadian frontier towns from Iroquois west to Kingston, Ont. Steps are being taken to induce these places to make the preliminary move, then the government will act in aiding the building and equipment of the line.

The Windsor, Essex and Lake Shore Rapid Railway Company has decided that its line shall be operated by electricity. This system will connect Windsor, Leamington, Kingsville and Chatham, and

will be one of the most complete interurban roads on the continent. A number of prominent Canadian capitalists associated with E. A. [illegible] of Philadelphia, Pa., are interested in the line. W.

Winnipeg, Man., June 2.—Current from the new street railways power plant at Lac du Bonnet is now in the city, the plant having been officially opened.

John Murphy, formerly of the Ottawa Electric Company, has been appointed superintendent electrician to the Department of Railways and Canals and also to the railway commission.

The municipal operation of the electric-light system in Edmonton during 1905-6 resulted, it is said, in a profit of $20,873.71. This sum is to be spent on the extension of the power-house plant, and reduction in the price of light to consumers of three cents a kilowatt-hour will be made.

Because the Hamilton (Ont.) aldermen would not accede to the Cataract Power Company's demand to fix terms on which the Radial Railway Company would be given the free use of King Street, Colonel Gibson said the proposed $200,000 terminal station would not be built. The company offered what was said to be equal to $6,000 a year, but the council wanted it to be left to arbitration at the expiration of the agreement in 1928.

Operations have been begun on the Quebec and Saguenay Electric Railway, of which Mr. Rudolph Forget, M. P., of Charlevoix, is president. The work will start nine miles from Ste. Anne de Beaupre, the objective point being St. Catharines Bay, opposite Tadousac.

The shareholders of the Hamilton, Caledonia and Lake Erie Railway have decided to build their electric railway to Caledonia and Dunville and have also decided to proceed at once with the pipe line to bring natural gas from Selkirk to Hamilton, a number of good contracts having been made. H.

Ohio.

Cleveland, June 2.—Announcement was made a few days ago that the Cleveland, Painesville and Eastern electric railway had purchased the control of the Cleveland, Painesville and Ashtabula. The former has a line from Cleveland to Painesville and the latter owns the line from Painesville to Ashtabula. The first is owned by the Everett-Moore people and the other by W. J. Hayes and associates. J. W. Holcomb and W. J. Hayes will remain on the board of the purchased company. The syndicate now has a line from Ashtabula to Detroit.

The incorporation of the Cleveland, Youngstown and Eastern Railway Company a few days ago is a step in the direction of the reorganization of the Eastern Ohio, which has been under way for the last two weeks. The name of the new company would indicate that an extension is to be built to connect with the Mahoning and Shenango Valley road, which will give it an entrance to Youngstown and connection with New Castle, and finally with Pittsburg and other Pennsylvania towns.

It is rumored that the Northern Ohio Traction and Light Company will greatly increase its capital stock to take care of the absorption of the Canton-Akron line. With the roads now in operation about Canton, Akron and Youngstown the possibility of forming a large system is good, and for this reason the Northern Ohio people are going slowly and probably paving the way for the future.

J. L. Adams, general manager of the Schoepf roads, has stated that his people will not plan further for an interurban station in Columbus until the question is settled as to whether grooved rails will be required within the city limits. He said that the heavy cars of the interurbans could not operate over grooved rails.

Stockholders of the Pennsylvania and Ohio Railway Company have voted to increase the bonded indebtedness of the company from $700,000 to $1,600,000 in order to secure funds for the purchase of the Ashtabula and Lake Shore line and Woodland Beach park.

State Highway Commissioner Sam Huston has ruled that if counties desire aid in the improvement of public roads from his department, the commissioners must take more care in the manner in which franchises are granted to traction companies. Traction roads often make it impossible, he says, to improve the public roads, and where this is true, applications for such aid must be refused.

Considerable interest is manifested in two companies that were incorporated last week by the same people. One of them is the Cleveland Gas and Electric Company, formed for the purpose of merging the gas interests in Cleveland and incidentally operating electric railroads. The other is the Union Gas and Electric Company of Cincinnati, which will take over the properties of the Cincinnati Gas and Electric Company on a lease. Samuel Powers, G. Lewis Meade, Rollin White, Joseph B. White and Charles A. Leib are the incorporators. The ultimate capital stock of the Union Gas and Electric Company will be $10,000,000 preferred and the same amount of common.

H. G. Galpin, former superintendent of the Millcreek Valley traction road, has been made assistant general superintendent of the [illegible] Company.

[illegible] Columbus, [illegible] J. A. Horton, general freight agent of the [illegible] and Springfield, [illegible] agent at the [illegible] resigned. George Hunt [illegible] A. W. Jordan, division freight and passenger agent of the Indiana, Columbus and [illegible] the duties of Mr. Davis. O. M. [illegible]

Indiana.

Indianapolis, June 2.—Work was begun during the week on the Indianapolis, [illegible] and Toledo electric railway, and on the [illegible] extension of the Indianapolis, Columbus and Southern line. Work is progressing rapidly [illegible] on the Connersville extension of the Indianapolis and Cincinnati line, on the Indianapolis and Western, the Evansville and Newport, the Evansville and Mt. Vernon, the Winona Interurban and many other electric roads in the state.

The Indianapolis and Louisville Traction Company has filed a trust deed at Jeffersonville for $1,250,000 in favor of the Colonial Trust Company of Pittsburg to cover the cost of constructing the part of its line between Sellersburg and Seymour, which is the last link in the line connecting Indianapolis and Louisville. Work was begun this week at several points and the construction will be pushed rapidly.

A $3,000,000 bond mortgage, given by the Indianapolis, Crawfordsville and Western Traction Company to the Central Trust Company of Indianapolis, was filed this week. Of the $3,000,000, $1,500,000 is to be available at once to construct, equip and put into operation the line from Indianapolis to Crawfordsville. The remaining $1,500,000 is to be available for the completion of the line from Crawfordsville to Danville, Ill. The first division of the line is almost completed and will connect Indianapolis, Clearmont, Brownsburg, Pittsboro, Ramstown, Lizton, Jamestown, New Ross, Mace and Crawfordsville. The Moore-Mansfield Construction Company has the contract. A. F. Ramsey of Crawfordsville is president and Edward Hawkins of Indianapolis secretary.

The Muncie and Portland electric railway was formally opened for passengers and freight traffic on June 1st. The roadbed and equipment of this line is said to excel any other in Indiana. The new line will enter the new terminal station at Muncie when completed.

Charles Murdock and Henry W. Marshall of Lafayette have completed negotiations for the purchase of the Evansville street-railway company and the Evansville and Princeton line. Improvements that will cost $150,000 will be put on the latter property.

The Marion, Bluffton and Eastern Traction Company is pushing the completion of its line. The Moore-Mansfield Construction Company has a large force of men on the line. The erection of a two-story brick sub-station and waiting room has been commenced at Van Buren.

The Indiana Union Traction Company is seeking a settlement of its franchise rights in Anderson. Conditions have changed and the company asks to be relieved of some of its obligations, and, if granted, promises to begin the construction of large repair shops near Anderson at once.

Fifty old soldiers while attending the annual encampment at Lafayette were injured in a collision of two trolley cars while en route to the battle ground. Both cars were derailed and damaged and a motorman killed.

The Indiana Supreme Court has upheld the law, recently enacted, prohibiting the construction of railroads through graveyards of cemeteries. Traction lines have frequently tried to construct lines into cemeteries for the accommodation of the people, but the court holds that this cannot be done under the statute. S. S.

Michigan.

Grand Rapids, June 2.—The village of Hartford is considering a proposition to place a 32-candlepower incandescent light upon each street corner in the village, the number required being estimated at 40. The total cost to the village of installing the lights will be about $1 each, while the cost of operation will approximate $300 a year.

The surveyors for the Electric, Land and Development Company of Traverse City will begin work immediately on the lands controlled by the company. It is possible that it will be necessary to build two dams in order to supply the demand for power. Cadillac seems to be well pleased with the proposition and there is a market for much power there. The company expects to develop about 12,000 horsepower, but, if necessary, it can increase this to 16,000.

At a meeting of the directors and representative citizens held in Ithaca it was decided to change the name of the Detroit, Owosso and Saginaw Railroad to the Detroit, Saginaw and Grand Rapids Railway, these being the objective points which it was thought would eventually be reached by the electric road.

E. P. Kinney, who has been manager of the [illegible] troit United Railway. L. W. B.

Illinois.

Peoria, June 2.—The [illegible] Company has been [illegible] of $2,000 to [illegible] Ill. The incorporators [illegible] are Philip Decker, A. J. [illegible] W. F. Hughes and H. A. [illegible]

The [illegible] Heating and Lighting Company of Chicago has been incorporated [illegible] $2,000. The incorporators are M. I. [illegible], J. A. [illegible]son and C. [illegible]

The Durant Electric Supplies Company of Chicago has been granted incorporation papers to manufacture electrical supplies; capital, $[illegible]. H. S. Durant, Elliott J. Durant and Frank W. [illegible] are the incorporators.

The Rock Island and Southern Railway has inaugurated an interurban service between Galesburg and Monmouth. The schedule will be one hour between the two places, with a fare of 60 cents for the round trip.

Surveys are being made for the Illinois Central Electric Railway at Canton and material is arriving for the construction work.

M. T. Smith has been promoted to be assistant to Division Traffic Manager J. F. Thompson at the Springfield office of the Illinois Traction Company, and Roy Wright has been made secretary to General Traffic Manager B. R. Stephens.

The contract for the bridge over the Vandalia Railway at Morton has been let by the Illinois Traction Company to the Decatur Bridge Company. It is to be of steel, resting on concrete abutments.

Showing how interurbans affect the steam railways, the Illinois Central Railroad will on June 10th put on an interurban service between Decatur and Champaign. This will make, with the regular trains, six trains a day. The line between Springfield and Lincoln will be in operation by August.

L. E. Fischer of Danville, general manager of the Illinois Traction Company, was in Lincoln this week looking for the best entrance into the city from the south. V. N.

Southeastern States.

Charlotte, N. C., June 2.—Frank Jay Gould, principal owner of the Virginia Passenger and Power Company, and other interests in Virginia, spent several days in that section recently inspecting the roads, making the tour partly in a large automobile.

A revival of interest in the restoration of the Asheville and Overlook Mountain electric railway has begun, and a representative of the New York syndicate who purchased the Asheville and Craggy Mountain line, invites the people of Asheville to take stock in the line. A company is to be organized for the purpose of buying the right-of-way and supplying necessary material.

A $6,000 contract for an electric plant at the Kentucky School for the Deaf at Danville, Ky., has been let to a Pittsburg firm and work will be started at once.

Plans have been completed at the Navy Department at Washington for the installation of six space-telegraph stations in the Philippines.

R. W. Lassiter of Oxford, N. C., and O. T. Smith of the Westinghouse company visited Raleigh, N. C., recently to look into the introduction of electric power into the city from Eagle Falls on Roanoke River, from the plant of a big corporation organized recently in Richmond, Va. The corporation will have $5,000,000, and it is backed by Henry G. Murray of Baltimore and many others, including members of the Westinghouse company. Mr. Lassiter says that work will be started at once.

The Norfolk and Portsmouth Traction Company has just been granted a franchise in the town of Suffolk, Va., insuring local service in connection with the interurban service.

The annual meeting of the stockholders of the Catawba Power Company will be held in Charlotte, N. C., on June 21st for the purpose of elect-

ing a board of directors and transacting such other business as may come before the meeting.

The Gadsden (Ala.) Street Railway, Light and Power Company will build an entirely new power plant to cost in the neighborhood of $200,000. This will be located on the site of the present plant on the corner of Locust and Fifth streets. Electrical engineers are now working on the plans.

On account of the flattering reports on the waterpower at Flint River near Albany, Ga., it is probable that the development by New York capitalists will be undertaken and that an electric railway will be constructed to Macon, connecting there with a line to Atlanta to be built by the same interests. Local capital is also interested in the scheme. Judge S. W. Smith of Albany is said to be interested in the plan. L.

Pacific Slope

Oakland, Cal., May 31.—It is understood that the policy of the Pacific Gas and Electric Company, as to future distribution of current in San Francisco, has been decided upon and that to the surprise of most of the supply dealers and electrical engineers the old direct-current system is to be used in the downtown districts east of Van Ness Avenue to the practical exclusion of alternating current. The general expectation of supply men and the manufacturers was that alternating-current motors would be used almost exclusively, except for elevator service, and large orders had been placed in the East for alternating-current motors for early delivery.

Although officials of the company announced very soon after the fire that their main generating plant on the Potrero was intact, and it was started up about April 30th, there was considerable delay in making service connections for commercial lighting and much more in making connection with many of the factories downtown. In fact a number of small manufacturers in the vicinity of First Street have been ready for business for about two weeks and have been put off from day to day by the electric company's officials on the ground that they could not supply the current for want of distributing facilities, etc.

Notwithstanding this, the Mutual Electric Company's steam plant, with a capacity of 3,000 kilowatts without overloading, has been in successful operation for a month past, and by putting up wires for a distance of three or four blocks under emergency conditions, this important manufacturing district, it seems, could have been served. Great interest is taken by all concerned in the future movements of the Pacific company regarding the use of the Mutual plant, which it has purchased, having made the first payment.

Articles of incorporation of the Pacific Light and Power Company have been filed with a capital stock of $10,000,000. H. E. Huntington is president. The directors are I. W. Hellman, A. Borel, C. De Guigne, M. G. Kerckoff and others.

A force of men is engaged in putting up a line of poles for transmission of electrical energy from Los Angeles, Cal., to the site of a power station to be installed on the Lacy tract in East Fourth Street, Santa Ana, Cal., for the Pacific Electric Company.

Notice has been given that an application has been made for a franchise for an electric railway in Pasadena, Cal. Sealed bids will be received by the City Council up to June 5th for the franchise, which is to be sold to the highest bidder.

A franchise has been granted to M. P. Kincaid and associates for 50 years for a light and power system at Olympia, Wash. A lighting and heating system is to be installed in the business section of Olympia.

W. H. Lowman of Anacortes, Wash., who has secured a franchise to construct and operate a water system in that town, has been in Seattle consulting with persons interested in the project. The corporation will be known as the Skagit Valley Water Company. It is proposed to establish a light and power system in connection with the water system, the franchise for which will be asked from the Anacortes council.

A power line is being constructed from the Washington Water Power Company's line above Burke, Wash., to the property of the Great Western Mining Company, which is preparing to install a compressor.

Articles of incorporation have been filed for the Standard Electric Company by J. C. Baird, F. E. Harmer and F. A. Waltz, with a capital stock of $15,000. The principal place of business is at Portland, Ore. The company will deal in electrical and gas fixtures.

The Inland Empire Railway will spend $700,000 in developing a power site 12 miles northwest of Spokane, Wash. The corporation will supply power to operate its electric-railway systems and will invade the lighting field of Spokane. The river will be dammed about a mile north of where Deep Creek enters the Spokane River. This report is confirmed by F. A. Blackwell, chairman of the board of directors of the company.

A shipload of ties has arrived at San Diego, Cal., for the National City and Otay Railway Company and will be used in putting the track in shape for rapid transit. The work of changing to an electric road is expected to begin about the first of June. A.

Northwestern States.

Minneapolis, June 2.—Work is progressing on the new power development which the St. Anthony Falls Water Power Company is undertaking on Hennepin Island, Minneapolis. It will require about two years to complete the work, at present about 130 men being employed in making the necessary excavations. It is estimated that it will be possible to develop 9,000 horsepower at the new plant, the initial cost of which will be about $1,000,000.

I. A. Smith of St. Louis is at Mankato, Minn., investigating the feasibility of constructing electric-railway lines from Mankato to Waseca and from Blue Earth, via Waseca, to Faribault.

There is talk of building a trolley line from Jamestown to Courtenay, N. D. It is thought that work will be started shortly and that the line will be completed this year.

An election will be held at Rush City, Minn., June 12th to vote $12,000 worth of bonds for the purpose of the city purchasing the electric-light plant.

New pumps are to be installed at the Duluth (Minn.) pumping station, which will be driven by electrical power furnished by the Great Northern Power Company. The contract for the first pump was let to the General Electric Company.

The municipal electric-light system at Alexandria, Minn., will have to be remodeled and enlarged. Estimates have been furnished by Charles L. Fillsbury, engineer, of Minneapolis.

The Great Northern Power Company has submitted plans for its transmission lines for bringing its electrical current into Duluth, Minn. The cables will each carry a current of 30,000 volts and will be strung on steel towers 70 feet high. R.

PERSONAL.

James T. Daniels has succeeded J. H. Ainsworth as manager of the local Bell telephone exchange at Columbus, Ohio, the latter taking charge of the exchange at Dayton.

Marshall Morgan, son of Randall Morgan, was married in Philadelphia on June 6th. After a trip to Europe the young couple will make their home in Cincinnati, where Mr. Morgan is engaged in learning the traction business under W. Kelsey Schoepf.

J. B. N. Cardoza, formerly in charge of the Berkeley division of the Norfolk, Portsmouth and Newport News (Va.) Electric Railway Company, has been promoted to be chief of maintenance of way of the Norfolk and Portsmouth Traction Company.

Edgar K. Ray, a prominent street-railway promotor and head of what is known as the Ray system of street railways in Rhode Island and Southern Massachusetts, died at his home at Elms Farms, Mass., on May 30th. He is survived by his wife, a daughter and a son.

N. D. McPhail of Denver, Colo., has accepted a position as manager of the newly created new-business department of the Western United Gas and Electric Company in Aurora, Ill. Mr. McPhail has served a Denver company in a similar capacity for four years.

Prof. Louis A. Weigel of Rochester, N. Y., one of the first Americans to recognize the practical possibilities of the X-ray, died recently at the age of 31 years. It is said that his death was caused by diseases brought on through his almost constant experiments in connection with X-ray work.

L. J. Shlesinger, former manager of the Muncie, Hartford City and Fort Wayne Traction Company, has been made superintendent of motive power for the entire system of the Indiana Union Traction Company, vice P. J. Mitten, who is made master mechanic of the Anderson local car shops.

Chief Electrician A. M. Schoen of the Underwriters' Southeastern Tariff Association, has been elected to the Board of Managers of the American Institute of Electrical Engineers. Chief Inspector V. E. MacKnight, also of the Southeastern office, was elected to the executive committee of the National Association for Uniform Inspection Reports at the recent annual meeting of the National Fire Protection Association held in Chicago.

Morgan Brooks of Urbana, Ill., professor of electrical engineering of the University of Illinois, departed June 2d on a trip to Europe, going direct from New York to Naples, Italy. Prof. Brooks had intended going about two weeks earlier, but deferred his departure in order to attend the meeting of the American Institute of Electrical Engineers in Milwaukee last week. He is accompanied by his oldest son, Henry, a youth of 17, and they expect to return about August 1st.

First Vice-president Percy R. Todd of the New York, New Haven and Hartford Railroad Company is, according to report, to take a position as head of a large electric-railway enterprise in Canada. The project, it is stated, contemplates the construction of an electric road several hundred miles long, paralleling largely the Grand Trunk Railway and reaching several of the most important cities of Canada. Mr. Todd is a Canadian, being the son of the late Alpheus Todd, librarian of Parliament. The report is understood to refer to the projected extension to Toronto of the radial line now operating between Prescott and Kingston. The civic authorities of Toronto have been applied to by this line for permission to enter that city, assurance being given that the construction of the line would be carried out in that event.

H. M. Lauritzen of New York city, illuminating engineer, member of the Illuminating Engineering Society of New York, is about to leave for a three months' tour of the Pacific Coast on illuminating-engineering business. Mr. Lauritzen was called to Portland, Ore., by the Portland General Electric Company, where he wil spend about six weeks in this class of work. He will spend two weeks in Seattle and a week each in San Francisco, Los Angeles and in Chicago on his return.

Claude L. Matthews of St. Louis was married on June 2d to Miss Jane Skinker, also of St. Louis. The wedding took place in Christ Church Cathedral at 5 p. m. A bridal party of 14 attended the couple to the altar, Miss Julia Maffitt being maid of honor and Mr. W. N. Matthews best man. There was a large and fashionable gathering at the church, for both the bride and groom are popular in society. Mr. Matthews is a member of the well-known firm of W. N. Matthews & Brother of St. Louis, and he has many friends among the electrical people who will be glad to hear of his marriage.

ELECTRIC LIGHTING.

Claremont, I. T., has issued bonds to construct an electric-light plant and waterworks.

The Winfield (Kan.) Light and Power Company has been incorporated with a capital stock of $250,000.

Houston Bros. have applied for a franchise to construct an electric-light and power plant in Vicksburg, Miss.

The Vendome Amusement Company of Sulphur, I. T., proposes to purchase a small electric plant for lighting the amusement grounds.

The Board of Public Works and joint light committee of Paducah, Ky., have decided to expend $20,000 for placing the city electric-light system in good condition.

The Sandpoint Water Company, which owns the electric-light system in Sandpoint, Ida., is figuring on putting in additional lights in the new additions and also of putting in a day circuit for power purposes.

The Edison Electric Light Company of York, Pa., has decided to extend its lighting system to the village of Hellam, where current will be supplied for the lighting of stores and homes, and for power.

The Topeka Electrical Company, the new electric-light and power company which has been organized in Topeka, Kan., by C. R. Maunsell, has received a charter. The capital is $200,000. The company will apply for a franchise from the City Council.

The new flywheel, to replace the one which recently burst in the plant of the Mansfield (Ohio) Railway, Light and Power Company, has been cast by the Fulton Foundry Company of St. Louis. It weighs 28 tons. The big plant, which was badly damaged, is rapidly getting back into shape.

The electric-light company of Winslow, Ariz., has signed a contract with the Santa Fe Railroad for the purpose of furnishing light to the local depot, offices, Harvey House, reading room and roundhouse. The company has not yet decided to supply lights in residences, but it is quite probable that it will do so.

The City Power, Light and Water Company of Augusta, Ark., has been incorporated with a capital of $50,000 with a view to the operation of an electric-light plant and water system. I. A. Vinson and A. H. Tilman are among the stockholders. Later on the company will also construct an electric railroad.

The Bear Creek Water Company has been incorporated by Christian Yegen, T. Lamport and F. H. Church, with a capital stock of $60,000, the principal place of business being Bear Creek, Mont. The object of the company is to furnish Bear Creek with water and electric light. The installation of gasworks is also contemplated.

The Crawford electric-light plant of Crawford, Neb., has recently ordered from the Crocker-Wheeler Company of Ampere, N. J., two alternating-current generators of 120 and 60 kilovolt-amperes, respectively. Both these generators are of 2,300 volts. This increased capacity is for lighting the city streets, etc., in addition to the present electrical equipment.

At Dubuque, Iowa, the mayor and City Council seem ready to adopt an ordinance which will effectively regulate the installation and maintenance of electric wiring. The underwriters' electrical bureau inspector was invited to meet with the council and explain the operation of a measure of this character, together with its advantages to the people of the city, and the council committee on elec-

trical construction was instructed to draft an ordinance regulating the electrical hazard.

The Edison Electric Illuminating Company of Topeka, Kan., has announced that beginning June 1st a new schedule of rates will be in effect. Electricity for commercial use will be reduced to five cents a kilowatt hour and the residence rate will be nine cents a kilowatt. An official of the company is quoted as saying that up to the present the machinery has been overloaded, but with recent additions of machinery the company is now able to reduce rates and take care of a larger growth in business.

At Council Bluffs, Iowa, a change in the political composition of the City Council has resulted in the appointment of a new city electrician. He is the individual who was in charge of the work up to two years ago. The change is thought to be a benefit to the service, as the present incumbent has had considerable experience in supervising the installation of electric wiring. The management of the lighting company has also been changed, and the present policy includes a more aggressive effort to maintain a good standard for inside wiring. The work in progress indicates that the present standard is very fair and it will be further improved. Considerable underground wiring has been installed, removing some of the obstruction to the work of the fire department which previously existed.

ELECTRIC RAILWAYS

The Texas Traction Company, which is arranging to build an interurban line between Dallas and Sherman, Texas, will erect a $300,000 power plant at McKinney.

Engineers and surveyors who have been locating the route of the Puget Sound and Gray's Harbor Electric Railroad have completed all preliminary work from Hoquiam up to Montesano, Wash., along the Chehalis River. G. M. Clapp is chief engineer, Tacoma, Wash.

The Tide Water Development Company of Birmingham, Ala., has been incorporated with a capital of $100,000 by R. H. Little, D. J. Hancock, Robert J. Johnson and J. B. Chenney. The company proposes to build electric railways and water lines throughout the state of Alabama.

Mayor Dempsey of Cincinnati will, it is said, suggest to the City Council that every second or third street car carry a jackscrew and a portable telephone. The mayor stated that he was prompted to do this by seeing a man's life slowly crushed out under a car, aid for him being delayed half an hour while sending for a jackscrew.

According to press reports the street-car service was in large part resumed in San Francisco on April 28th. We wonder what would have become of the street-car lines if they had been operated under municipal ownership, and in that event how long it would have taken before active operation was resumed.—Real Estate News, Chicago.

Work has been commenced on the walls of the new addition to the power house of the Wilmington (Del.) City Railway Company on the Brandywine. The company is greatly in need of the additional power which the addition to the plant will provide, and the machinery will be ready to place in the new house when the builders are done.

The Kansas Traction Company has been formally organized at Oswego, Kan., and a charter has been applied for. The company is made up of Cherokee and Labette County capital, and proposes to build an electric line through these two counties from Cherryvale, through Oswego, Mound Valley, Altamont, Halliwell and Columbus. The president is Sam B. Miller of Oswego; secretary, J. D. Morley, Oswego, and treasurer, C. O. Wright of Cherryvale.

Denver papers say that the Denver Tramway Company is reported to be trying to get control of the Denver Intermountain Railway, which operates between Denver and Golden. The little road has an entrance to Fifteenth and Arapahoe streets, and some of the stockholders have been trying to induce the officers to make an effort to operate trolley cars to all parts of the city. The Denver Terminal Railway Company, which was defeated in the recent election, also wants to purchase the line with the possibility of extending it to Boulder and other points in the northern part of the state.

The merging of Southern Michigan electric railways, brought about by the Mills-Elliott people of Lansing, has been perfected by the formation of the Michigan United Railways Company. Recently the new company formally took over the properties of the Michigan Traction Company, the Michigan Traction Extension Company, the Jackson and Battle Creek Traction Company, the Lansing and Suburban Traction Company, and all of the capital stock of the Lansing and Jackson Company, whose line is under construction between Lansing and Jackson. The total length of the lines in the merger in operation is 153 miles, made up of the Kalamazoo, Battle Creek and Lansing city and suburban lines, Lansing to St. Johns, Jackson to Battle Creek, and Battle Creek to Kalamazoo. The 37½ miles between Jackson and Lansing is under construction. Of the board [illegible] for power development [illegible] ment and [illegible] United Railways Company [illegible] W. Mills, vice-president [illegible] tary, Robert Morrison, Jr. [illegible] manager, James R. [illegible] J. M. Bramlett.

The Intermountain [illegible] Company, capitalized at [illegible] filed articles of incorporation [illegible] new company is the one [illegible] Salt Lake and Ogden street [illegible] national Trust Company [illegible] finance what it terms the [illegible] tric road proposition in the West. It proposes to immediately commence the construction of an electric road from Levanuth to Preston, Idaho, [illegible] miles.

Work on the Front Street station and inclines of the Rapid Transit Company's Market Street subway in Philadelphia, which involves the demolition of the entire block of business buildings bounded by Front, Water, Market and Arch streets, has been begun. A handsome station will be erected of structural steel and concrete. Above ground it will be a two-story ornamental structure, containing waiting rooms on the first floor and offices on the second. The estimated cost is about $500,000. The Millard Construction Company is about to start work on the subway at the eastern end of Market Street. The delay in beginning has been caused by the non-arrival of the machinery for the electric hoists.

Passenger traffic on the Chicago elevated railways for May shows a good gain over May 1905. The South Side Elevated carried a daily average of passengers in May, 1906, of 97,159; the Metropolitan average was 136,736, and the Northwestern 81,748. The plans for financing the Douglas Park extension of the Metropolitan West Side Elevated have been completed. The addition will be financed out of the company's treasury, as the expenditure is comparatively small. The Humboldt Park extension will necessitate an outlay of considerable capital. Treasury securities are to be sold for the purpose, but as the company has three years in which to complete the work, this piece of financing is not of immediate consideration.

The Portsmouth Street Railway Company's plant is located in the eastern suburbs of Portsmouth, Ohio, upon a large property owned by the company, which has been improved for a railway park. Two 400-kilowatt Westinghouse-Parsons turbines are already operating at this plant, serving the entire city with light and power. The plant was built entirely for turbine machinery. Superheated steam and high vacuum are used. Condensing water is obtainable from an artificial lake which has been constructed upon the property. A rotary converter in the plant serves the nearby traction lines with 500-volt direct current, but the main power is transmitted over high-tension alternating-current lines into the city and outlying districts. Recently this company ordered a 500-kilowatt Westinghouse turbine to add to the equipment.

POWER TRANSMISSION.

The Roanoke Power Company of Roanoke Rapids, N. C., has ordered from the Crocker-Wheeler Company of Ampere, N. J., one 750-kilowatt 2,300-volt 200-revolution-per-minute alternating-current generator to be installed at the company's power plant at Roanoke Rapids.

Mayor Reeder of Batesville, Ark., is endeavoring to get a favorable report from the Rivers and Harbors Committee of the House at Washington on a bill to allow the Batesville Power Company to utilize water from White River in developing electrical energy for lighting and power use in Batesville.

Stockholders of the York Haven Water and Power Company at a recent meeting decided to transfer the main office of the company to York, Pa. An office has been secured and H. Gordon Nes of York will be secretary and treasurer. The other officers elected are: President, George Poole; vice-president, Eugene Ivins.

It is said that $700,000 will be expended by Jay P. Graves' Inland Empire Railway Company in developing its power site, 12 miles northeast of Spokane, Wash., on the Spokane River, and the corporation will supply power for its electric-railway system and invade the electric-light field in Spokane. F. A. Blackwell of Cœur d'Alene, Idaho, is prominent in the new company.

The proposition to build a large waterpower plant on the Grand River near Muskogee, I. T., is now before the Commercial Club. Capitalists from Joplin, Mo., and Chicago have agreed to put in the plant and have made their proposition to the club. They propose to put in an electric water plant and dam to furnish 2,500 horsepower at first, which can readily be increased to 5,000 or 10,000 horsepower with very little extra work. It is proposed to create a capital stock of $1,500,000 and [illegible]

At present [illegible] Sa[illegible] horsepower and [illegible] The entire [illegible] mated at [illegible] supplying Zurich [illegible] lized in the Alps [illegible] owing to failure [illegible] the several canton[illegible] cided for the [illegible] which is to erect a [illegible] near Sil. The hydraulic [illegible] horsepower for 11 hours a day [illegible] river at a height of 11.48 feet [illegible] reservoir 4.59 miles in length [illegible] 77,000,000 gallons. Various [illegible] under discussion respecting the mode of [illegible] ting this power for the total [illegible] miles as the crow flies, and it is [illegible] ploy continuous current in order to [illegible] cost by about $90,000.

The Telluride Power Company of Provo, Utah, will install another power plant on the [illegible] the Utah Lake, just west of Provo. The capacity of the plant is to be 5,000 horsepower. Salt Lake, Ogden and the smaller towns between Provo and Ogden will be furnished with light and power. Another pole line will be run to Mercur and Eureka for propelling machinery at the mines. Application for the appropriation of water to be diverted from Utah Lake for power purposes has been made. The company proposes to install pumps to pump the water out of the lake into a [illegible] channel and then into a pipe line nine feet in diameter. The fall of the pipe line will give an operating head of 84 feet, and two Samson turbine 40-inch wheels will be installed to generate the power. The water, after passing over the wheels will be diverted into the Jordan River. The pumping station, it is said, will serve a double purpose and furnish the Jordan and Salt Lake canals with their full amount of water. Lucien L. Nunn is president of the Telluride company.

PUBLICATIONS.

The Iron Age Directory for 1906 is out. It is a classified index of the hardware, iron, machinery and metal trades, and is published by the David Williams Company, New York.

The Cutter Company of Philadelphia is sending out a large calender, on each sheet of which is a large cut and description of some one of its various types of circuit-breakers. The company reports a most prosperous year, for which it extends compliments to its friends and customers.

Bulletin No. 3703, from the Emerson Electric Manufacturing Company, St. Louis, is devoted to motor-driven laboratory lathes for direct current. Lathes of this type are similar to the alternating-current lathes made by the company, having the additional advantage of good speed regulation.

The Robins Conveying Belt Company, Park Row Building, New York, is sending out Bulletin No. 15, which treats of Robins conveying and elevating machinery in retail coal pockets and locomotive coaling stations. The company has made a careful study of labor-saving machinery for the conveying and distributing of coal. A glance at the new bulletin, which is well illustrated, will present ideas to coal men and railway men.

SOCIETIES AND SCHOOLS.

The International Association of Municipal Electricians will hold its convention this year in New Haven, Conn., August 15th to 17th.

At the first national convention of the Order of Interurban Trainmen, held in Lorain, Ohio, the following officers were elected: Grand master, W. P. Rutledge, Lorain; grand counsel, W. L. Hughes, Lorain; grand chaplain, Rev. M. J. Hadley, Lorain; secretary and treasurer, C. L. Root, Rock River.

Ohio; executive board, John Ingalls, P. Rutledge, A. H. Davreau, A. A. Moore, R. H. Doning; board of trustees, P. O. Christiansen, H. Merritt, I. H. Mills.

The Illinois State Electric Association has chosen Springfield, Ill., as the meeting place for the next annual convention. The dates named for the meeting are September 19th and 20th. David Davis of Litchfield is president of the association and H. E. Chubbuck of La Salle is secretary.

After conference with leading teachers of electrical engineering and prominent practicing engineers the authorities of the electrical engineering department of Sibley College, Cornell University, Ithaca, N. Y., have decided upon a list of books which are deemed most useful to the technical graduate leaving college. The list has been issued in printed form for distribution.

At the commencement in June at Lehigh University, South Bethlehem, Pa., there will be 106 candidates for degrees. Of these 15 are for the degree of electrical engineer and seven for electrometallurgist. The other candidates are for the degrees of master of arts, master of science, bachelor of arts, civil engineer, mechanical engineer, engineer of mines, metallurgical engineer and analytical chemist. During university week, June 10th to 13th, an interesting programme will be carried out.

The Robert Fulton Association has received an invitation from the Allis-Chalmers Company to visit the new West Allis shops on June 10th. A party of the association members will be made up to leave Chicago at 9 a. m. June 10th, via the Chicago, Milwaukee and St. Paul Railroad. Those wishing tickets may obtain them from Alfred Johnson, care Mandel Brothers, Chicago. The shops of the Allis-Chalmers Company offer a splendid opportunity to see the newest methods in the construction and handling of large steam engines, steam turbines, gas engines, etc.

Annual commencement exercises of the Worcester Polytechnic Institute will be held the week beginning June 10th. The baccalaureate sermon will be given by the Rev. Willard Scott. Dr. L. P. Kinnicutt, professor of chemistry in the Institute, will deliver the annual commencement lecture, the subject being "Sanitary Science and the Public Health." Thursday, June 14th, the graduating exercises will be held in Boynton Hall, at which Charles G. Washburn, president of the Institute corporation, will deliver the commencement address on the subject of "Technical Education in Relation to Industrial Development."

Mr. C. A. S. Howlett, chairman of the general advance committee of the Electrical Salesmen's Association, is advancing an idea to introduce a "question box" into the Electrical Salesmen's Association similar to the "question box" in the National Electric Light Association, the object being to develop an interest among the members and have something in which all can take an active part. On receipt of the questions dealing with the sale of electrical goods, they would be submitted to different ones for answers. When a sufficient quantity had collected, they would be printed and distributed among members and sold to non-members. Mr. Howlett would be glad to get an expression from members and also a quantity of questions from friends and associates. His address is 3,300 Beacon Street, Chicago.

MISCELLANEOUS.

As indicative of German enterprise in the South American states, it may be mentioned that the German Oversea Electrical Company of Berlin, which is closely connected with the Allegemeine company, is increasing its capital from $1,750,000 to $3,500,000 for the extension of electrical enterprises at Montevideo and in Chile.

The House of Representatives, on June 4th, passed the Burton Bill. The bill authorizes the president to open negotiations with Great Britain for a common understanding and line of action regarding the preservation of Niagara River. It establishes the principle, from an international point of view, that the United States reserves the right to take for domestic and sanitary purposes unlimited quantjes of water from the Great Lakes.

A bill has been introduced at Washington, D. C., for the purpose of aiding in the construction of a railroad and telegraph and telephone line in Alaska, to run from Cordova Bay to a point on the Yukon River, the work to be carried on by a company with head offices in New York, and to have a capital stock of 200,000 shares of $100 each, and to be known as the Alaska Railroad Company.

The engine frame and slide for the first rolling-mill engine for the Carnegie Steel Company was recently cast at the West Allis foundries of the Allis-Chalmers Company and has proved to be the largest and heaviest single piece ever poured in the shops. The single piece for frame and slide in this case weighed roughly 105 tons, and is designed for an engine whose cylinders will measure 50 inches and 78 inches in diameter and have a stroke of 60 inches. The pattern for this single casting measured 32 feet long, 11 feet wide and 10 feet high, representing the work of 10 expert patternmakers for a period of over four months. The amount of lumber used in its construction reached the surprising aggregate of 22,000 feet and over. The pit in which the casting was poured measured 40 feet long, 15 feet wide and 11 feet deep, into which was poured some 105 tons or more of molten metal, the pouring of which consumed eight to 10 minutes time. Nine ladles, four with a capacity of 25 tons each, one 13 tons and four five tons each, were used in the operation.

The Savannah Electric Company of Savannah, Ga., is defendant in a suit for damages which involves the question as to whether the company can be held responsible for the acts of its agents as they affect a third person who is not under an obligation to the company for any service or protection. Conductor Moore of the company, it is said, was intoxicated and started a row with a passenger on his car. Moore drew a revolver and fired. A stray bullet struck Mrs. F. F. Wheeler, who was sitting on the porch of her home, causing her death. Mr. Wheeler and his son are now suing the company for $20,000 damages. The shooting occurred last October.

The matter of installing a signaling system in the freight tunnels of the Illinois Tunnel Company in Chicago is said to be puzzling signal engineers. The company recently called for bids for equipping the tunnels with signal devices to be used in operating the electric trains. Some of the leading signal manufacturers have inspected the tunnels and say the job presents a different problem from any that has arisen in the history of railroad construction. The Chicago tunnel presents a network of tracks, of loops and of crossings, and how to protect them all by signal devices and still be free to operate trains without too much delay is the problem presented. An official of the company is said to favor manual block signals.

A bill has been introduced in the House by Representative Lilley of Pennsylvania, for the establishment of a commission on weights and measures, to be composed of not less than nine nor more than 15 commissioners, to be appointed by the president and ratified by the Senate, and to be selected in such a manner that the various important professions and industries would be represented, and particularly the scientific, industrial, agricultural, commercial, mechanical and maritime interests. It would be the duty of the commission to investigate and report to Congress upon the subject of measures of weight, length and volume at present in use in foreign countries, and to suggest any expedient and feasible improvements which may be made in our own systems of weights and measures.

At the recent meeting of the National Fire Protection Association in Chicago the opinion prevailed that public protection has not kept pace with the growth of buildings and increase of valuation in congested centers and that the business conditions and prosperity of the country are liable to interruption if this increasing loss cannot be checked. Resolutions were therefore adopted urging all interested to co-operate in bringing about better conditions by adopting improved methods of construction, by safeguarding hazards of occupancy and by introducing automatic sprinklers and other private protection with private water supplies quite in addition to the public fire service. Municipalities are urged to pass ordinances involving the adoption of an improved building code along the lines of the building code recommended by the National Board of Fire Underwriters.

TRADE NEWS.

H. F. Galligan has engaged in the electrical fixture business in Weir City, Kan.

Robert F. McDoble, consulting and supervising engineer, announces the removal of his office from San Francisco to Colorado Springs, Colo., 20 East Rafael Street.

The Chicago office of the Triumph Electric Company has been removed to 410 Great Northern Building, and is now in charge of F. L. Merrill, who is well known to the electrical fraternity. Locke Etheridge, formerly of the Northern Electrical Manufacturing Company, will assist Mr. Merrill.

The second heavy installment of orders for new machine-tool equipments was placed recently by the Allis-Chalmers Company for installation in the new machine-shop units Nos. 4, 5 and 6, which are rapidly nearing completion. This order covers, among other things, an equipment of 109 separate machine tools of various kinds for shop No. 5, and 85 tools for shop No. 4, where steam turbines and heavy electrical machines will be built.

A decision has been handed down by Judge Seaman in the United States Circuit Court of Milwaukee, Wis., involving patent 508,637. This case was a suit of the General Electric Company against the National Electric Company, in which the former charged that this patent, relating to certain features of construction in an electric generator, was infringed. This important feature relates to a form of ventilating the armature. The decision of Judge Seaman, which is of greater importance because it follows a similar opinion of Judge Thompson of the Ohio District Court, restrains the National Electric Company from the further manufacture of this ventilating feature.

Sealed proposals are being invited until June 20th for constructing a space-telegraph station at Fort Wood, New York Harbor. Detailed information will be furnished upon application to G. C. Burnell, constructing quartermaster at that post.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until June 26th for furnishing western navy yards with the following material embraced in schedule 593: Incandescent lamps, carbons, bells and buzzers, desk lamp shades, thermostat springs, wire, cable, voltmeters, silver anodes and miscellaneous electrical supplies. Proposal blanks can be obtained at the navy pay office in San Francisco or upon application to the bureau at Washington.

Plans have been discussed in York, Pa., for the launching of the Heaney Fireproof Wire Company, a local industry of York. The American patents on insulated wire and the machinery for its manufacture were acquired from the Teter-Heaney Developing Company of York, which has perfected a new method of wire insulation. Among the persons mentioned in connection with the new venture are W. F. Bay Stewart, D. F. Lafean and W. H. Griffith of York, and Joseph Velt of New York city.

The date of opening bids for the power and electric equipment of the Michigan Central Railroad has been extended from June 1st to July 1st, and it is probable that awards will be made a month or so from the latter date. The specifications cover the erection of the power station and sub-stations and the installation of machinery and all material that is necessary to operate an up-to-date electric line. The part of the line that is to be electrified is that adjacent to and through the proposed new tunnel under the Detroit River. The bids for the construction of the tunnel are all in and awards for this latter work can be expected almost any day.

Wire glass is of great assistance in protecting buildings from fire, as was demonstrated forcibly in San Francisco, where the building occupied by the Western Electric Company offered a striking example. In this case the wire glass prevented the fire from adjacent property from gaining an entrance through the windows, and to it more than anything else was due the saving of the building from destruction. An extensive manufacturer of wire glass is the Mississippi Wire Glass Company of New York city. In answer to a letter of inquiry sent to several prominent engineers and others, the company has received several replies very complimentary to its product, regarding the protection offered by the glass during the San Francisco fire. One of these cites the example of the building of the California Electrical Works, a four-story mill-construction building. Adjacent the building on the west a three-story warehouse was completely destroyed—only 27 feet away. The building was saved, although inside the windows the heat was so terrific as to char the woodwork. In another letter examples were given, one being the new telephone building, opposite the California Hotel, where the wire glass performed admirably.

BUSINESS.

Mention was made last week of a folder from the Manhattan Electrical Supply Company, in which it was wrongly quoted from the folder that the company is now located in New York, "Only 45 minutes from Broadway," whereas the wording was, "Only 45 seconds from Broadway." "Forty-five minutes from Broadway" is an expression which gives a wrong impression of the distance of the company's headquarters from that famous thoroughfare, however expressive it may be to lovers of a good "show."

Kohler Bros. of Chicago, through their Pacific Coast managers, Abner Doble Company, have just finished installing a four-motor Kohler equipment for the new octuple Hoe press which the San Francisco Examiner has installed and placed in operation in its temporary building in San Francisco. They have also closed a contract for a two-motor Kohler equipment for a sextuple Hoe press, which is now being shipped for the San Francisco Call for installation in its old building at Third and Market streets.

A convenient little pocket thermometric scale is being passed around among its friends by the J. P. Devine Company of Buffalo, N. Y. The scale is for the conversion of the readings of Reaumer, Fahrenheit or Centigrade thermometers from one to the others. It consists of three celluloid cards held together at one corner and bearing the three thermometer scales parallel to each other, so that a given temperature on one scale may be found in terms of the other scales by reading across. The J. P. Devine Company being a manufacturer of vacuum drying, evaporating, impregnating and

such apparatus, the class of trade with which the company is interested will find this little device useful.

Following the recent starting of the 5,000-kilowatt Allis-Chalmers steam turbine and generator unit at the Williamsburg power house of the Brooklyn Rapid Transit Company, Allis-Chalmers turbines have been put practically in readiness for starting at the power [illegible] Edison Company, [illegible] Lighting Company, [illegible] Lighting Company, [illegible] Edison Company, [illegible] for the Memphis [illegible] Company, of Memphis [illegible] gone [illegible] Woodlee, World [illegible]

[illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 29, 1906

821,611. Trolley for Electric Railways. Edward F. Creevy, Chicago, Ill. Application filed July 11, 1900.

A type of underground trolley is described, which comprises a trolley axle adapted to run in the conduit and carrying on each end wheels which engage the conductors.

821,615. Magnetic Separator. Myron Dings, Milwaukee, Wis. Application filed September 15, 1904.

Opposing segmental pole pieces co-operate with a magnetizable carrier arranged to travel between the pole pieces, and provided with a downwardly and inwardly receding series of annular ribs. A segmental shield is arranged to extend downwardly and inwardly between the carrier and one of the pole pieces, and adapted to convey material along the under surfaces of the overhanging carrier ribs.

821,622. Process of Cleaning Metallic Surfaces. Thomas A. Edison, Llewellyn Park, N. J. Application filed June 20, 1904.

The process of cleaning continuous metallic strips consists in passing the strip as a cathode through a suitable cleansing bath and in removing the strip from the bath through a conduit extending below the surface thereof.

821,623. Storage-battery-filling Apparatus. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed November 2, 1904.

An apparatus for filling metallic storage-battery pans is described.

821,624. Gas Separator for Storage Batteries. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed November 2, 1904.

The process of removing soluble impurities from alkaline storage batteries employing conducting receptacles of an insoluble metal consists in connecting the depolarizing mass as a cathode in circuit with the conducting receptacle in an alkaline solution, in passing a reverse current between the two to heat the solution and generate hydrogen gas in the active mass, and in finally pouring off the solution.

821,626. Process of Making Metallic Films or Flakes. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed March 30, 1905.

The process of making metallic films consists in depositing a soluble metallic film on a suitable cathode, in electrodepositing thereon a thin film of metallic cobalt or cobalt alloy and in dissolving the soluble metal to detach the insoluble film.

821,627. Process of Making Metallic Flakes or Scales. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed March 30, 1905.

For making metallic scales or flakes, the process consists in subliming a metallic chloride to form scale-like or crystalline flakes thereof, then in reducing the chloride flakes to the hydroxide state, and finally in reducing the hydroxide to the metallic state.

821,628. Process for Making Conducting Films. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed May 26, 1905.

Making conducting films is done by fusing a sulphur compound of a metal or metals, cooling the fused mass to result in the crystallization of the metallic sulphur compound in thin scale or films, separating the scales and in finally converting the latter to the metallic state.

821,639. Fireman's Signaling System. Alan J. Hart, Montreal, Canada. Application filed December 12, 1904.

A method of signaling through conductors carried by the hose is described.

821,672. Automatic Controller for Motor Compressors. Walter J. Richards, Milwaukee, Wis. Application filed March 9, 1904.

A controller for the motor compressor of a fluid pressure system comprises a magnet, a main switch for the motor actuated thereby, and adapted to oppose the influence of the magnet, a primary switch for controlling the operation of the magnet in series therewith and actuated by the pressure of the fluid-pressure system and a circuit controlled by the primary switch for short-circuiting the magnet.

821,673. System of Fluid-pressure Control. Walter J. Richards, Milwaukee, Wis. Application filed March 21, 1904.

A system for fluid-pressure control comprises a driving mechanism, a pump, an electrically controlled means for connecting the pump with the driving mechanism, an electric generator driven by the driving mechanism and supplying current to the electrically controlled means and a switch sensitive to the fluid pressure for controlling the flow of current to the electrically controlled means.

821,697. Electric Current Controller. Lynde Bradley, Milwaukee, Wis., assignor to the Compression Rheostat Company, Milwaukee, Wis. Application filed June 9, 1904.

In an electric current [illegible] drum and mechanically operated [illegible] ject the medium to pressure [illegible] power as the pressure [illegible]

821,719. Trolley. Mina H. Keelson, Amesbury, Mass. Application filed September 2[illegible], 1904.

Details are described.

821,733. Telegraph Pole. Duncan W. Peck, Syracuse, N. Y. Application filed November [illegible], 190[illegible].

A form of hollow metallic pole [illegible] for the conductor is described.

821,741. Telegraphy. Michael I. Pupin, New York, N. Y. Application filed January 28, 189[illegible].

Combined with a main line are means for [illegible] several electromotive forces of different frequencies [illegible] the main line through transformers [illegible] form closed magnetic circuits and having a large magnetic leakage, selective parts connected to the main line and means for tuning each selective part to respond to one of the electromotive forces thrown upon the main line. (See cut.)

821,746. Insulator. Augusto Richard, Milan, Italy. Application filed March 17, 1904.

The insulator is provided with a cup-shaped metallic bush having its inner end closed, a thin layer of cement securing the bush to the insulator and a paraffined washer surrounding and abutting the bush to prevent the entrance of moisture to the cement.

821,747. Controlling Apparatus. Walter J. Richards, Milwaukee, Wis. Application filed July 2, 1903.

Combined with an electric motor are a fluid pump driven thereby, a pressure system supplied by the pump, switching means controlled by the pressure in the system to govern the circuit for the motor and electrical means for preventing the operation of the suction valves of the pump upon the closure of the circuit through the motor.

821,752. Continuous Magnetic Furnace. Henry C. Shaw, Glenshaw, Pa. Application filed April 8, 1905.

In a furnace, oven or the like, are a magnet and means for moving is so as to advance, relatively to the magnet, magnetic material within its influence into or through the furnace.

821,753. Portable Telephone. Will A. Shimer, Rochester, N. Y. Application filed October 3, 1905.

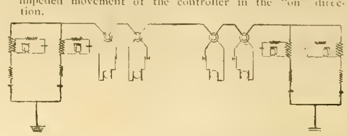
A desk set attachment for a telephone is described.

821,767. Railway Signaling System. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed January 12, 1906.

Combined with an appliance for controlling the passage of a car or train along a railway are a motor for operating the car from one position to another, an electromagnetic device for holding the appliance in the position to which it has been moved and a source of multiphase current supply for the electromagnetic device.

821,768. Controller Regulator. Joseph V. E. Titus, Keokuk, Iowa., assignor to the Electrical Devices Company, Keokuk, Iowa. Application filed April 11, 1904.

In a controller regulator are means controlled by a magnet for rendering the regulator operative continuously while the operating circuit is made to permit an impeded movement of the controller in the "on" direction.



NO. 821,741.—SELECTIVE TELEGRAPH APPARATUS.

821,778. Telephone Toll Box. Odilon Brisbois, Chicago, Ill., assignor of one-half to the Turner Brass Works, Chicago, Ill. Application filed May 1, 1905.

Details of a coin-operated toll box for telephone service are set forth.

821,800. Lock-out Device for Telephones. Ruben C. M. Hastings and Thurston Matheny, Athens, Ohio. Application filed April 4, 1905.

Several substations are connected on a party line with a receiver hook at each station, a receiver hook-locking member provided with a projecting shoulder, a pivotally mounted lever having one arm movable into engagement with the shoulder, the second arm of the lever having a eye-way connection, and a selector arranged to engage the second arm of the lever.

821,801. Electric-railroad Signaling Device. Henry A. Hoeschen, Omaha, Neb. Application filed May 2, 1905.

The parts of the system are an electric generator, armature, movable head provided with downwardly projecting leg for reciprocating the armature when depressed by passing vehicles and springs for normally supporting the movable head.

821,807. Multiple Switchboard for Telephone Exchanges. Milo G. Kellogg, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed [illegible] 1[illegible].

[illegible]

821,820. Selective [illegible]. Otto H. [illegible] Application filed April 6, 1905.

[illegible]

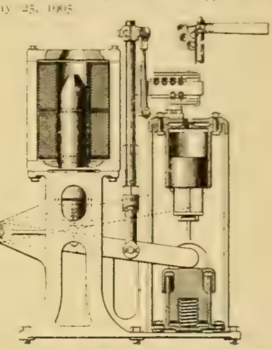
821,830. [illegible] New York, N. Y. [illegible] Application filed May [illegible]

[illegible]

821,832. Electrical Discharge Apparatus. [illegible] Seeley, Los Angeles, Cal., assignor to [illegible] chronous State [illegible] Application filed January 25, 1905.

[illegible] coils. Discharge [illegible] ends of the secondary coils.

821,837. Dynamo-electric Apparatus. William Stanley, Great Barrington, Mass. Application filed May 25, 1905.



NO. 821,809.—SIGNAL-OPERATING MECHANISM.

Combined with two stators are two rotors, the rotors being each provided with multiphase windings, one of the windings producing a larger number of poles than the other, the poles produced by the [illegible] rotating magnetically in opposite directions. Means supply alternating currents to the windings [illegible] rotate the rotors so that the [illegible] of the stators shall be the same.

821,838. Method of Generating Alternating Currents. William Stanley, Great Barrington, Mass. Original application filed May 25, 1905. Divided and this application filed June 6, 1905.

A method of generating alternating currents of constant potential for variations of currents delivered consists in generating two electromotive forces of equal frequency but opposite potential gradient and correcting the variations of one such potential by the other.

821,873. Electric Fuse. Otto C. Hoffmann, Buffalo, N. Y., assignor to the Fuse Wire and Manufacturing Company, Buffalo, N. Y. Application filed April 25, 1904.

A fuse for electric circuits consists of an integral cylindrical conductor flattened to a thin sheet-like section and thus presenting the greatest area at its fusing point.

821,883. Fuse. Francis I. du Pont, Wilmington, Del., assignor to the E. I. Du Pont de Nemóurs Powder Company, Wilmington, Del. Application filed January 5, 1906.

Combined with several fuses, or sets of fuses, each fuse comprising a casing containing fulminate of mercury, are a block of smokeless powder above the mercury, the blocks being of different thicknesses, and an electric circuit including all of the fuses.

821,898. Central-energy Telephone System. William A. Taylor, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed February 4, 1901. Renewed September 17, 1904.

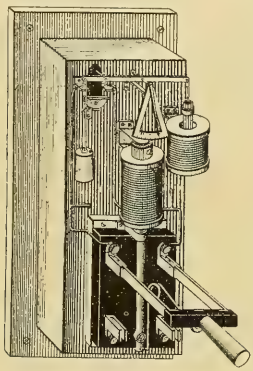
Condensers unite the lines for conversation, a signal controlling electromagnet being bridged between the two limbs of the talking circuit of one of the lines. The electromagnet has two windings and possesses impedance to the passage of talking currents, the charging source of

electricity being adapted to send current through the windings in a direction to cause them to neutralize each other.

821,899. Railway Signal-operating Mechanism. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 24, 1906.

Combined with a mechanism for operating a railway signal comprising an electromagnetic device are a buffer or cushion device, a movable part controlled by the electromagnetic device, and adapted to engage the buffer upon a movement of the signal in either direction, and a connection between the movable part and the signal. (See cut on preceding page.)

821,902. Static Induction Generator. Henry B. Todd, Meriden, Conn. Application filed February 18, 1905.



NO. 822,084.—CIRCUIT-BREAKER.

A generating plate or cylinder for static machines is composed of fibrous material and sulphur.

821,909. Apparatus for the Regulation of Electric Systems. George A. Wells, Jr., New York, N. Y. Application filed November 10, 1903.

A generator is adapted to supply the line conductors with the working current, a compensating electric machine being adapted to store mechanical energy and release it subsequently as electric energy and connected with the line conductors. A booster is interposed in the connection between the compensating machine and one of the line conductors.

821,914. Automatic Electric Signaling Device for Railway Switch Systems. David C. Wolfe, Lyons, Kan. Application filed August 9, 1905.

Automatic electrically operated switches to sidetrack trains moving in opposite directions are described.

821,916. Railway Signaling System. Azel Ames, Jr., Cleveland, Ohio, and John S. Hobson, Edgewood Park, Pa., assignors to the Union Switch and Signal Company, Swissvale, Pa. Application filed February 24, 1906.

A block-signal system, electromagnetically operated, forms the basis of the patent.

821,920. Insulating Appliance. William A. Bonnell, Brooklyn, N. Y. Application filed April 3, 1905.

Associated parts are insulating appliances, pipe outlets and outlet boxes, the insulating appliances comprising tubular and ring members, the ring members provided with an inner recess, and all of the members adapted to pass over and insulate the pipe outlets.

821,924. Attachment for Telephones. Henry L. Carpenter, Minneapolis, Minn. Application filed January 30, 1905.

An attachment for a desk set allows of its being tipped down over a pivotal arrangement in the base.

821,931. Electrical Transmitting and Receiving Apparatus. John P. L. Donlevy, London, England. Application filed August 21, 1905.

Electrical transmitting and receiving apparatus comprises a keyboard having spring keys and electrical contact devices in connection therewith, a casing having sight holes therein, shutters for the holes, type drums in the casing and means for rotating and traversing the drums and operating the shutters from the keyboard.

821,936. Current Regulator. William K. Gibboney, Buffalo, N. Y., assignor to the Pittsburg Reduction Company, New Kensington, Pa. Application filed November 19, 1904.

Means for regulating furnace electrodes comprise motive devices for feeding the electrodes, normally open circuits for the motive devices, an electromagnetic regulating device operated by current derived from the main current and proportional thereto, a magnetic device arranged to oppose the action of the regulating device energized from a separate source, and means for varying the force of the opposing magnetic device.

821,981. Telephone Switch. Addington L. Brincklé, Philadelphia, Pa. Application filed December 13, 1904.

A switch located within the standard and capable upon being manipulated of connecting the line alternately with the bell-ringing circuit and the talking circuit and of maintaining itself in either connection, together with means for operating the switch extending without the standard, are the important features of originality.

821,992. Relay Device. John P. Downs, Cleveland, Ohio, assignor to the North Electric Company, Cleveland, Ohio. Application filed May 1, 1902.

Combined with a helix-wound core having a polar extension are an armature responsive thereto, magnetically engaging the extension in normal condition substantially throughout an area equal to their effective cross-sections, a knife-edge being provided for and freely supporting the armature, and contact parts adapted to be actuated by the armature.

822,003. Electric Time Switch. Frederick C. Huber and John E. Manzel, Rosebank, N. Y. Application filed May 23, 1905.

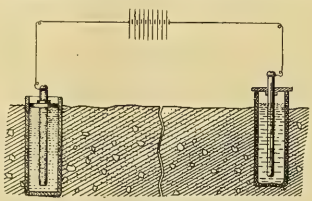
Details are described.

822,007. Incandescent-lamp Socket. Norman Marshall, Newton, Mass. Application filed April 22, 1904.

An incandescent-lamp socket has a cap provided with means for securing it to a fixture or support, a shell detachably connected with the cap and a shade holder permanently secured to and forming a part of the cap.

822,028. Railway Signaling System. Jacob B. Struble, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed July 13, 1904. Renewed March 7, 1905.

Several circuits each contain a translating apparatus and require different electromotive forces. A generator is common to all of the circuits and means in one or more of the circuits offer a counter force to the electromotive force of the current from the generator, whereby the electromotive force of the generator in the circuits is reduced.



NO. 822,175.—METHOD OF LOCATING METALS IN THE EARTH.

822,029. Time Relay Recording Clock and Signal Mechanism. Guy P. Thurber, Pittsburg, Pa. Application filed May 11, 1905.

A driven shaft is normally held stationary, electrical means releasing the shaft to automatically set air brakes. Means operated by the shaft record the time when the air brakes are set.

822,036. Electrical Switch. Earl C. Bacon, Indianapolis, Ind., assignor to the Flash Light Sign Company, Connersville, Ind. Application filed December 8, 1904.

A thermostatic circuit-regulating device, operated by the expansive effect of a metallic strip, alternately throws the current in one of two sets of lamp circuits.

822,043. Automatic Insulator. Gaétan M. Corell, New York, N. Y. Application filed December 21, 1904.

One claim reads as follows: "In a device of the class described, in combination, an insulating-body, a conductor having legs with breaks therein and mounted within the body, movable plungers mounted within the body, contact plates carried thereby which may bridge the breaks, springs constraining the plungers in the direction of the legs, and other contact plates carried by the plungers and engaging the conductor at other points."

822,084. Electric Circuit-breaker. George G. Stout, Parkersburg, W. Va. Application filed March 30, 1905.

Combined with the switch are a resistance coil connected across the poles of the switch, an armature associated with the coil, a magnet coil connected across the poles of the switch with an open-circuit switch and connecting means between the open-circuit switch and the armature. A switch-locking element is associated with the last-mentioned coil, the open-circuit switch being adapted to be closed by the movement of the armature which causes the last-mentioned coil to actuate the switch-locking element to release the switch. (See cut.)

822,091. Prepayment Electric Meter. James J. Wood, Fort Wayne, Ind. Application filed June 12, 1905.

In a prepayment electric meter is a circuit-closer operated by the totalizer, comprising a spindle, a weight hung loosely thereon, circuit-closing contacts operated by the weight, and an adjustable frame carrying the spindle and contacts.

822,109. Electrolytic Cell. George A. Gabriel, New York, N. Y., assignor to the Bleach and Caustic Process Company, New York, N. Y. Application filed February 26, 1906.

In combination with an electrode, one face only of which is in contact with the active electrolyte, are liquid conduits extending from the opposite face for conveying liquid away from the face.

822,175. Process of Locating and Extracting Metals Beneath the Earth's Surface. Edson R. Wolcott, Golden, Colo. Application filed September 5, 1905.

A process of locating metals beneath the surface of the earth consists in placing electrodes having the relation of anode and cathode in the earth and passing an electric current between them and causing the metals in solution in the vicinity of the electrodes to move through the earth and be deposited upon the cathode. (See cut.)

822,193. Relay Device. John P. Downs, Boston, Mass., assignor to the North Electric Company, Cleveland, Ohio. Original application filed May 1, 1902. Divided and this application filed October 14, 1904.

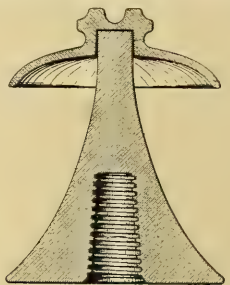
In an electromagnetic appliance are an electromagnet, a protective shell or casing therefor and a thumb-nut permanently and rotatably secured to the shell, and adapted to secure the latter removably in position over the parts of the appliance.

822,211. Insulator. Fred M. Locke, Victor, N. Y. Application filed June 23, 1902.

A bell-shape porcelain center piece gradually increases in diameter from top to bottom and has a central threaded aperture extending upwardly from its lower face, the upper end of the center piece being substantially flat and parallel with its lower end face. A porcelain cap rests upon the flat upper end of the center piece. (See cut.)

822,222. Apparatus for Effecting the Storing Up of Speech or Signals. Valdemar Poulsen, Copenhagen, Denmark, assignor to the American Telegraphone Company. Original application filed July 8, 1899. Divided and this application filed April 3, 1900. Renewed March 20, 1906.

An apparatus for storing and reproducing electrical impulses consists of an electromagnet, a paramagnetic surface within the magnetic influence of the electromagnet, means for moving the magnet and surface with respect to each other, so that different portions of the surface will be successively presented to the magnet, and means whereby magnetic impressions of the impulses are caused to pass to and from the body through the magnet.



NO. 822,211.—INSULATOR.

822,223. Automatic Controller for Pressure Systems. Walter J. Richards, Milwaukee, Wis. Original application filed March 9, 1904. Divided and this application filed April 6, 1905.

In the device are a solenoid comprising a pair of coils connected together, a primary switch adapted in one position to send current through one of the coils and a switch operated by the solenoid to shunt the coil and the connection made by the primary switch and to send an energizing-current through the other coil in shunt with the motor to hold the switch in its operated position. The primary switch is adapted in another position to connect the first-mentioned coil in multiple are with the other coil to neutralize its effect and release the main switch. A motor circuit is controlled by the main switch.

REISSUE.

12,490. Controlling Means for Electric Circuits. Julius K. Lux, St. Louis, Mo. Original application filed June 3, 1897. Divided and application filed June 25, 1903. Application filed May 24, 1904. Application for reissue filed April 5, 1906.

In a snap opening and closing circuit-controlling device are a suitable support, an electrical contact carried thereby, a movable electrical contact adapted to cooperate with the first-mentioned contact and means for actuating the movable contact and for effecting a more powerful snap action in closing the contacts than in opening them.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on June 4, 1906:

404,438. Non-interfering Fire-alarm Signal Box. J. J. Ruddick, Richmond, Ind.
404,463. Filament for Incandescent Electric Lamps. T. D. Bottom, New York, N. Y.
404,466. Electric Motor. A. S. Bradley, Yonkers, N. Y.
404,466. Alternating-current Electric Motor. C. S. Bradley, Yonkers, N. Y.
404,469. Electric Railway. W. Cannell, Cleveland, Ohio.
404,470. Voltmeter. L. Daft, Plainfield, N. J.
404,471. Telephone Transmitter. E. S. Drake, Cambridge, Mass.
404,484. Dynamo-electric Machine. W. Hochhausen, Brooklyn, N. Y.
404,500. Endless Belt for Grips for Cable Railways. J. H. Pendleton, Brooklyn, and A. Bryson, Jr., C. Tiers and L. Moss, New York.
404,518. Fire-alarm Telegraph. S. A. Chase, Evart, Mich.
404,519. Duplex Fire Telegraph. S. A. Chase, Evart, Mich.
404,533. Electric Motor and Regulator. A. Gartner, Newark, N. J.
404,567. System of Generators for Alternating-electric Currents. O. B. Shallenberger, Rochester, N. Y.
404,602. Regulator for Dynamo-electric Machines. E. P. Clark, New York, N. Y.
404,630. Induction Coil. J. F. Kelly, Hoboken, N. J.
404,631. Safety Attachment for Electric Motors. W. S. Paca, Baltimore, Md.
404,661. Electric Motor. H. B. Slater, Detroit, Mich.
404,667. Fireman's Electric Wire Cutter. D. A. Woodhouse, Elizabeth, N. J.
404,680. Telephone Support. C. W. Brown, Montreal, Quebec, Canada.
404,687. Electric Railroad. L. Daft, Plainfield, N. J.
404,698. Portable Electric Lantern. W. Frishmuth, Philadelphia, Pa.
404,699. Galvanic Battery. W. Frishmuth, Philadelphia, Pa.
404,712. Detachable Brush Holder for Dynamos. J. F. Kester, Terre Haute, Ind.
404,713. Armature Core for Dynamos. J. F. Kester, Terre Haute, Ind.
404,714. Regulator for Dynamo-electric Machines or Motors. J. F. Kester, Terre Haute, Ind.
404,715. Brush Spring for Dynamos. J. F. Kester, Terre Haute, Ind.
404,783. Regulator for Electric Motors. A. Gartner, Newark, N. J.
404,801. Electric Meter for Alternate Currents. M. M. M. Slattery, Fort Wayne, Ind.
404,813. Electric-cable Terminal. R. H. Widdicombe, Chicago, Ill.

WESTERN ELECTRICIAN

EVERY SATURDAY

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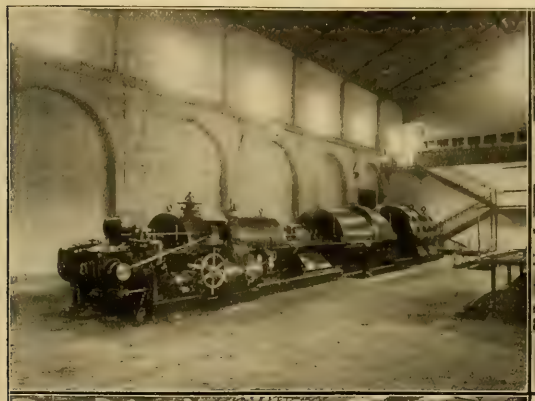
The Exposition in Milan and the Electrical Undertakings of the City.

By Frank C. Perkins.

The International Exposition now being held at Milan, under the patronage of his majesty the king of Italy, is a comprehensive exposition of art, sciences, industries and agriculture, as well as the mechanical and electrical development of the present day. This unique Italian world's fair is for the purpose of celebrating the opening of the Simplon Tunnel, which shortens the time required to travel from the principal Italian cities to the French metropolis by a number of hours. The grounds exhibition [illegible] with [illegible] and [illegible] athletic sports, as well as [illegible] racing and other prize competition. The naval and merchant marine display covers an area of 12,000 square meters, while that of the automobiles and cycles is 10,000 square meters. A station for [illegible] telegraphy has been installed, and the pavilions of France, Switzerland, Austria, Belgium and the South American republics are of unique design, the electrical effects being well carried out and very extensive.

Electrical current for supplying this exposition [illegible] for lighting, and the [illegible]



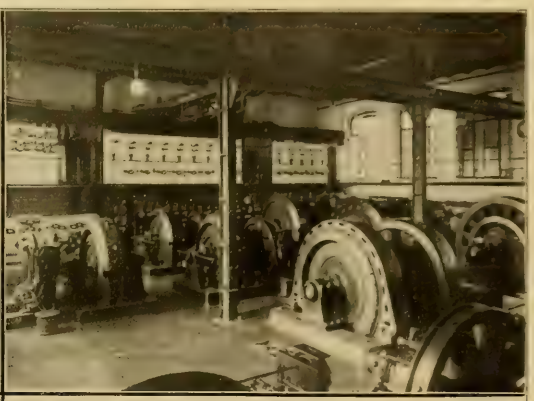


Fig. 1. 4,500-horsepower Steam Turbine in Porta Volta Station.
Fig. 2. Motor-generators in Radegonda Sub-station.
Fig. 3. Switchboard and High-tension Oil Switches at Porta Volta Station.
Fig. 4. Milan-Paderno 15,000-volt Transmission Line Crossing Railroad

of the exposition cover an area of nearly 1,000,000 square meters. The buildings cover an area of 245,300 square meters, and the countries which take part officially include France, Great Britain, Switzerland, Belgium, Germany and Austria, as well as Hungary, Japan, Morocco, Bulgaria and China, and the South American countries, including Peru, Chile, Guatemala and San Domingo. Nearly all of the other countries are largely represented, including the United States, Canada, Mexico, Holland, Norway, Spain, Russia and Greece.

There are over 120 buildings and pavilions, the principal ones including the Fine Arts Building, Simplon Building, Aquarium Building, Decorative Art Building, Machinery Hall and the Electricity Building. The Fine Arts section covers an area of 12,000 square meters, and the Decorative Art Building 24,000 square meters, while Machinery Hall and the Land Transport buildings have an area of 30,000 square meters and 25,000 square meters respectively.

It is stated that more than 100 national and international congresses will be held during this

with its light and power is distributed entirely by underground cables laid in wooden troughs filled with sand and asphaltum. Sub-stations are provided on the grounds, with transformers for reducing the pressure of the current, which is transmitted from the Milan electrical service conductors. The current is generated by the steam-turbine plant in Milan, and is supplemented by current from the Paderno hydro-electric station, being supplied by the Societa Italiana Edison di Ellettricita of Milan.

The steam electric generating central station in Milan was originally located at Radegonda, where it operated until year 1900, this plant now being equipped and utilized as a sub-station. The Porta Volta plant, which is now the main station, was recently equipped with a Parsons steam turbine of 4,500-horsepower capacity, and another unit of the same type of 3,000-horsepower output. The larger of these units is shown in Fig. 1. In this plant there are also three Tosi compound engines of 1,000 horsepower each, driving alternators, and two Tosi engines of 200 horsepower

is also supplied with electric current by the Edison company. The direct-current underground system, as well as the electric-railway feeders, are supplied with current from the old station of Radegonda, now employed as a converting sub-station. The total length of the three-phase cable forming the distribution network is nearly 200,000 meters. There are a total of 176 transformers of 11,600 kilowatts capacity, reducing the pressure from 3,700 volts to 160 volts, the three-phase current supplied from these sub-stations being used for lighting and power entirely.

Current generated at the Porta Volta central station is conducted by 15 three-phase cables at a pressure of 3,700 volts, forming a single network in the shape of a ring, intersected by two almost diametrical cross branches. There are 153 transforming sub-stations on this network and on the cables branching from it, the current being distributed principally in the outer portion of the city of Milan.

There are in operation nearly 4,000 motors, of a total capacity of about 12,000 horsepower, con-

nected to the three-phase mains of this company, this power being employed by about 1,000 customers. There are also on these mains about 80,000 incandescent lamps and nearly a thousand arc lights.

At the Radegonda sub-station there are five motor-generators of 550 kilowatts capacity, operating at a speed of 315 revolutions a minute, and converting the three-phase current at 3,700 volts into direct current at 550 volts for electric-railway service. There are also at this sub-station nine motor-generators converting the three-phase current from 3,700 volts into direct current at 125 volts for lighting service, seven of these direct-connected sets being of 250 kilowatts capacity, with two units of 60 kilowatts each. Fig. 2 is a view of a portion of the interior of this sub-station. There are also five 100-kilowatt Thury boosters installed for use in charging the batteries, which consist of four Tudor accumulator plants, having a total capacity of 20,000 ampere-hours at 130 volts, at a one-hour discharge rate, and 3,800 ampere-hours at 550 volts. The batteries are constantly connected with a switchboard and lighting service, the batteries having no end-cell switches. It is stated that the charge and discharge is governed by the boosters, the latter having their fields automatically regulated by the Magrini system.

The maximum demand of energy on the station is about 2,000 kilowatts, and the distribution is made on the three-wire system, with about 125 kilometers of cables, with 150 volts pressure between the outside conductors There are about 1,000 arc lights and 80,000 incandescent lamps supplied with current from these cables, while the maximum demand of energy for the electric-railway line is nearly 3,000 kilowatts. On the latter service the battery acts as a regulating plant without other governing device.

The electric railways of Milan are provided with about 400 motor cars, each weighing 6,400 kilograms, and a number of trailers are also utilized. The railway feeders take current from the above-mentioned sub-station by 12 underground cables, and the cars are handled in a very simple manner, as from the Piazza del Duomo, numerous radial lines being installed, intersected by a number of cross lines, and special arrangements have been made for handling the visitors to the Milan Exposition with ease and comfort to the passengers.

Under ordinary conditions over 330,000 passengers are carried in a day, the total number in a year representing nearly 100,000,000 persons. There are a number of interurban-railway lines operated by the Edison company, one of which is the Monza line,

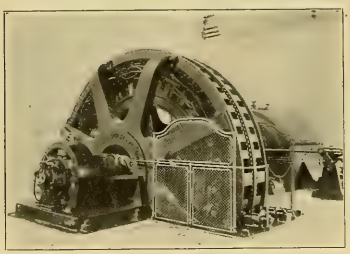


FIG. 6. A 1,500-KILOWATT HYDRO-ELECTRIC UNIT IN PLANT OF MILAN-PADERNO DEVELOPMENT.

which carries passengers on double-deck cars, which are very popular. This line is supplied with current from a sub-station equipped with several 200-kilowatt converters and a storage-battery installation having an output of more than 1,000 amperes at 550 volts.

The Edison company, which supplies the current for the city of Milan, as well as the Milan Exposition, has a generating equipment of about 30,000 horsepower, feeding about 4,000 electric motors of 20,000-horsepower capacity and about 200,000 incandescent lamps, as well as 3,000 arc lamps. There is a maximum load on the above circuit of 16,000 kilowatts, while the municipal railway lines, about 150 kilometers in length of single track, have about 400 cars in operation, this number being greatly increased during the exposition. The lighting service and power service is provided with about 10,000 electric meters, and about 330,000 meters of underground cable have been laid.

One of the artistic transformer and cut-out street sub-stations is illustrated in Fig. 5, and the double transmission-line steel bridgework at a crossing of one of the steam-railway lines is shown in Fig. 4. The average distance of these poles is 60 meters and the total length of the power-transmission line to the Paderno hydro-electric plant is 32,785 meters. A branch transmission line from this plant supplies current to Monza, another to Brianza and still another to the sub-station at Sesto S. Giovanni, where the current is supplied to the suburban electric railway above mentioned.

The transmission lines from the Paderno plant include more than a score of conductors, nine millimeters in diameter, mounted on the two rows of iron poles placed about seven feet from each other, side by side. The transmission lines are supplied with three-phase current at 14,000 volts pressure and a frequency of 42 cycles a second, generated directly at this tension in the armature coils of the alternators.

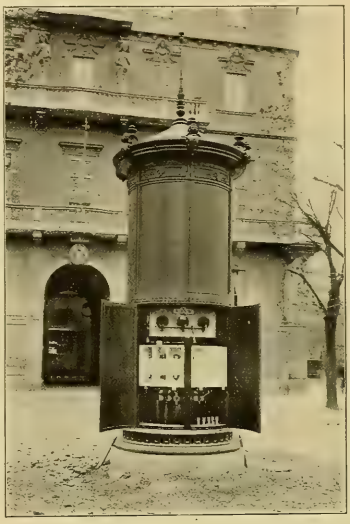


FIG. 5. A 100 KILOWATT STREET TRANSFORMER IN MILAN.

There are seven hydro-electric units, consisting of 1,500-kilowatt generators built by Brown, Boveri & Co., directly coupled to reaction turbines constructed at Milan, Italy, by Riva, Monneret & Co. One of the units is shown in Fig. 6. These turbines operate at a speed of 180 revolutions a minute. The generators supply the high-tension current directly to the central-station switchboard, and from thence to the various transmission lines to the Milan Exposition and Milan underground distribution system, as well as those of the other towns supplied by this power after being stepped down in pressure.

The 2,500-horsepower hydraulic turbines at the Paderno plant are supplied with water through seven steel pipes, 1,200 millimeters in diameter, from one large penstock, which takes its supply from the last of a series of tunnels. This plant utilizes the water from the River Adda, a dam being constructed, with a canal 2,268 meters long and a total capacity of 54 cubic meters a second. The plant utilizes a fall of 30 meters, the water being carried a portion of the distance through open trenches and for the balance of the way through tunnels. The accompanying view (Fig. 6) shows one of the 1,500-kilowatt alternators of 14,000 volts pressure, the exciter on its extended shaft, and the turbine in the background. A wire netting or framework is provided at the alternator to keep persons away from the dangerous high-voltage windings of the machine.

A very fine display of electrical machinery, electrically operated tools, and engines, boilers and auxiliary apparatus is being made in the machinery and electricity department, many of the important electrical manufacturers having extensive exhibits of their apparatus at the exposition.

A Central Plant for Illinois Towns.

The Watseka (Ill.) Republican says that H. J. Frith and associates, owners of the Watseka Electric Light, Heat and Power Company, are advancing a plan to consolidate the electric plants in a number of the towns in the vicinity and supply current to all from one large plant to be located in Watseka. The towns to be taken into the scheme are Onarga, Gilman, Milford, Sheldon, Crescent City, Woodland, Pittwood and Martinton. Where plants are already in operation in the towns mentioned the owners would become stockholders in the new company. A transmission system would be constructed between the towns and by this means farmers in the territory served will be able to enjoy the conveniences of electric light and power. The project is said to be meeting with favor.

New Steam-turbine Electric Plant for Wilmington, Del.

A company has recently been organized, known as the Delmarvia Construction Company, for building an entire new power plant and distribution system for serving residents of Wilmington, Del. This undertaking, it is understood, is being financed by Baltimore interests. A new plant is now under construction and is designed entirely for steam turbines. Two 500-kilowatt Westinghouse-Parsons units will be installed at the present time, with engine and motor-driven exciter units. The plant will furnish power to an alternating-current distribution system at a frequency of 60 cycles.

Illuminating Engineering Society.

A meeting of the Illuminating Engineering Society in New York was held June 8th at 8 p. m. The paper of the evening was by Dr. Louis Bell upon the subject of "Some Physiological Factors in Illumination and Photometry." Dr. Bell is an electrical engineer who is making a specialty of illumination, and his paper was a thorough analysis of the subject. To add to the interest of the meeting, several noted oculists were present and took part in the discussion. An abstract of the paper and discussion appears elsewhere in this issue.

At a meeting of the council of the society on June 8th several resolutions were unanimously adopted, which provided for the organization of sections in any city or locality where the membership is at least 50; the New York members are to be organized as the New York section; each section is to have its own officers; expenses of sections for stenographic report, postal cards, etc., to be borne by the main organization; actions of the sections must first be referred to the council of the main society for approval, except matters relating to holding of meetings and discussion of papers; all meetings of sections shall be held before the 20th of the month; stenographic reports of discussion shall be submitted to members for correction prior to being printed.

Award of Prizes for Papers in Co-operative Development Competition.

At the convention of the National Electric Light Association in Atlantic City on June 7th the committee of the association having in charge the awarding of prizes for the Co-operative Electrical Development Association's competition made its report. Some time ago the Co-operative association, as announced in the Western Electrician, offered prizes of $500, $300 and $200 for the three best papers submitted on the "Organization and Conduct of a New-business Department Suitable for Central Stations in Cities of 50,000 Population or Less." Papers were invited from central-station men, and the awards were to be made by a committee of the National Electric Light Association. This committee, appointed by President Blood, consisted of Douglass Burnett of Baltimore, E. H. Mather of Portland, Maine, and J. E. Montague of Niagara Falls. It made its report through Mr. Burnett at the Atlantic City convention of last week.

Mr. Burnett said that 22 papers had been received, and that the judgment of the committee had been unanimous in making the following awards:

First prize, $500—M. S. Seelman, Jr., Brooklyn.

Second prize, $300—S. M. Kennedy, Los Angeles, Cal.

Third prize, $200—J. M. Robb, Peoria, Ill.

Honorable mention—Charles N. Jackson, Toledo; Fred D. Sampson, Charlotte, N. C.; W. R. Sweaney, Minneapolis; James L. Wiltse, Brooklyn.

Before handing a draft for $500 to Mr. Seelman, who was the only prize winner present, Mr. J. Robert Crouse of the Co-operative Electrical Development Association said that that association would offer other prizes during the coming year. He was well pleased with the experiment and gratified that it had been carried out under the prestige of the National Electric Light Association. The papers secured represented successful commercial practice.

The prize-winning papers and perhaps some of the others will be furnished to the electrical press.

Alcohol, Benzol and Gasoline, Versus Steam Motor Cars in Europe.

The use of alcohol as a fuel for internal combustion engines is rapidly increasing in Germany and other European countries, and is competing strongly with gasoline and benzol for the operation of motor cars on the suburban and interurban railways on the Continent. All of these internal combustion-fuel engines are being employed to a considerable extent in competition with the steam railway motor cars for frequent trips in thickly settled districts, and all of the above mentioned motor cars are said to be successfully in operation, on the steam-railway branches, the steam railway engineers taking this method of meeting the strong competition and great development of electric motor cars for suburban and interurban traffic.

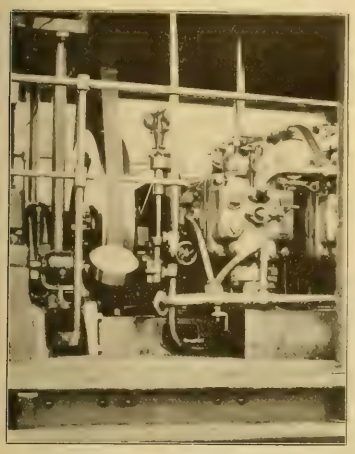


FIG. 1. GASOLINE ENGINE AND GENERATORS IN CAR OF NORTHEASTERN RAILWAY.

With all government tax taken off from the denaturized alcohol, this fuel will, without question, be largely employed in the United States and Canada for this class of service, the alcohol, benzol and gasoline motor cars being all of practically the same construction, with but slight differences as to details of mixers or carburetters.

On the Northeastern Railway of England, a combination gasoline electric autocar is working with great satisfaction, and is said to be meeting all the requirements of this service. Fig. 1 shows the compact arrangement of the engine and generator in the cab. The gasoline engines were made by the Wolseley Tool and Motor Company of Birmingham, England.

A Serpollet motor car is operated by the Societe des Tramways de Port au Prince, between Croix de Bossales, Douane and Champs de Mars and a number of steam motor cars are running on the London and Southwestern Railway in England, one of these cars, for eight first-class passengers, 32 third-class passengers and a ton of baggage. The engines have cylinders nine by 14 inches, located at one end of the car, the driving wheels being three feet in diameter. This car has a total length of 51 feet 2.5 inches, and is in charge of two men only, who can operate it from either end, should it become necessary. The tank carries sufficient water for a run of 60 miles, and the coal bunker is supplied with sufficient fuel for one day's work.

Steam motor cars have also been constructed for the Great Central Railway of England at its works at Corton, near Manchester. These cars are 61.51 feet long and are divided into several compartments, including an engine room, baggage room, vestibule, first-class and third-class compartments, as well as smoking room and operators' room. They are arranged to seat 12 first-class and 44 third-class passengers and are equipped with electric lights throughout. In addition to the ordinanry hand brake, there are vacuum automatic brakes, operated from either end of the car. The engine compartment is fitted with a vertical multi-tubular boiler having 450 tubes 1.25 inches in diameter, steel boiler plates being employed with a copper firebox. The steam cylinders are below the car frame, the driving wheels propelled by them being coupled together.

It is stated that these cars are operated at an [illegible] providing an [illegible] and frequent [illegible] are supplied by [illegible] by a dynamo driven [illegible] ing. The water tanks [illegible] bottom of the car while the [illegible] ers in the engine room.

It may be of interest to [illegible] details of construction of the [illegible] electric autocar above referred to in operation on the Northeastern Railway in England.

A self propelled gasoline electric railway [illegible] designed to meet the need for an [illegible] service to act as a feeder to the [illegible] the Northeastern Railway Company. This [illegible] autocar is designed to carry [illegible] and mails, and to enter to [illegible]

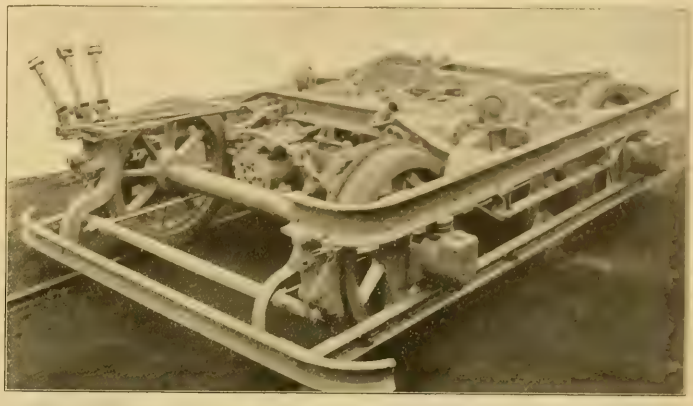


FIG. 2. TRUCK OF STEAM DRIVEN MOTOR CAR FOR AUSTRIAN AND HUNGARIAN RAILWAYS.

regular service. The idea carried out in the construction of this car was the installation of electric motors, an electric generator and gasoline engine, so arranged that when the car was on electrified lines of railway it could pick up the current exactly as an ordinary electric car, and when off the electrified lines would generate its own current and would become self-contained and self-propelled. The car is mounted on two four-wheeled trucks, each of which is provided with a direct-current railway motor. The engine room, located at one end of the car, is equipped with an electrical generator

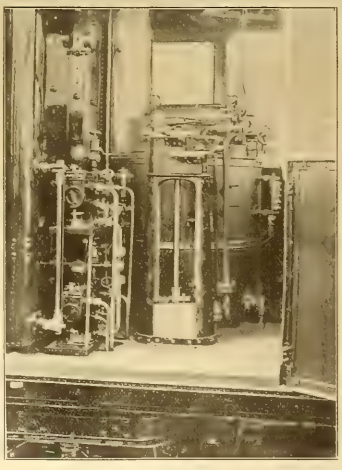


FIG. 3. BOILER COMPARTMENT OF AUSTRIAN AND HUNGARIAN RAILWAYS CAR.

directly coupled to an 80-horsepower gasoline engine of the four-cylinder type, which operates at a speed of 420 revolutions a minute. The engine has a 10-inch stroke and is provided with cylinders, each having a diameter of 8.5 inches. In the gas engine compartment there is also a small exciting dynamo for charging a set of storage batteries utilized for lighting the coach, the dynamo being [illegible] revolutions a minute and a maximum speed of [illegible] revolutions a minute.

Cars of this type can be run between the regular trains during sudden temporary increase in the traffic, several being kept at important centers to be used instead of specials, which is accomplished without any alterations in the existing permanent way by the use of the combined gasoline electric autocar.

Another important point is in cases where it has been found economical to equip an existing railway with a system of electric traction. One or more of these coaches may be kept in reserve in case of breakdown or temporary overload, when they can be put into traffic at a few minutes' notice.

Further, a branch line, which it would not pay to electrify, may be required to be worked in conjunction with the electrified line, and in such a case coaches of this type could be economically used.

A gasoline motor car constructed for the Konigl. Wurtembergischen Staatseisenbahnen by the Daimler Motor Company of Cannstadt, Germany, operates on a normal gauge track. It is equipped with a 25-horsepower Daimler motor and has a seating capacity for 36 passengers.

A number of steam-driven motor cars have been employed on the Austrian and Hungarian railways constructed by Ganz & Co. of Budapesth. The engine cylinders and gearing are connected on the trucks of a two-axle steam motor car constructed for the Arader & Csanader Versingten Eisenbahnen. Fig. 2 is a view of one of the trucks showing one of the engine cylinders. This car has a baggage room and two passenger compartments, one for second class and the other for third class, the boiler and controlling apparatus being located in the engine compartment at one end of the car. Fig. 3 is a view of the boiler compartment. The maximum speed of this car is 55 kilometers an hour when operating alone and 35 kilometers an hour hauling a load of from 30 to 35 tons on a maximum grade of 30 per cent.

The water tank carries 1,000 liters, which is sufficient for a run of 70 kilometers. The power required is about 35 horsepower, the weight without coal being 11,000 kilograms. This car has standing room for 12 persons and a seating capacity of 10 second class passengers and 24 third-class passengers, making a total capacity for 46 passengers. The total length is 10.8 meters, the wheel base being 5.5 meters. The gauge is 1,435 millimeters and the total width of the car is 2,440 millimeters. P.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

CONVENTION AT ATLANTIC CITY, JUNE 5-8.

Fairly considered in all its phases, the twenty-ninth convention of the National Electric Light Association, held at Atlantic City, N. J., last week, was the most successful in the history of the organization. The total attendance reached 1,400, and in this respect perhaps surpassed any other electric-light convention ever held in this country. The place of meeting was well chosen, and offered many new attractions which it would be impossible to find in inland cities. These attractions, however, did not prevent an attendance of from 300 to 500 at the various sessions. These sessions were held in a hall on Young's Pier, the exhibits of manufacturers being ranged in front of the pier.

Unqualified praise is due the officers of the association and the various committees who had the programme and entertainment features in charge. President Blood, Secretary and Treasurer Eglin and Mr. Arthur Williams, chairman of the convention committee, in particular, did most efficient work to make the meeting a success in every way.

In the discussion of problems relating to the electric-lighting industry, three subjects easily took the lead as offering fruitful fields to be considered. These were the discussion of types of lamps, both incandescent and arc, the getting and retaining of central-station business, and the evening discussion of the municipal-ownership agitation. The appearance of such new illuminants as the magnetite and flaming-arc lamps was naturally a subject to be considered thoroughly, as these types of apparatus are believed by many to possess possibilities very attractive to the central-station industry.

Exhibits of electrical apparatus, as will be seen by the accompanying illustrations, were elaborate and attractive, and for the first time in this country tantalum lamps were shown as a commercial exhibit, being listed at 75 cents apiece.

Everything was done to contribute to the comfort and enjoyment of the delegates and visitors, and all through the convention the weather was fine, so that everything could be carried out according to programme, without a hitch.

Following is given an outline report of the proceedings of the convention. Much excellent material remains for future issues of the Western Electrician, but a general survey of everything done in the open sessions, with several abstracts of papers and discussions, are given herewith.

First Day's Proceedings.

A general resume of the proceedings of Tuesday, June 5th, was telegraphed to the Western Electrician and appeared in the issue of last week. To make the present account complete, however, the leading features may be briefly recapitulated.

President William H. Blood, Jr., of Boston called the meeting to order promptly and introduced Mayor F. P. Stoy of Atlantic City, who welcomed the delegates. Mr. Blood then delivered his annual address. Secretary W. C. L. Eglin of Philadelphia said that 10 sister organizations had sent representatives to attend the meeting.

The first paper presented was the report of the committee on progress, which consists of T. C. Martin of New York. This was followed by the paper on "Mercury-arc Rectifier System with Magnetite Lamps for Street Illumination," by W. S. Barstow of Portland, Ore. This paper was given in the Western Electrician last week. This comparatively new and perhaps very important system excited much interest. The paper was discussed by J. H. Hallberg of New York, P. D. Wagoner of Schenectady, Arthur Williams of New York, Dudley Farrand of Newark, N. J., C. A. S. Howlett of Chicago, and the author of the paper.

A closely allied subject was treated in the paper of L. B. Marks of New York on "The Flaming Carbon Arc Lamp." Messrs. Wagoner, Hallberg, J. H. Perkins of Wilkesbarre, Pa., W. S. Barstow, Williams, President Blood, Samuel Scovil of Cleveland, and Mr. Marks discussed this interesting paper, which is given in abstract in this issue.

At the afternoon session Mr. Eglin, chairman of the steam-turbine committee, presented the third and concluding report of this valuable committee. The committee was thanked, and, at its own request, discharged. John Meyer of Philadelphia then gave his paper on "Mechanical Refrigeration." L. H. Scherck of Birmingham, Ala., W. W. Freeman of Brooklyn, Fred E. Matthews of Hartford, Conn., S. B. Storer of Buffalo, D. F. McGee of Red Oak, Iowa, and Mr. Meyer participated in the discussion.

"Fuel Economy" was the subject of J. H. Hallberg's paper, which was discussed by G. E. Claflin of Boston, L. R. Nash of Savannah, Ga., A. J. Campbell of New London, Conn., and the author. This paper was given in abstract in the Western Electrician last week.

James I. Ayer of Boston, ex-president of the association, read a report on "Electric Heating." Max Loewenthal of New York opened the discussion, in which E. F. McCabe of Lewistown, Pa., H. L. Wallau of Cleveland and Mr. Ayer more briefly participated.

The paper of Paul Spencer of Philadelphia was read by his associate, W. D. Partridge. Its subject was "Line Construction for Overhead Light and Power Service." There was a brief discussion by C. T. Murdock of Terre Haute, S. G. Rhodes of New York, Mr. McCabe, A. G. Lloyd of Shreveport, La., W. T. Morrison of New York, W. F. Wells of New York, J. T. Hutchinson of Rochester, N. Y., and Mr. Partridge.

NIGHT VIEW OF FRONT OF YOUNG'S PIER, ATLANTIC CITY, HEADQUARTERS OF THE N. E. L. A.—IN FRONT IS SHOWN A PORTION OF THE FAMOUS BOARD WALK.

In the evening there was a very enjoyable reception and dance at the Marlborough-Blenheim—a fine new hotel. When the dancing was at its height the scene was a brilliant one.

New-business Getting.

Wednesday was the field day of the new-business-getting and old-business-retaining movement now so conspicuous in the electrical industry. As one speaker phrased it, the movement shows the awakening of the commercial spirit among the central-station companies. The first of this class of papers was prepared by F. W. Frueauff of Denver and read, in his absence, by John Craig Hammond of Denver and New York. Its theme was "Business-getting Methods." D. F. McGee of Red Oak, Iowa, followed with his paper on "How to Make a Small Electric Plant Pay." Then came a symposium on "Some Methods Used in Securing and Retaining Business," made up of contributions from Mathias E. Turner of Cleveland, Norman T. Wilcox of Lowell, Mass., George N. Tidd of Marion, Ind., R. S. Wallace of Peoria, George B. Tripp of Colorado Springs and Leon H. Scherck of Birmingham, Ala. All of these gentlemen were present and presented their own papers except Messrs. Wilcox and Tripp. F. N. Sanderson read Mr. Wilcox's contribution, and Mr. Wallau that of Mr. Tripp.

These papers were discussed by F. W. Smith of New York, M. S. Seelman, Jr., of Brooklyn, John F. Gilchrist of Chicago, W. H. Gardner, Jr., of Boston, J. S. Codman of Boston, Mr. Freeman of Brooklyn, Mr. Hammond of Denver, C. H. Herrick of Boston, George B. Stetson of New Bedford, Mass., and Harold Almert of Chicago.

The talk went over much familiar ground—made familiar, that is, within the last year or so—but yet was interesting and profitable. Various expedients for securing and keeping business were presented and discussed, and a mass of suggestions was amassed, of which readers of the Western Electrician shall have the benefit in a future issue or future issues. Finally, on Mr. Herrick's motion, it was decided that a committee of five should be appointed to investigate, collect and suggest methods for the sale of electricity. This committee is to report at the next convention and is to be known as the Committee on Exploitation.

"Free" Installation of Electric Signs.

A very handsomely printed and illustrated report on electric-sign conditions in the United States, with particular reference to "free" electric signs as a factor in central-station prosperity, was presented by John F. Gilchrist of the Chicago Edison Company and read in abstract by his brother, James M. Gilchrist of Chicago. The author is a firm believer in electric signs. He says that a "free" sign "is only one step in placing your product in your customer's hands in a usable shape—a little poorer form of investment than your engines and dynamos, equal to your lines, much better than your arc lamps; that is, if you use a good sign." An outline form of an electric-sign ordinance concluded this admired report, which was later discussed by Percy Ingalls of Newark, N. J., and E. W. Lloyd of Chicago.

Electrical Co-operation.

J. Robert Crouse, that indefatigable champion of the get-together movement and the Co-operative Electrical Development Association, was on hand to open the session of Wednesday afternoon with his paper on "Profitable Commercial Co-operation," which he abstracted. Mr. Crouse is an enthusiast on co-operation; he oozes it from every pore, so to speak. His carefully thought-out plea for "the general principle of limited commercial co-operation and generic selling," with practical plans for carrying it out, was attentively listened to by a large audience and heartily applauded.

Following this, naturally, came the report of the committee to co-operate with lamp manufacturers' advertising committee. This committee consisted of Paul Spencer of Philadelphia, John F. Gilchrist of Chicago and J. E. Montague of Niagara Falls. It was appointed as the result of Mr. Crouse's missionary work at the Denver convention of last year. In the absence of Mr. Spencer, Mr. Gilchrist presented it. The committee endorsed the work of the Co-operative Electrical Development Association, which should receive unqualified moral support from the National Electric Light Association. It recommended the appointment of a committee to assist the co-operative association in its work. On motion this recommendation was adopted by the association.

There was a brief discussion, during which Converse D. Marsh of New York praised the work of the co-operative association as well as that of Mr. Crouse.

Protection from Lightning.

In the absence of Alex Dow of Detroit, R. S. Stewart of the same city presented the report on protection from lightning during 1905. The report was based on inquiries made by the committee and addressed to the company members of the association. An elaborate tabulation, giving much valuable information, was the result. N. J. Neal of Boston opened the discussion, and was followed by H. C. Wirt of Schenectady.

Grounding of Alternating-current Secondaries.

Sidney Hosmer of Boston sent in a brief paper on "Grounding Secondary Alternating-current Services," which was read by C. H. Herrick. P. H. Bartlett of Philadelphia and W. T. Morrison of New York discussed the paper.

Fire Hazard of Electricity.

H. C. Wirt of Schenectady gave the report on the fire hazard of electricity. Compared with other causes of fires, electricity makes an excellent showing. The National Electrical Code rules are very satisfactory in practically all cases. But sometimes extreme interpretations by inspectors cause trouble. W. H. Merrill, Jr., of Chicago, secretary of the Underwriters' Laboratories of Chicago, opened the dicussion. Among other things he said:

"You have, to begin with, we all admit, the best, the safest form of energy used for the pro-

duction of artificial light. As time goes on it may be possible, through the intelligence of your workers, that you will bring this energy to the point of perfection that nature has done in lighting, and give us, like the firefly, light without attendant heat. Then the farmer in the wayside hotel can wrap his towel about his lamp, as he finds it impossible to blow it out, and the people who desire to warm the bedclothing can use the incandescent light for a bed warmer without the disastrous results which we have experienced in many sections. But until that time comes, insurance interests ask your helpful co-operation in the work they have endeavored to do intelligently and carefully through the means that they have employed in determining exactly the extent to which this hazard is a factor in their business and to report to you and to others the exact nature of the troubles which their experience shows, in the thought that when all pull together for the common good the common good must be conserved."

C. J. H. Woodbury of Boston, secretary of the National Conference on Electrical Rules, also spoke on the subject.

EXECUTIVE SESSION.

At the executive session, after the open session of Wednesday afternoon, a committee to nominate officers was appointed. It consisted of Samuel Scovil of Cleveland, James I. Ayer of Boston, J. E. Montague of Niagara Falls, J. T. Cowling and Percy Ingalls of Newark, N. J.

An amendment to the constitution was proposed to provide for an "invited membership class," to be composed of college professors. The amendment was referred to a committee consisting of Dudley Ferrand, Arthur Williams and W. C. L. Eglin.

A committee to revise the constitution and by-laws, consisting of Samuel Scovil, Louis A. Ferguson of Chicago and W. C. L. Eglin of Philadelphia was appointed.

THEATER PARTY.

On Wednesday evening there was a theater party at the Savoy Theater. The association itself defrayed the cost of the entertainment.

ALTERNATING-CURRENT DISTRIBUTION.

The first paper of Thursday was read by Charles W. Stone of Schenectady and was entitled "Alternating-current Systems of Distribution and their Automatic Regulation." The speaker detailed various systems of primary and secondary distribution and devoted much of his paper to describing automatic regulators. Mr. Wallau of Cleveland, Mr. Hallberg of New York, J. F. Geiser of Waynesboro, Pa., and the author joined in the discussion.

SERVICE METERS.

William Bradshaw of Pittsburg read his paper on "The Maintenance and Calibration of Service Meters." The speaker said that the difficulties of maintaining and calibrating the meter equipment of a central station are many and serious. Nevertheless, they can be overcome by a properly organized and equipped bureau. Proper primary and secondary standards should be provided. J. F. Becker of Brooklyn, Dr. Edward Weston of Newark, N. J., and Mr. Bradshaw discussed the paper. During his talk Dr. Weston made some interesting observations on the accuracy of springs.

"I have had quite a little experience with springs and also dynamometers," he said, "and I certainly found the springs rather more reliable. In fact, you must expect to find in instruments of the dynamometer type errors which are errors due to [illegible] dynamometer [illegible] a fixed position [illegible] field. That makes an error.

"Springs are [illegible] world, are [illegible] a dynamometer [illegible] compensated for [illegible] In the use of springs in timepieces the error due to the very minute variation [illegible] cumulative, for its effect is increased with each beat of the balance wheel, whereas in using the spring for obtaining a balance or a condition of equilibrium, that practically does not count at all.

"The Siemens dynamometer type of instrument is not an unreliable instrument on account of its spring, but on account of the nature of the instrument, the effective character of design and the method of inducing the current through the coil. I venture to say that springs properly constructed will show an error of less than one-tenth of one per cent., or even one one-hundredth of one per cent., but they should not be tested by the application of anything in the way of electrical current or the introduction of a lot of elements which properly do not belong to them mechanically. They should be tested by the application of a weight at a known distance from the center, that is, acting upon a drum carefully counterbalanced at a known distance from the center."

ALTERNATING-CURRENT ELEVATORS.

"Alternating-current Elevators" was the interesting subject of W. N. Dickinson, Jr., of New York, an elevator engineer. It is not an easy task to produce a high-speed alternating-current elevator satisfactory in every way, but the high-speed direct-current elevator meets the requirements. Mechanically and electrically controlled elevators for low and medium speeds are now on the market. Mr. Wagoner of Schenectady, Mr. McCabe of Lewistown, Pa., and W. A. Layman of St. Louis discussed the subject, and the last-named spoke of the single-phase elevator motor which his company is introducing. Reference is made to this paper elsewhere in this issue.

AWARD OF CO-OPERATIVE ASSOCIATION PRIZES.

Douglass Burnett of Baltimore reported for the committee on the award of prizes for essays offered by the Co-operative Electrical Development Association. This award is noted elsewhere in this issue of the Western Electrician.

RELATION WITH STATE ASSOCIATIONS.

S. R. Bradley, Jr., New York, moved that a committee of five be appointed by the president to consider and report to the executive committee upon the relations between this association and such local associations as may exist in the states or districts. This motion was carried.

President Blood then appointed as a committee provided for in the motion just passed the following-named gentlemen: S. R. Bradley, Jr., New York; E. H. Davis, Williamsport, Pa.; L. H. Scherck, Birmingham, Ala.; J. F. Gilchrist, Chicago, Ill.; W. H. Fellows, Leavenworth, Kan.

SWITCHBOARD PRACTICE.

E. M. Hewlett of Schenectady read his paper on [illegible]

[illegible]

President Blood [illegible] and the [illegible] went to Mr. A. H. [illegible] The latter was presented [illegible]

There [illegible] were made that the scorer finally gave up his task in despair.

LECTURE ON MUNICIPAL OWNERSHIP.

Everett W. Burdett, a Boston lawyer, delivered an able address on "The Agitation for Municipal Ownership in the United States" on Thursday evening. There was a large attendance in the convention hall, including many ladies, and the address was voted a very scholarly and able treatment of the subject. Although moderate in statement, the lecturer was firm in the conviction that private ownership is better than public ownership for such utilities as electric lighting and electric railways. Public control, as under the Massachusetts plan, offers, he thought, a vastly better solution of existing difficulties than municipal ownership. T. Commerford Martin of New York presided.

NEW AND IMPROVED MEANS OF ILLUMINATION.

Much of the session of Friday morning was devoted to improved methods of illumination. Prof. H. E. Clifford of the Massachusetts Institute of Technology, Boston, opened by presenting in abstract his paper on "New Illuminants." He spoke of the Moore vacuum-tube lighting system, which was on exhibition on the Pier, and said that it could now be used with 60-cycle current. In relation to metallic-filament lamps he uttered a word of warning. Lighting interests should be careful to reflect before displacing the cheap and effective carbon filament. The experiment is rather doubtful as yet. Tests of tantalum lamps showed that not one had a life of 100 hours on 133-cycle current. On 60 cycles the average was 178 hours for frosted bulbs and 129 for clear bulbs. The average with direct current was 462 hours. Assuming the lamp to cost 60 cents and to have a life of 700 hours, the renewal charge would be too high. Again, consumers would be aghast at a lamp costing 60 or 75 cents, after being accustomed to 20-cent lamps. Better use light now thrown away, by employing shades and such auxiliaries, than dispense with present lamps in the search for high efficiency.

GROUP OF DELEGATES TO NATIONAL ELECTRIC LIGHT CONVENTION AT YOUNG'S PIER, ATLANTIC CITY, N. J.

[Continued on page 404.]

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

The Exposition in Milan and the Electrical Undertakings of the City. By Frank C. Perkins. Illustrated 487, 488
A Central Plant for Illinois Towns 488
New Steam-turbine Electric Plant for Wilmington, Del. 488
Illuminating Engineering Society 488
Award of Prizes for Papers in Co-operative Development Competition 488
Alcohol, Benzol and Gasoline, versus Steam Motor Cars in Europe. Illustrated 489
National Electric Light Association (Annual Convention in Atlantic City, N. J.). Illustrated 490, 491, 494, 495, 496, 497, 498, 499, 500
Report of Proceeding 490, 491, 494
Convention Notes 494, 495, 496, 497, 498, 499, 500
Arthur Williams. Portrait 494
Editorial 492
Chicago Edison and Commonwealth Electric Ordinance Passes Council 493
Recent Improvements in Steam-turbine Design 493
Progress in the Electrical Upbuilding of San Francisco. 493
Concrete Power House for the Seattle Electric Company. 493
Cable Cars to be Abandoned in Chicago 493
How to Make a Small Electric Plant Pay. By D. D. McGee. (National Electric Light Association.) 500, 501
Alternating-current Elevators. By W. N. Dickinson, Jr. (National Electric Light Association.) 501, 502
The Flaming Carbon Arc Lamp. By L. B. Marks. Illustrated. (National Electric Light Association.) 502, 503, 504
Exhibit of Central-station Advertising 504
Some Physiological Factors in Illumination and Photometry. By Dr. Louis Bell. Illustrated. (Illuminating Engineering Society.) 504, 505
Books Received 505
Independents May Get Into Cincinnati 506
Southeastern Telephone Developments 506
Indiana Telephone Items 506
Telephone News from the Northwest 506
General Telephone News 506
Manufacturers and Dealers 506
Electrical Concessions in Colombia 506
Chicago Drainage Canal Power Offered at Lower Rate 506
Niels A. Christensen. Portrait 507
Electric for British Dockyards 507
William H. Schott. Portrait 507
Peculiar Steam-turbine Accident. Illustrated 507, 508
Engines Under Test Supplying Power for Factory Purposes. Illustrated 508, 509
Electric Motor Passes Ordeal of Fire. Illustrated 509
A Compact Type of Gasoline Torch. Illustrated 509

DEPARTMENTS.

Correspondence 509, 510, 511
Great Britain 509
New York 509
New England 509, 510
Southeastern States 510
Ohio 510
Indiana 510
Michigan 510, 511
Dominion of Canada 511
Pacific Slope 511
Mexico 511
Northwestern States 511
Personal 511
Electric Lighting 512
Electric Railways 512
Power Transmission 512
Publications 512
Societies and Schools 512
Miscellaneous 512
Trade News 512, 513
Business 513
Illustrated Electrical Patent Record 513, 514

DATES AHEAD.

Illinois Independent Telephone Association (annual meeting), Coliseum, Peoria, Ill., June 19th and 20th.

Canadian Electrical Association (annual convention), Clifton House, Niagara Falls, Ont., June 19th, 20th and 21st.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Hollenden Hotel, Cleveland, Ohio, July 18th to 20th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

IN THE TRANSMISSION of alternating current through a condenser there is always encountered a reduction of energy due to the damping effect of the condenser, which must be allowed for in calculations by a certain damping factor. It has been pointed out by T. Noda that the damping factor of a condenser may be reduced by adding another condenser to the circuit, and as close as possible to the spark gap. Two vibrations are then produced, one of them having a constant period somewhat longer than the primary vibration, while the period of the other is a function of the ratio between the periods of the two circuits. By adding a capacity about 50 times as large as that in the primary circuit, the damping of vibration No. 1 may be reduced to 0.047 and of vibration No. 2 to 0.023, if the ratio of periods is properly chosen, and if the secondary circuit contains the same capacity as the primary. The curve of resonance in the circuit then becomes very decided.

BETTERMENT of the street-car service in Chicago seems now to be assured for the near future, and the first tangible move in this direction was made this week by the Chicago City Council, when it passed the ordinance permitting the electrification of the cable lines, which have for so long been a disgrace to the city. It is generally understood that the mayor will approve that portion of the ordinance permitting the electrification of the North and West Side lines, which use the tunnels under the river, but may veto that for the South Side lines. Should he veto the latter, however, it is believed that enough votes can be mustered to pass it over his veto. Large orders for street-railway equipment have been placed by both the Union Traction and the Chicago City Railway companies, looking to an electric service to be installed at once. The cable lines on the North and West sides to be converted to electrical operation cover a distance of 32 miles, single track, while those on the South Side include 22 miles.

AMONG THE NEW illuminants to attract the attention of the central-station man is the flaming carbon arc lamp. The new lamp is only just beginning to be appreciated in this country, though its use has become comparatively common in Europe. While it possesses several inherent disadvantages, it is none the less true that for certain classes of illumination, notably street lighting, it has much to recommend it over the ordinary arc lamp, and may prove a valuable agent in meeting gas-lighting competition. Mr. L. B. Marks, in a paper read before the Atlantic City convention of the National Electric Light Association, entitled "The Flaming Carbon Arc Lamp," which appears in abstract elsewhere in this issue, gives some very timely information on the construction of the lamp and some comparative figures of the cost of operation of the flaming arc lamp and the enclosed arc lamp now commonly used for street illumination.

Heretofore one of the objections to the flaming arc has been the emission of fumes and vapors which have made it objectionable, especially for indoor purposes. In the later types, however, this objection is overcome by the use of what is termed an economizer, upon which the vapors arising from the arc are condensed. Some types of the lamp also make use of a special form of condenser to receive the vapor deposits. These deposits are whitish in color and they collect on the under surface of the economizer or condenser, thus aiding materially in reflecting the light in a downward direction.

From careful measurements, it has been determined that the flaming arc gives a little over five times the total luminous flux of the enclosed arc lamp, using the same amount of power at the arc. For street lighting, the yellowish tinge of the light emitted by the flaming arc is highly efficient, but for interior lighting, where color values are important, the yellow light is objectionable, as under it white colors appear cream-colored, shades of yellow are intensified, and the color values at the violet end of the spectrum are much distorted. Figures given by Mr. Marks show that when the station cost of producing energy is less than two cents a kilowatt-hour, and the price of the flaming-arc carbons 10 cents a trim (which is one-third less than the present cost in this country), it would not pay to install the flaming arc. When the cost of energy is higher, however, the flaming arc is economical, particularly if the cost of the carbons is reduced, which is probable to be the case as more improved methods are devised.

ATLANTIC CITY witnessed last week what, all things considered, was the best convention ever held by the National Electric Light Association. The convention was the twenty-ninth in the association's history, and it was held in a hall on Young's Pier, beginning Tuesday, June 5th, and ending Friday, June 8th. The total registered attendance, including ladies—over 1,400—was perhaps the largest at any electric-light convention ever held in the country, and was the more noteworthy as there was not a large force of local electrical men to swell it. The number of railroad certificates turned in was between 500 and 600, and the actual attendance at the various sessions was from 300 to 500.

The programme was carried through without a hitch, due to President Blood's courteous yet firm insistence on promptness and brevity. The convention reflects much credit on Mr. Blood's administration and on the quiet but valuable work of Mr. Eglin, the secretary and treasurer. Mr. Arthur Williams, the chairman of the convention committee, also did good work, and his promotion to the presidency was deserved. A cordial word of praise is also due Miss Billings, the assistant secretary and treasurer, and to her staff of assistants, for the efficient manner in which the work of the "front office" was carried out.

Perhaps the three most noteworthy features of the convention were the discussion of new types of lamps, both arc and incandescent, the papers and discussions relating to the getting and retaining of central-station business—the commercial side of the electric-lighting industry—and the excellent evening address of Mr. Burdett of Boston on the municipal-ownership agitation. An important departure was the decision to appoint a committee to revise the specifications for public street lighting, in view of the appearance of new arc lamps like the magnetite and flaming arc, which, if widely introduced, may bring about economy of current consumption, in the benefit from which the central station, bearing the expense of making the change, has, of course, a right to share. Significant, also, was the appointment of a committee to consider the relation of the national association to the state and district associations. This indicates the modern tendency toward co-operation. It is important, also, to note that the Co-operative Electrical Development Association was officially indorsed.

The exhibition of electrical apparatus, held in the front of the pier, was an entire success. It was comprehensive and well arranged. For the first time at a United States electrical convention, tantalum lamps (listed at 75 cents each) were shown as commercial exhibits. There were also flaming arc lamps and an interesting demonstration of the remarkable Moore vacuum-tube lighting system. Improved mercury-vapor lamps, Nernst lamps with vertical glowers, models of steam-turbine blades, a single-phase elevator motor, mechanical refrigeration by electric power and many other new and interesting things were shown.

Atlantic City proved to be a very pleasant meeting place. The famous Board Walk and Young's Pier were especially illuminated. The weather was good, the hotels excellent and reasonable in price, and the invigoration of the salt air of the ocean and the sight of the tumbling breakers of the Atlantic ever present. One thing showing the size and importance and modernity of the association was the fact that it entertained itself, raising a fund for the purpose. It did the job well too. Each lady in attendance received a dozen roses on arrival, and there was always good music on the Pier and easy chairs in plenty. There were also a dance, a sailing party, a theater party, golfing, horseback riding on the beach for the children, an automobile ride and a grand rolling-chair parade on the last day. It is safe to say that everyone present was entirely pleased with the arrangements made.

Chicago Edison and Commonwealth Electric Ordinance Passes the Council.

The Edison Commonwealth ordinance was passed by the city council this week. No amendments were made to the measure as reported by the committee. But few changes are made in the ordinance as already outlined in the Western Electrician. The Chicago Edison Company and the Commonwealth Electric Company are given authority to consolidate, or to transfer the business, property and ordinance rights of the Edison company to the Commonwealth company on the condition that the company taking over the Edison company (whether a new consolidated company or the Commonwealth company) shall thereafter pay annually to the city the same percentage of its gross revenue as the Commonwealth company now pays, viz.: three per cent. No transfer is to be made to any company except one organized under the laws of Illinois. Rates are fixed in the new ordinance for a term of five years. The gross maximum rate is 15 cents a kilowatt-hour for the first two years, and 13 cents a kilowatt-hour for the succeeding three years, to be figured on a 30-hours use per month. After this the secondary rate is 10 cents a kilowatt hour for the first year, 9 cents for the second year, 8 cents for the third year and 7 cents for the fourth and fifth years, all rates being subject to 1 cent a kilowatt-hour discount for payment of bills within 10 days. Arc lights are to be furnished the city at $75 a year.

Recent Improvements in Steam-turbine Design.

Several important improvements in steam-turbine design have been patented recently by men who are prominent in this field of invention. The patents were granted to Johann Stumpf, Elihu Thomson and W. L. R. Emmet.

Applications were filed September 8, 1903, by Mr. Stumpf for two patents upon a steam turbine. One of these inventions involved the combination of several turbines adopted to act upon separate machines, and specified methods for admitting steam to the turbines and governing means automatically controlled by the turbine wheel for controlling the steam-admission devices. The bucket wheels of the turbines are mounted on separate shafts, each driving an independent load, and the governing mechanisms for several wheels being controlled by their respective sections of the shaft. The second patent embodies means for driving the machine elements in opposite directions, a hollow shaft being fixed to one turbine wheel and having a flange at its opposite end to which a machine element may be secured. A shaft between the other turbine wheel and another element passes through the hollow shaft and flange and is entirely inclosed by the shaft.

The patent granted to Mr. Thomson is for a means of governing turbines. A hydraulic motor operates the regulating valve, a constantly running pump supplying the fluid for the actuation of the pump. An accumulator is provided for receiving the fluid discharged by the pump after the regulating valve has moved to a given position. Application was made for this patent on September 30, 1905.

Six patents were awarded to Mr. Emmet covering different phases of turbine construction. The first of these provided for a regulating device which comprises a chest provided with regulating nozzle-valves. These co-operate with relaying valves contained in a second chest, and the two chests being connected by a conduit for conveying steam from one to the other. The nozzle-valves are provided with pistons, which are controlled by the relay valves through levers which are moved by a cam in a predetermined manner.

The second patent of Mr. Emmet refers to a turbine comprising intermediate buckets with a device for discharging the steam against the buckets. A hood presenting a smooth surface is located in proximity to the idle bucket wheels so as to reduce the rotation losses.

In the third patent there is provided a wheel and intermediate buckets, a diaphragm being located between the bucket wheels. An internal projection in the casing of the turbine provides a support common to the diaphragm and intermediate buckets. The diaphragm is designed to decrease the rotation losses.

The three remaining patents relate to a "power-generating apparatus" which is the combination of two or more high pressure reciprocating engines and a low pressure turbine. Separate nozzles receive the exhaust steam from the engines and direct it against the rotating part of the turbine.

Progress in the Electrical Upbuilding of San Francisco.

San Francisco, June 7.—The Pacific States Telephone Company has been laboring under great disadvantages ever since the big fire which destroyed the executive office building, the old Central Exchange building and the entire equipment of three out of the four new operating buildings. The [illegible] office on Steiner Street, near Bush, which was the smallest of the new operating plants, was outside the fire zone and was again ready for business to a certain extent, almost as soon as the fire was out. A temporary switchboard was later installed in the new main office on Bush Street, near Kearney, where the largest switchboard in the world was burned. The water front and burned district are now served from this office, where a temporary switchboard for 5,000 telephones has been installed. The long-distance connections have been greatly improved during the last month and a temporary service installed in the city. This has been of some use to the business community, but, owing to the difficulties of harmonizing the new central energy wire-center system, which was only partly in use at the time of the disaster, with the temporary lines, it has had very many weak points.

No complete telephone book has yet been issued, although one is now in preparation, which, it is probable, will greatly improve the situation. One of the electric-lighting plants is still using messengers to report troubles on its lighting circuits, for want of complete telephone facilities. Over 8,000 telephones are now in working order and new ones are being connected up at the rate of 250 a day.

The Pacific States Gas and Electric Company has made some progress during the last week, but some of the manufacturers in the heavy-business district, from Van Ness Avenue east to the water front, and from Thirteenth Street on the south side of Market, are still waiting for electric power to be supplied. It has been announced that, as a rule, only direct current will be furnished them. Just what the reason is for this practice in distribution is not generally known, although there are surmises that the alternating-current underground system which the San Francisco Gas and Electric Company took over from the Independent Electric Light and Power Company has not stood the settling and disrupting effects of the earthquake as well as the old Edison three-wire underground system, which furnishes direct current at 110 and 220 volts in the same territory east of Van Ness Avenue.

The expense of repairing the alternating distribution system with the fire debris not yet removed would probably be very great. So the direct-current system is being put in order as rapidly as possible.

About June 3d one of the three motor-generator sets at the ill-fated Jessie Street station, which has been burned three times, was started up again, relieving the Mutual electric-light plant at Stuart and Spear streets of its direct-current load on the Pacific Gas and Electric Company's circuits, which it had been supplying since April 30th. From now on considerable improvement is expected to be made in the underground service of the big lighting concern. A.

Concrete Power House for the Seattle Electric Company.

A new power house to cost $500,000 and to be one of the most substantial structures on the Coast is being erected at Georgetown for the Seattle Electric Company of Seattle, Wash. The original plans called for a steel structure, but while the piles were being driven, the San Francisco earthquake occurred and the lesson was promptly applied to the power station. Steel gave way to reinforced concrete, to be put up in monolithic form and thus to be made proof against earthquake and fire.

The work of construction is being done by Frank B. Gilbreth, general contractor, of New York and Boston, according to a system perfected by him. The Seattle Times says that the foundation slab, 80 by 218 feet, was formed by driving 1,800 piles, their tops being covered over with three feet of concrete, the mass incorporating 20 tons of steel rods ranging from one-quarter to 1½ inches in diameter.

Reinforced concrete pyramids rise from the slab and await the establishment of boilers and engines. The walls will go up to a height of 80 feet, ranging in thickness from six to 18 inches. Steel-rod reinforcement will be carried through the walls, 160 tons to be used in this work. A roof of similar [illegible]

Cable Cars to be Abandoned in Chicago.

[illegible] strengthen the position of the [illegible] negotiation and legal controversy [illegible] Supreme Court of the United States [illegible] the companies have no rights under the 99-year act, the council has [illegible] improvements. The council likewise approved the [illegible] providing for the lowering of the three river tunnels. Mayor Dunne will probably sign the ordinances. If so, the companies promise to begin at once the work of changing the old cable lines to trolley operation. With the trolley equipment will come other operating improvements. The trolleyizing ordinance is, of course, only a [illegible] grant, but it is a step in the present negotiations looking toward a satisfactory settlement of the traction question, which has become so deeply involved in the municipal-ownership agitation.

The street-railway companies reported to the council committee on local transportation at its meeting this week that they were not yet prepared to furnish figures showing the value of their properties, the figures to be used as the basis of a discussion on the indeterminate license settlement. Eastern representatives of the Union Traction interests were expected in Chicago to attend the meeting this week at which the Chicago Railways Company, the new holding corporation for the Union Traction interests, will be reorganized. It is said that the seven directors will be George E. Adams, Henry A. Blair, James H. Eckels, W. N. Eisendrath, John W. Gary, Frederick H. Rawson and E. D. Hulbert.

A draft of an ordinance intended to be the basis for a permanent settlement between the city and the car companies has been prepared by Walter L. Fisher, special counsel on traction matters to the local transportation committee of the council. The ordinance is along the lines of the ideas of Mayor Dunne outlined recently in a letter to the chairman of the committee. Mr. Fisher's draft for a settlement has met the approval of many of the aldermen. Alderman Foreman, who has led the anti-municipal ownership forces, thinks it is a good plan, under existing circumstances, for a satisfactory settlement and the inauguration of adequate transportation facilities.

Some of the features of the draft are as follows:

The company agrees to sell to the city within .. months and to reconstruct its property. The overhead trolley is to be used except as the underground trolley may be required by the city. Subways are to be provided if required by the city. The company agrees to spend $...... a year on its lines.

Provision is made for the joint use of tracks, through routes, exchange of transfers and other features for better service. Purchase of the property by the city may be made on the first of January or the first of July of each year, after giving six months' notice. A board of supervising engineers is to have charge of the reconstruction and reequipment of the lines, consisting of one member appointed by the city, one by the company and the third by the other two.

The city may take over the lines prior to completion of their reconstruction on payment of the cost of the work done, plus a percentage of the cost. The city may grant the right to take over the property at the times and on the terms agreed on to a new company, but the new licensee shall pay .. percentage in addition to the price fixed for the city's purchase of the property. At the end of twenty years the city may purchase the property, or its licensee may do so.

Costs of operation, management and extension shall be paid by the company, subject to the provisions of the ordinance. The company shall be authorized to retain .. percentage of the sum remaining after a proper percentage of the receipts has been paid to the city. The city's share of the receipts shall be kept by the municipality as a sinking fund for the purchase of the property.

Provisions are made for forfeiture of the ordinance and all the rights and privileges of the company in case the company shall default in the conditions of the measure. A fine of $.... a day is to be provided for failure of the company to carry out the provisions of the ordinance. In default of the Chicago City Railway Company's accepting the ordinance, the Chicago Union Traction system may be extended to cover the territory of the South side, or vice versa; in case the Chicago City, but not the Chicago Union Traction organization, accepts the ordinance, the South Side company may extend its lines and operation into the North and West Sides.

The denatured alcohol bill, which provides that alcohol which has been rendered unfit for drink or use in medicine may be manufactured without being subject to the internal revenue tax, has become a law with the signature of President Roosevelt.

National Electric Light Association.

[*Continued from page 491.*]

D. MacFarlan Moore of Newark, N. J., spoke of his system of vacuum-tube lighting (described recently in the Western Electrician), which, he said, had now "arrived." The tube shown at the exhibition gave 2,200 candlepower and consumed 3,300 watts, showing an efficiency of 1½ watts per candle. The longer the tube the greater the efficiency. The life of the tube is infinite, so far as known. Mr. Moore spoke enthusiastically of his invention. It burns air electrically, he said. It does not burn carbon; there are no renewals. A gaseous conductor is sure to be the final form of illumination. It is safer than any other form of lighting ever devised. The tube is comparatively cold to the hand. If it should break, the light goes out, and a splice can be made in half an hour or so. But the liability of breakage is small. The color (a sort of pinkish tinge) is perfect, but any desired color may be produced by changing the gas fed to the tube. But pure white is not so efficient. The new system gives the alternating current an enormous advantage. It opens up a new trade—glass plumbing. Wiremen will have to learn to join glass.

Francis W. Wilson of Harrison, N. J., read a carefully prepared paper on "Higher Efficiency Incandescent Lamps—Their Value and Effect on Central-station Service." Speaking particularly of the new "metallized" or gem-filament lamp, he endeavored to show that high-efficiency lamps are advantageous to the central station. The manager should seek increased hours of lighting, owing to the reduced cost to customers.

Other Papers.

R. H. Ballard of Los Angeles abstracted his interesting paper on "The Edison System of Southern California."

In the absence of the author, E. F. Cassel's paper on "Design and Manufacture of Hydro-electric Installations as a Whole" was abstracted by C. A. Tupper of Milwaukee.

Election of Officers and Concluding Business.

Invitations for the next meeting were received from Norfolk, Va. (Jamestown Exposition), Minneapolis and Saratoga Springs. They were referred to the incoming executive committee.

It was announced that one of the New York Central electric locomotives, designed by the General Electric Company, had been sent to Atlantic City expressly for the inspection of members of the association.

The committee on president's address reported in favor of a committee to consider the subject of readjustment of annual dues. It also indorsed the suggestion that a representative of the association be appointed to confer with the fire underwriters. Samuel Scovil presented the report.

Paul Lüpke of Trenton, N. J., presented the bulky volume containing the "Question Box" and "Wrinkles." This book represents much hard, faithful work, and the delegates were eager to secure copies to take home with them.

At a short executive session held after Friday morning's session, these officers, on recommendation of the committee appointed for the purpose, were elected:

President—Arthur Williams, New York.

First vice-president—Dudley Farrand, Newark, N. J.

Second vice-president—Alex Dow, Detroit.

Secretary and treasurer—W. C. L. Eglin, Philadelphia (re-elected).

Executive committee (new members)—C. R. Huntley, Buffalo; H. T. Tate, Dayton, O.; Louis A. Ferguson, Chicago.

Arthur Williams, the new president of the association, is general inspector of the New York Edison Company. He is greatly interested in the association work and a tireless worker, which qualifications, together with an intimate knowledge of central-station operating methods, will make him a strong man for the office. Mr. Williams was promoted from the office of first vice-president, and as he is accustomed to handle large affairs there is no doubt in the minds of his associates that he will maintain the high standard set by his predecessors at the head of affairs of the National Electric Light Association. Mr. Williams' election to this important office comes as no surprise to his friends, for his work in behalf of the organization is known to all. So large and comprehensive has become the scope of the association, and so many are the duties devolving upon its chief executive officer, that the position is one which necessitates the choice of a man who is not afraid of hard work, and whose faithfulness has been demonstrated. Such a man is Mr. Williams, and the association will be benefited by his administration.

On Friday afternoon there was an executive session, at which various committee reports not previously submitted were presented. Adjournment without date was then taken.

Friday's entertainment features included an automobile ride for the ladies and a rolling-chair ride, in procession, on the Board Walk. The latter feature was unique to most of the members and was greatly enjoyed. Soon after it the dismantling of exhibits began, and the notable convention of 1906 was over.

Notes of Exhibits, Exhibitors and Visitors.

Capt. Candee of the Okonite Company was of course on hand daily.

E. Kuhlman of the Kuhlman Electric Company was daily on hand at the Pier.

The handsome little stickpins of the General Electric Company were a much-coveted souvenir.

Bleecker S. Barnard, president of the Standard Vitrified Conduit Company, was a welcome visitor.

James G. Biddle was in attendance at the exhibit of the American Instrument Company of Philadelphia.

Emil O. Lundin, president of the Lundin Electric and Machine Company, was in attendance at the convention.

The Benjamin Electric Manufacturing Company of Chicago appeared in the person of Basil G. Kodjbanoff.

The Sangamo Electric Company got out a very pretty little souvenir in the form of a meter for a paper weight.

The Alfred F. Moore Company of Philadelphia was present with a small exhibit in the Gould storage-battery space.

Max Lowenthal, E. E., was present at the convention and looking out for his interests in connection with electric heating.

Harold Almert, consulting engineer, of Chicago, and the president of the Northwestern Electrical Association, met many of his central-station friends at the convention. Mr. Almert was formerly a central-station man himself, and still is connected with the management of a hydro-electric plant in Michigan.

ARTHUR WILLIAMS, NEW PRESIDENT OF NATIONAL ELECTRIC LIGHT ASSOCIATION.

President and General Manager Frank J. Holmes looked after the interests of the Vulcan Electric Heating Company of Chicago.

The Sarco two-light reflector was installed on incandescent lamps about the exhibits as well as on the ceiling of the main hall.

Among the central-station men in attendance was W. B. MacDonald of the Evansville Gas and Electric Company of Evansville, Ind.

The American Transformer Company of Newark, N. J., gave out as souvenirs a novel iron cigar which will make a first-rate paper weight.

William G. Brown, vice-president of the Ewing-Merkle Electric Company, St. Louis, attended the convention and renewed many acquaintances.

Western Manager H. F. Tate of the National Conduit and Cable Company, who has his headquarters in Chicago, was a welcome visitor at the convention.

Manager W. H. Jacobs of the Triumph Company of Cincinnati was on hand daily. Mr. Jacobs is always warmly welcomed at every convention. His friends are legion.

President and General Manager L. Lowenthal of the Economical Electric Lamp Company of New York did the honors of his company in behalf of "turn-down lamps."

Colonel Nash of the Warren Electric and Specialty Company was daily in attendance during the convention. Mr. Nash is one of the most popular managers in the lamp industry, and is more than heartily welcomed on every business and festive occasion.

W. S. Sisson, secretary of the D. & W. Fuse Company of Providence, R. I., was present, with his pockets filled with samples of the famous Deltabeston magnet wire.

The Beck Flaming Arc Company's lamp was on exhibition and attracted a great deal of attention. This exhibit was in charge of President Louis J. Auerbacher of New York.

The Chase-Shawmut Company of Newburyport, Mass., was represented at the convention by Harry P. Moore, sales manager, and Mr. Louis J. Costa, the Philadelphia representative.

The Samson Cordage Works of Boston, Mass., was looked after by F. J. Coakley. The Samson spot cord, waterproofed, for arc lamps was a specialty that attracted much attention.

The Phœnix Glass Company, manufacturer of inner and outer glass globes, was represented by Vice-president A. H. Patterson of New York and Treasurer E. P. Ebberts from Pittsburg.

Sales Manager Henry B. Kirkland of the American Circular Loom Company was one of the first at Atlantic City. Mr. Kirkland has just returned from a short trip to Europe—a very short trip.

Sales Manager Avery P. Eckert and Superintendent James Ferguson were daily in attendance at Young's Pier looking after the interests of the Safety Wire and Cable Company of New York.

Sales Manager L. P. Sawyer of the Buckeye Electric Company, with his usual energy, assisted by J. M. Smith, Pennsylvania representative, first placed before the convention the new tantalum lamp.

John L. Gleason exhibited a full line of his patented specialties, including molding and a conduit junction, switch and outlet boxes. He was in charge of the exhibit, assisted by Reinhold Eberhardt.

The Franklin Electric Manufacturing Company of Hartford, Conn., had no exhibit at the convention, but was well represented by Messrs. P. S. Klees, Charles N. Thorpe, G. O. Curtis and H. A. Truitt.

Advertising Manager Gale of the General Electric Company was unfortunate enough to be stricken with an attack of tonsilitis. Mr. Gale's energetic temperament, however, conquered his illness after a day in bed.

Western Manager J. R. Wiley of the Standard Underground Cable Company came down on the Chicago special. Miss Wiley was one of the most popular and attractive among the ladies at the social functions of the convention.

The Sangamo Electric Company's exhibit consisted of its well-known types of alternating and direct-current meters. The alternating current is a new device. This exhibit was in charge of Secretary R. C. Lamphier, assisted by T. F. McKenna.

The Sarco Company, while not having an exhibit at the convention, was ably represented by R. H. Schoenberg, who liberally distributed blotters showing the Sarco pendant switch, and also gave out some handsome advertising embossed cards.

The Oneida Community Company's exhibit consisted of a full line of the well-known Oneida galvanized chains for suspension of arc lights and signs. This exhibit was in charge of Manager S. R. Leonard of the hardware department and Mr. V. W. Lee.

Secretary and Treasurer Thomas I. Stacey of the Electric Appliance Company, Chicago, arrived on Wednesday and mingled with the delegates on Young's Pier. Mr. Stacey is on an eastern trip and took the occasion to represent his company at Atlantic City.

The National Metal Molding Company, which has absorbed the Osborne Flexible Conduit Company, had a very fine exhibit in charge of Manager C. E. Corrigan, assisted by J. A. Campbell. It is making an especial showing of its Economy rigid conduit and the Flexduct flexible conduit.

Philadelphia turned out Edwin A. Jenkins, secretary of the H. T. Paiste Company, along with George "Aleck" McElevee, who arrived early Tuesday morning. Frank Booth of Boston also put in his appearance in the interest of the above company and the New York Insulated Wire Company.

New York Manager Donohoe of the American Electrical Works appeared on Wednesday, accompanied by Mrs. Donohoe. Mr. Donohoe was only recently promoted from the management of the Chicago office to take charge of the company's more extended field of operation from its New York office.

One of the most interesting exhibits, and one which was constantly surrounded by delegates, was that of the Simplex Electric Heating Company of Cambridge, Mass. The exhibit consisted of a full line of cooking apparatus, electric irons and heaters, all in operation. The demonstrations were going on all day, and samples of electrically cooked

dainties were on hand. This exhibit was in charge of General Manager J. I. Ayer, and the company was also represented by C. W. Richards, Charles H. Johnson, and Roger Williams, New York manager.

President Frank M. Boyer of the Chicago Mica Company of Valparaiso, Ind., found time to drop in to the convention on Tuesday. The Chicago Mica Company made no exhibit, but Mr. Boyer reports the company in a prosperous condition, as is especially evidenced by its large factory at Valparaiso.

The Crocker Wheeler Company exhibited a line of small direct-current motors for power users; also core transformers for power transmission at high voltages, as well as the edgewise wound filled coil for 4,000 kilovolt ampere generators for the Chicago Drainage Canal plant, of which four units of this capacity will be installed. Numerous photo-

THE PHELPS COMPANY.

graphs, both of direct-current and alternating-current installations, were shown. The company was ably represented by Samuel Russell, manager Philadelphia office, R. N. C. Barnes, Boston office; E. B. De Grass, New York office, and W. C. Appleton of the main office at Ampere, N. J.

Among the prominent central-station men in attendance, that had graduated from the manufacturers of larger electrical apparatus, was Assistant Manager W. J. Ferris of the Illinois Traction system. Mr. Ferris' headquarters are now at Champaign, Ill., but his responsibilities take him all over several states.

The Atlantic Electric Light and Power Company of Atlantic City made a comprehensive exhibit of heating apparatus. The display consisted of a great variety of heating specialties manufactured by the General Electric Company, and included cooking utensils and irons. A specialty that attracted a large amount of attention was the General Electric luminous radiators. Emphasis should be made of the fact that this exhibit was presented with the idea, in the main, of encouraging central stations as to the value of a practical demonstration direct to the people—in a word, with the idea of illustrating the great value of a "live" exhibition. Two attractive young ladies were in constant attendance and the [illegible] Manager of the General [illegible] department, and [illegible] Drager.

Dr. Edward Weston of [illegible] of the most prominent of the [illegible] Dr. Weston is not only a great authority on [illegible] instruments but also one of the [illegible]

CROCKER-WHEELER COMPANY.

and inventors in the general electric lighting field. He took part in the discussion of Thursday on service meters.

The Standard Paint Company's exhibit was well looked after by P. M. Wade, advertising manager, Charles E. Smith, manager of paint department,

NATIONAL BRAKE AND ELECTRIC COMPANY.

and J. N. Richards, sales manager. It made a special exhibit of its new line of P. & B. baking and air drying varnishes; also the old line of P. & B. products.

Mr. Morris of the Banner Company of Youngstown, Ohio, put in an appearance early Tuesday morning, bringing with him a full supply of incandescent lamps. The Banner Company has only recently become finally settled in its splendid new lamp factory at Youngstown. This new plant is looked upon as one of the model incandescent-lamp factories of the West. When it is remembered that only a few years ago the Banner Company started in what was literally a tiny frame building down by the steel works at Youngstown, the present magnificent brick factory stands, literally, as a [illegible]

ONEIDA COMMUNITY, LIMITED.

candlepower fell to 80 per cent of the initial reading. Herman J. Jaeger, president of the company, was in attendance for a day or two.

Thursday, Robert Lozier of the Power and Mining Machinery Company's eastern office appeared. Mr. Lozier is now exploiting in the East the large gas engines manufactured by his company in Milwaukee. His long experience in the electrical business led to his appointment to his present responsible position in New York; he has met already with remarkable success.

The convention just closed proved conclusively that the central-station managers are fully aroused to the importance of adopting modern and aggressive methods in the merchandizing of electric current, and the sessions of the convention at which new-business papers were read and discussed were largely attended. A due share of this stimulus of interest is to be credited to the Curtis Advertising Company of Detroit, Mich., which has been conducting, in co-operation with the Co-operative Electrical Development Association, a forceful campaign of advertising. The "Booster," a quarterly publication issued by this company, was one of the most attractive pieces of literature issued during the convention and attracted a great deal of favorable

H. W. Johns-Manville Company.

Allis-Chalmers Company.

EXHIBITS AT THE ATLANTIC CITY CONVENTION.

comment. The company's representatives at the convention were Fred A. Curtis, president; Charles A. Parker, secretary-treasurer; C. H. Johnston, vice-president, and Norman Miner, special representative.

Norman McCarty, general sales manager of the American Diesel Engine Company, was in charge of an attractive booth containing views of installations. He was ably assisted by James D. McPherson, assistant chief engineer; H. P. Rust, New England agent; Francis Head, Philadelphia agent, and George F. Murphy of the New York office.

It is safe to say that no one at the convention received a more cordial welcome that Dr. Habirshaw. Dr. Habirshaw was attended by his Japanese servant, and rumor has it that the doctor created no little flutter among the ladies. Manager of Sales J. B. Olson was also of the Habirshaw party, and this time he was accompanied by Mrs. Olson.

Among the most prominent central-station men to "do" Atlantic City, not only in a business but a festive sense, was General Manager W. B. McDonald of the Evansville Gas and Electric Company, Evansville, Ind. Mr. McDonald came down on the Chicago special and returned to Evansville via New York and Philadelphia, starting Thursday.

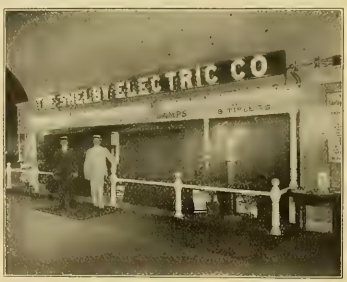
The Pennsylvania Lines' "Special" from Chicago made splendid time and arrived at Atlantic City several hours ahead of its promised schedule. Mr. Kimball had pledged the Pennsylvania Lines to put the party in Atlantic City about 5 p. m. Monday, and when the big train drew up at the Pennsylvania station in Atlantic City at 1:45 p. m. many were the favorable comments on the service. District Passenger Agent G. G. Beltzhoover was personally in charge of the train, and the party of 67 was so delighted with the hospitable and thorough manner in which the special was handled that a testimonial letter, signed by all on board, was presented to Mr. Beltzhoover in compliment of his admirable management of the traffic arrangements.

One of the most welcome visitors was John Craig Hammond of Denver and New York, representing the Denver Gas and Electric Company. Henry L. Doherty & Co. and Eglinton, Hammond & Andrews of 60 Wall Street, New York city. At the Denver convention of last year Mr. Hammond's kindness was unfailing and his courtesy unvarying. He took part in the new-business discussion of Wednesday and was warmly greeted.

Manager Jesse Scribner of the General Electric Company's lighting department, Chicago office, was in attendance, arriving from Chicago with Mrs. Scribner on the special over the Pennsylvania lines. Mr. Scribner deserved and received much credit for his energetic and courteous assistance tendered those in charge of the western transportation arrangements. Through his enlistment of the staff of the General Electric Company in behalf of this train, many western delegates were diverted and tempted to make this pleasant trip from Chicago. Mrs. Scribner was heartily welcomed by her many old friends among the "electrical ladies" and was prominent among the younger married set at the ball at the Marlborough-Blenheim Tuesday evening.

The Holophane Glass Company was represented by V. R. Lansingh, general manager of the sales department. Its principal exhibit was in connection with the General Electric Company's exhibit, where Pagoda reflectors were used on all the high-efficiency meridian and tantalum lamps. Another exhibit was in connection with the Federal Electric Company, whose clusters were equipped with the new special high-efficiency Pagoda reflectors. A third exhibit was in connection with the Central Station exhibit, where a large Holophane sphere capped a large pillar. This sphere was equipped with different lights which alternately flashed on and off, giving a variety of colors which attracted much attention. A good deal of interest was attracted by the statement that in the future it would be possible for central stations to get their Holophane shades, which have heretofore been sold exclusively by the General Electric and other lamp companies, directly from the Holophane company itself.

Among the gentlemen distinguished in the manufacturing line that dropped in at Young's Pier were Second Vice-president L. A. Osborne and Acting Vice-president W. M. MacFarlan of the Westinghouse Electric and Manufacturing Company. Messrs. MacFarlan and Osborne were in constant attendance at the company's booth welcoming the company's host of friends. Incidentally it may be men-



THE SHELBY ELECTRIC COMPANY.

BECK FLAMING LAMP COMPANY.

Gould Storage Battery Company and G. M. Gest, Conduit Contractor.

Metropolitan Engineering Company.

EXHIBITS AT THE ATLANTIC CITY CONVENTION.

Standard Paint Company.

Southern Exchange Company.

EXHIBITS AT THE ATLANTIC CITY CONVENTION.

tioned that Mr. Osborne, accompanied by Mr. Morris Coster, the company's foreign representative, came down from New York to Atlantic City in the Westinghouse automobile.

The Excello Arc Lamp Company's exhibit was in charge of Secretary O. Baerwinkel and H. E. Dinsmore. Its exhibit consisted of the Excello Sunray arc lamp for outdoor use, two of which were also used on the verandas of the Pier, and the Excello Snowball lamp for indoor use. The company also showed its unique one-watt one-candle miniature arc lamp.

The Southern Exchange Company, as usual, had a fine exhibit, in charge of President E. B. Chamberlin and Sales Manager W. G. Mitchell. An attractive booth contained an exhibit of construction material, comprising poles and cross-arms and a general line of the famous long-leaf yellow pine octagonal poles and southern white cedar poles, as well as Georgia pine cross-arms.

C. A. S. Howlett of the Western Electric Company, and also representing the Electric Salesmen's Association, came on with the Chicago delegation. He was indefatigable in the interests of his company, and likewise was the promoter and instigator of many interesting schemes that not only advertised the Western Electric Company but brought together more closely the electrical salesmen.

The Dearborn Drug and Chemical Works had a very neat and attractive exhibit of all of its products. A handsome oak case was filled with cut-glass bottles, each containing a sample of the various oils and boiler compounds which are produced by the company. The booth was especially attractive to the ladies of the convention, each lady being presented with a handsome box containing two bottles of choice perfume, the product of the Dearborn laboratories. The company was represented by the following persons: Robert F. Carr, first vice-president and general manager; William

BUCKEYE ELECTRIC COMPANY.

B. McVicker, second vice-president and eastern manager; George R. Carr, assistant general manager, and H. G. McConnaughy, New Jersey manager. ager.

J. H. Hallberg, after delivering his paper, spent his time pushing the goods of the new H. C. K. Company, of which he is the president. The company had an exhibit of high-efficiency incandescent electric lighting [illegible] press, in connection with the exhibit of the Phelps Company of Detroit.

The Phelps Company of Detroit, Mich., made a most interesting exhibit of [illegible] and the display was in charge of President Phelps and

SANGAMO ELECTRIC COMPANY.

Mr. Phelps, Sr. The Phelps Company is an expert in lamp advertising. The Phelps "yellow dog" was indefatigable in winking its left eye at every passer-by. The handsome wax lady in her robe de nuit, too, never closed her eyes during the night, and was constantly illustrating the way to turn up and turn down the Hylo lamps. The finest specialty presented by the company, in addition to its pull-string, long-distance "turn bulb" and several other most interesting devices, was the "4-glow" 1-4-16-20-candlepower lamp. The 10-ampere thermo-flasher, too, made an excellent impression. This flasher will "wink" 20 16-candlepower, 35 eight-candlepower, 56 four candlepower or 100 two-candlepower lamps.

The Gould Storage Battery Company presented a complete line of batteries covering stationary, vehicle, marine and sparking-set types. A new catalogue recently issued was distributed to all visitors. A complete line of photographs showing many recently installed Gould batteries were on exhibition. The company was represented at the convention by Frederic W. Hulme, H. U. Powers and L. L. Littlefield, Jr.

One of the most indefatigable and successful hustlers at the Atlantic City convention was Henry F. Frosch of the Chicago Electrical Show. Mr. Frosch represented at the convention Managing Director Homer E. Niesz of the Exposition company and was very highly elated over his success, for he was able to write several contracts for space that amounted to quite a large sale of the exposition floor. It will doubtless be a surprise to many to know that at least two-thirds of the space for next year's electrical show in Chicago is already contracted for.

One of the interesting exhibits was the combined one of G. M. Gest, represented by R. E. Brandeis, the American Vitrified Conduit Company, with S. A. Douglas in charge, and the H. B. Camp Company, looked out for by C. C. Baird. These companies had an exhibit among them, consisting of photographs of their conduit works and samples of their well known conduit. The Gest patented [illegible]

The Fort Wayne Electric Works of Fort Wayne, Ind., [illegible]

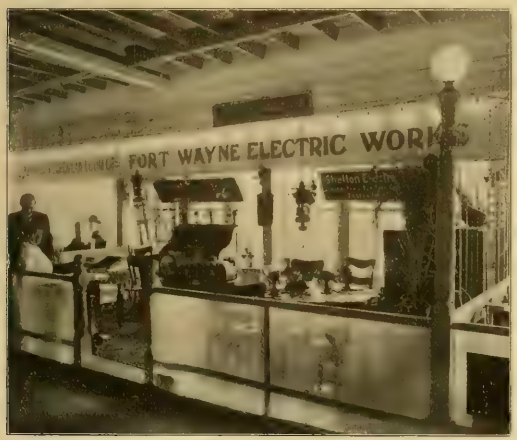
NIAGARA TACHOMETER AND INSTRUMENT COMPANY.

ager A. A. Serva. Among the interesting things shown in the exhibit were type K and W [illegible] meters, prepayment wattmeters, type A transformers, form C arc lamps and Shelton vibrators, manufactured by the Fort Wayne Electric Works for the Shelton Electric Company. Besides Mr. Serva there were T. L. Sturgeon, manager of the Philadelphia office; J. C. Lott, manager New York office; W. C. Knight, manager St. Louis office; C. A. Woolsey, E. H. Porter, J. A. Strauss and J. H. B. Van Zandt, all of the Philadelphia office; S. A. Ochs of the Boston office; A. H. Boyd and

OSBURN FLEXIBLE CONDUIT COMPANY AND NATIONAL METAL MOLDING COMPANY.

A. S. Rothrock of Fort Wayne, Ind. Mr. Gentry Shelton, accompanied by Mrs. Shelton, was also in attendance.

Sales Manager John W. Brooks of Pass & Seymour, Inc., of Solvay, N. Y., arrived at Young's Pier Wednesday morning. Pass & Seymour made no exhibit, but incidentally it should be mentioned that the concern has now under way, at Solvay, an



Fort Wayne Electric Works.

The Electric Storage Battery Company

EXHIBITS AT THE ATLANTIC CITY CONVENTION.

extensive addition to its porcelain factory. For several years the company's porcelain business has been speedily growing until the plant addition became an absolute necessity.

The Fibre Conduit Company of Orangeburg, N. Y., had a very interesting exhibit, which consisted of its various types of conduit, bends and fittings that are used for either underground or power-house construction. Circular matter of value and interest to the delegates was distributed. Messrs. W. W. Grant, vice-president; S. G. Thompson, New England manager, and W. W. Smythe, Jr., western manager, were in attendance.

Edward P. Smith of N. W. Harris & Co., bankers, Chicago, came down on the N. E. L. A. special from Chicago. This was Mr. Smith's initial electric-light convention, and he made many friends among the central-station financial men. N. W. Harris & Co. of late have made a special effort to interest themselves in electric-lighting properties, feeling that the electric-lighting industry could not be given too much attention.

The Standard Underground Cable Company was represented by C. J. Marsh, G. L. Wiley, H. P. Kimball and R. S. Hopkins of the New York office, Frank Clark Cosby of the Boston office, T. E. Hughes of the Philadelphia office, J. R. Wiley of the Chicago office, C. A. Brown of the Atlanta office and P. H. W. Smith and C. W. Davis of the home office at Pittsburg, Pa. Their headquarters were at the Marlborough-Blenheim.

The Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass., had a "live" exhibit of lighting supplies connected to a panel equipped with instruments, Wright demand indicators, switches and circuit-breakers. Seven forms of "G. I." enclosed arc lamps are exhibited, the 110-volt and series-multiple power circuit lamps being shown burning. A 3¼-ampere 110-volt direct-current multiple "Short" arc lamp (only 15½ inches high) attracted much attention. The exhibit also contained a "G. I." direct-current motor-generator set and "S. K. C." induction motors and lighting transformers. The line of supplies included lightning arresters, hanger-boards for arc lamps, several forms of floor and wall outlet boxes, flush push-button switches, pendant switches, knife switches and punched-clip switches. The company was represented at the convention by M. D. Barr, J. H. Noble, J. E. Cutler, A. W. Henshaw, H. C. Rice, A. H. Abell, G. H. Noble, Almon Foster, E. B. Dodd and J. S. Codman.

The Duncan Electric Manufacturing Company of Lafayette, Ind., was well represented by President Thomas Duncan and Sales Manager William H. Sinks. The company displayed the many "up-to-the-minute" features of its latest design of direct-current wattmeters. Many new devices have been added to this meter, making it, as hertofore, an accurate high-torque instrument for central-station use. President Duncan states that since the new design has been put on the market the factory has been taxed to the utmost to supply the demand.

It is safe to say that no one at the Atlantic City convention gave stronger evidence of high ability in the line of business entertainment than City Ticket Agent James S. Murphy of the Pennsylvania Lines. Mr. Murphy met the Chicago special and, co-operating with District Passenger Agent G. G. Beltzhoover, who was in command of this train, nobly did the honors in behalf of the road. Everyone voted Messrs. Murphy and Beltzhoover "strictly of the best."

The General Storage Battery Company of New York city made an extensive exhibit of its product. The operation of fluctuating loads, such as electric elevators, electric hoists, etc., was demonstrated on a miniature scale. In connection with this, a Bijur booster system was operated, showing how it keeps down the heavy rushes of current. By closing a large solenoid switch on the front of the board instantaneous loads of 2,000 amperes were drawn from a cell having a normal capacity of 84 amperes. This constituted one of the most interesting features of the exhibit. Besides this, there was shown the regular Bijur high-duty type of cell, a charging booster, consisting of a constant-speed motor driving a separately excited generator, a Bijur cell largely used in railway and lighting plants, a small lighting plant suitable for yachts, etc., plates of various sizes, a standard battery case for railway signals, standard car-lighting cells, constant-current boosters, etc. The company was represented by R. C. Shaal and F. E. Booss.

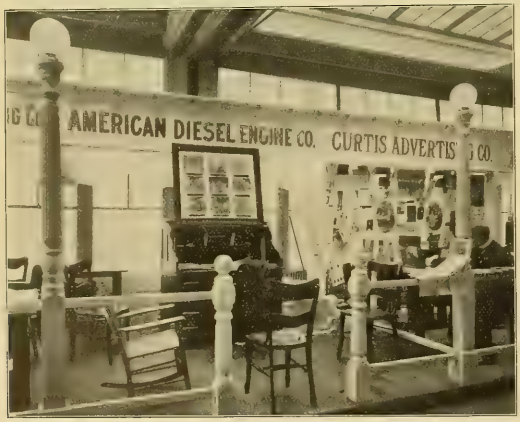
Managing Agent Francis Raymond of Chicago is one of those who joined the party of 67 who came on from Chicago on the Pennsylvania special. Mr. Raymond started in for himself about one year electric-lighting devices; also the new meter-seal ago and has been very successful. He is a born salesman, and, as his friends put it, "that is no surprise." Mr. Raymond, after the convention, will remain East, as he is about to add to his line a new agency.

Western electrical people who have become enthusiastic golfers—and there are many—will be interested to know that Mrs. Frank Donohoe carried off the cup which was offered by President Blood in the golf matches on Thursday at Atlantic City. Mrs. Donohoe has a splendid record to her credit

General Electric Company.

Simplex Electric Heating Company.

EXHIBITS AT THE ATLANTIC CITY CONVENTION.



American Diesel Engine Company.

Atlantic Electric Light and Power Company.

EXHIBITS AT THE ATLANTIC CITY CONVENTION.

The exhibit of the American Circular Loom Company was handled by General Sales Manager H. B. Kirkland, New York Representative R. B. Corey, Alex Henderson and H. C. Adams. The new Lutz metal molding was shown, as well as the well-known American circular loom tube and electroduct. The Lux metal molding is the latest development in the "canalization" of electric circuits. The removable capping on these moldings allows the conductors always to be accessible. This line of fittings is absolutely complete, including elbows for standard and irregular angles; "T" connections are also included, as is a device to con-

nect molding to standard size of rigid steel conduit, together with a full assortment of outlet boxes, porcelain rosettes and receptacles especially

GENERAL STORAGE BATTERY COMPANY.

designed for use with this molding. The principal advantage of the steel over the wood molding is the protection from mechanical injury, for of course nails, screws, etc., cannot be driven into it; it also occupies one-half the space required by the wood molding for the same size conductor. The American Circular Loom Company is prepared to make immediate delivery on these latest goods.

The National Carbon Company of Cleveland, Ohio, sent its usual large representation as follows: D. D. Dickey, general manager; H. E. Hackenberg, treasurer; J. S. Crider, secretary; N. C. Cotabish, sales manager; A. N. Barron, factory manager; J. F. Kerlin, assistant sales manager. Salesmen—A. E. Carrier, A. C. Henry, J. C. Irvine, F. C. Park, W. O'Conner, A. V. Ward, F. H. McDowell, C. W. Wilkins, F. J. Kysela, E. J. Kenny, A. D. Spear and W. C. Banks.

On Thursday Messrs. Terry and Tremaine, the "Napoleons of the lamp industry," put in an appearance at Young's Pier. Mr. Tremaine was immediately surrounded by a host of friends and overwhelmed with congratulations on his quick recovery from the appendicitis operation, which he recently underwent in Cleveland. "A little thinner, but still in the ring," said Mr. Tremaine, with a smile that indicated, to say the least, genuine delight at having escaped so successfully.

Manager G. A. Nesbit of the electrical department of B. S. Barnard & Co., New York, proved himself to be one of the most popular men at the convention. Mr. Nesbit is one of the most experienced men in the electrical business, and his long connection with several of the large companies now stands him in good stead in his present position.

men had prepared [illegible] but were disappointed during [illegible] the convention [illegible] their best [illegible] of the [illegible] ment arrived and [illegible] Vaughen and Phillips made [illegible]

DEARBORN DRUG AND CHEMICAL WORKS.

The Electric Storage Battery Company of Philadelphia exhibited an extensive line of Chloride accumulators and made an especial feature of its end-cell motor-control switch, connected with a drop type indicator. This exhibit was well repre-

JOHN L. GLEASON.

sented by the following-named gentlemen: Charles Blizzard, third vice-president and sales manager; G. H. Atkins, sales manager Chicago office; Frank J. Stone, sales manager Boston office; E. L. Reynolds, sales manager Pennsylvania territory, and Albert Taylor, sales manager of New York.

[illegible]

AMERICAN CIRCULAR LOOM COMPANY.

tings. This exhibit deserves [illegible] account of the number of new [illegible] the National Electrical Code standard [illegible] included several forms of [illegible] for 250 and 600-volt circuits. Another feature which attracted considerable attention was a line of high-tension porcelain insulators for transmission lines of 80,000 volts and less and several special forms of giant strain insulators for circuits of 10,000 volts and less. Other products of the company shown were Transite asbestos fireproof doors for sub-station work and other similar purposes, and Niagrite fireproof cable insulation for insulating cables. The company distributed a match safe and ash-tray souvenir, designed in the form of National Electrical Code standard enclosed fuse plug, made of porcelain and bronze. The following representatives were present: J. W. Perry, manager electrical department, New York; G. G. Meek of the New York office; C. N. Manfred, manager advertising department, New York; D. T. Dickson and H. M. Voorhes of the Philadelphia office; A. D. Newton of the Boston office. E. B. Hatch, president, and R. S. Cole, electrical engineer, of the Johns-Pratt Company were also in attendance.

The exhibit of the General Electric Company was at the left of the entrance and consisted of a complete line of incandescent lamps and high-efficiency tantalum lamps, fans and magnetite luminous arc lamps. There was also a line of heating apparatus on exhibition in another part of the building. The General Electric Company usually at conventions illustrates its nack of making interesting displays, and the present instance was no exception. This time, in addition to its novel heating display presented under the auspices of the Atlantic Electric

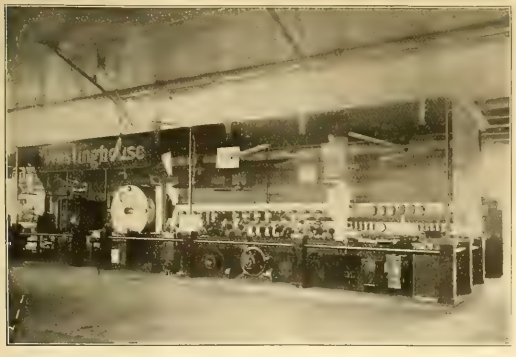


Exhibit of Westinghouse Companies.

Duncan Electric Manufacturing Company.

EXHIBITS AT THE ATLANTIC CITY CONVENTION.

B. S. Barnard & Co. are general agents for the St. Mary's Incandescent Lamp Company, and a number of calendars and stickers were distributed.

The Niagara Tachometer and Instrument Company was represented at Young's Pier by General Manager Charles H. Vaughen, and engineer and superintendent, Joseph A. Phillips. These gentle-

Manager W. A. Layman of the Wagner company of St. Louis was one of the most warmly welcomed at the convention. Mr. Layman of late years has rarely missed an electrical convention, and his company is always one of the most enthusiastic exhibitors. One reason for this, as put by Mr. Layman, is that the company always has something to exhibit, in that it never allows itself

Light and Power Company, without doubt the new tantalum lamp was the sensation and excited as much genuine curiosity and interest as anything presented at the convention. There were shown 25-candlepower 50-watt 700-hour life direct-current tantalum lamps, and there were also displayed the new Gem 50-watt 20-candlepower lamp, "successor" to the present 10-candlepower 50-watt lamp;

also the high efficiency and Meridian units, all with the new filament. There was, too, the General Electric two-watt-per-candlepower 16-watt multiple sign lamp. The company was represented by the following gentlemen: H. J. Buddy and G. L. Thompson of the Philadelphia office; P. D. Wagoner, J. H. Gilbert, C. W. Stone and F. H. Gale of the Schenectady office; A. D. Page and F. W. Willcox of the Harrison (N. J.) office; Charles Burleigh, H. W. Brown and A. F. Giles of the Boston office; Mr. Babson and L. H. Lewis of the New York office, and Mr. J. Scribner of the Chicago office.

As visitors to the National Electric Light Association convention entered the hall on Young's

WAGNER ELECTRIC MANUFACTURING COMPANY.

Pier their attention was first attracted by the large electric sign of the Allis-Chalmers Company suspended over a very handsome exhibit and reception room. The former contained an induction-motor-generator set of 50-horsepower capacity, six induction and direct-current motors and a potential starter, and a model showing moving and stationary blades of the Allis-Chalmers Company's steam turbine. The booth itself was fitted out with mission furniture with posts and rails stained of a color to match it. The floor was covered with green denim, and a profusion of palms and plants placed entirely around and through the enclosure gave to the exhibit a rather festive air which was heightened by bunting draped on either side of the red, white and blue electric sign. A number of souvenirs were distributed from the booth. Engineers

EXCELLO ARC LIGHT COMPANY.

and others directly interested in power plants were also shown a very neatly framed photograph of the Allis-Chalmers Company's turbine and generator which has made so remarkable a record in the Williamsburg Station of the Brooklyn Rapid Transit Company. A full line of the company's power and electrical publications were also displayed, the one most frequently called for being No. 1504 on steam turbines and generators, which has just been issued. The Allis-Chalmers Company's exhibit was arranged by C. A. Tupper of the Milwaukee office, who remained in charge of it. Among those who assisted in entertaining visitors to the booth were W. S. Doran, George B. Foster, J. C. M. Lucas, M. W. Thomas, W. H. Powell, G. Strafer, P. S. Gibson, F. L. Bunton, L. E. Bogen, G. W. Pulver and others of the company's salesmen and engineers, some of whom arrived too late for the first registration. The Allis-Chalmers Company was the first to have its exhibit in order and everything was in readiness promptly at the opening Monday night.

A large space in exhibition hall on the right-hand side of the entrance was occupied by the Westinghouse companies. The exhibit was very daintily arranged and among the prettiest booths on the Pier. Green drop curtains surrounded the booth on all sides, while the floor was covered with matting which harmonized in color. One-half of the booth was set apart for a reception room, where easy chairs were distributed freely. A feature of the exhibit was a large model of a Westinghouse type C single-phase wattmeter for 3,000 alternations. This meter stood 10 feet high and was about four feet deep from face to rear. The meter is built of wood, but is finished so as to serve as a very good representation of this line of meters. On all the posts supporting the brass rail about the exhibit were kept in operation the different styles of Westinghouse fans. Overhead were a half dozen of the new type Westinghouse ceiling fans. The exhibit on one side was lighted by Nernst lamps and on the other side by type K Cooper Hewitt mercury vapor lamps. A very complete line of Westinghouse arc lamps was displayed. A special feature of the Westinghouse exhibit was the new Nernst series-alternating vertical-glower system of street lighting. The system as shown consisted of four 60-candlepower lamps having single vertical glowers and spirally wound heaters mounted in strong weatherproof housings with reflectors and series transformers directly secured to a rack in the center of which was hung a standard Westinghouse series alternating-current arc lamp. The system is especially designed to meet gas competition in suburban street lighting and for the lighting of streets requiring a smaller unit of light than the arc lamp, at the same time allowing the use of arc lamps in the same series. The other apparatus exhibited by the Westinghouse company included a line of small motors, a very complete line of current-measuring instruments, lightning arresters, auto-starters and a complete line of switches and circuit-breakers. In addition to other decorations the Westinghouse had a very pretty design of flags showing the world in white relief on blue duck. The exhibit was in charge of J. C. McQuiston, the superintendent of the Westinghouse Companies' Publishing Department. S. P. Wilbur of the Nernst Lamp Company and E. D. Hays of the Cooper-Hewitt Electric Company represented their respective companies at the exhibit. Following is a list of Westinghouse men in attendance: From the Westinghouse Electric and Manufacturing Company—L. A. Osborne, second vice-president; W. M. McFarland, acting vice-president; C. S. Cook, manager of railway and lighting sales; S. L. Nicholson, manager of industrial and power sales; C. B. Humphrey, manager of detail and supply sales; Maurice Coster, manager of New York office, export department; W. C. Webster, assistant to second vice-president; W. F. Fowler, Paul T. Brady, Charles S. Powell, H. C. Stier, D. E. Drake, Fred W. Andrew, C. Aalborg, H. H. Van Staagen, G. E. Miller, H. W. Young, G. M. Bates, W. H. McGregor, C. C. Owens, C. R. Gilliland, Guy H. Gibbs, E. D. Mills, J. C. Warren, W. P. Jend, William Bradshaw, T. S. Perkins, H. P. Davis, E. C. Means, C. G. Bassett, T. H. B. Whipple, Samuel A. Chase, A. M. Thackara, Jr., F. W. Watts, W. H. Martins, Lawrence Moore, H. V. Rugg. From the Sawyer-Man Electric Company—Walter Cary, manager; H. V. Jackson. From the Westinghouse Machine Company—E. H. Sniffin, third vice-president. From the Nernst Lamp Company—Max Harris, general sales manager, and C. W. Davis.

How to Make a Small Electric Plant Pay.[1]

By D. F. McGee.

It has been proven that an entirely modern equipment is not essential for the financial success of an electric plant, and a wise manager of a small plant will hesitate before he consigns to the scrap heap equipment that he might, by overhauling and judicious arrangement, be able to operate at a net efficiency equal to the most modern equipment, besides saving for his company the amount required for new equipment and increased fixed charges that must necessarily follow such an expenditure. On the other hand, if he finds that his requirements and conditions call for an entirely new installation, he should not hesitate to make it, provided he can get the funds to do so—which is often difficult in a small plant.

The boiler room is usually the most neglected part of a small-plant equipment. Uncovered pipes, leaky valves and joints, improper boiler setting, careless firing and injudicious selection of fuel, are a few of the dividend-consuming devices common to small plants. It is well to have as few different sizes of valves, fittings, etc., as possible in the piping equipments. By making the nipples and short pieces of pipe of some uniform length, repairs will be simplified and many a shutdown be prevented, and a much smaller stock of fittings will provide for emergencies.

Boilers should be inspected at regular intervals and kept free from scale. Scale in boilers is often the cause of enormous waste of fuel. Every steam plant should have recording thermometers installed in the feed-water lines to boilers. The average engineer in the small plant does not realize the necessity of heating boiler feed water to, at least, 200 degrees.

Many central-station managers would have a rude awakening if they would take the trouble to install recording instruments. Recording voltmeters, as well as thermometers, will provide a healthy incentive for your men to attend to their duties, and will also provide a means by which that mystery of voltage variation, which has given us all so much trouble at various times, may be solved. It is well known that one of the chief difficulties in small plants is to have competent help available when accidents or other trouble occurs, which is generally during the time of the heaviest loads. We have provided for this by dividing the power-house force into three watches, with the understanding that they are to work 10 hours per day. This provides double force on duty two hours each day to make all repairs and tide over the peak-load period.

Engines should be indicated regularly, and valves adjusted for the most economical steam consumption. Tests of water and fuel consumption should be made at stated periods. A log book should be kept, showing records of the hourly readings of the various instruments. Daily readings should be made of the switchboard wattmeters. No plant is too small for those instruments. If a plant cannot afford load-curve drawing instruments, the engineer or switchboard attendant should plot the daily load from the ammeter readings. The curve thus drawn will bring before you plainly that hollow place in your load line that must be filled before you can corral that dividend-earning germ which we are all striving to cultivate with more or less success.

The distributing system of a small plant is very often the source of considerable waste. The annual losses from poor line construction, inefficient transformers and badly designed feeder systems would go a long way toward paying dividends. The line and transformer losses on above-mentioned plant at present are only 60 per cent. of what they were five years ago, when the income was only 25 per cent. of the present earnings. We scrapped 30 transformers and replaced the entire lot with four large ones, using three-wire secondary network with banked transformers to take care of this large increase of business.

The first duty of every manager is to provide for reliable and continuous service. He must furnish "the goods." Excuses won't go with the up-to-date American citizen.

His next duty is to his company. He must see that it receives an equitable return for money invested by it to provide the equipment to supply this service. Before he can do this, he must first know, beyond question, what constitutes the various costs that go to make up the entire operating expenses of the plant. He must be able to make a monthly comparison of his various costs, for it is only by this means that he will be able to keep a check on his operating expenses. By studying carefully all the facts and factors that constitute his costs, the manager will be able to steer clear of the folly of taking on unprofitable business.

In plants located in cities with populations of 10,000 and less, the manager must be familiar with every detail of his business. He must be his own solicitor. It has been said that an outside man can interest and get customers that the local manager cannot reach. If he can, it is because he is a man better fitted for the business. The manager of a small plant should know ways and means of approaching a prospective customer that a stranger cannot know. He should study the ambitions and weaknesses of every prospective customer. Often it is the wife and mother that should be approached, perhaps in an indirect manner. Very often it is the daughters of the house, who aspire to have as many conveniences as their neighbors. A hint from any source should not be neglected. There is always some way to land an interested party. A manager is not worthy of the name if he cannot find a way to do this.

Above all, a solicitor must be specific, and must be thoroughly posted regarding cost of installation and cost of operating the article sold; also regarding maintenance of same. He must be able to say, "Buy this; it will cost you so much to install and run, and will give you so much profit." He must be able to meet any argument that may be advanced by his competitors. Above all, he must be truthful. He must not make rash promises. It is well always to allow a factor of safety in this respect. How gratifying it is to hear from a customer that he is getting better results than you promised him. I can recall one incident that has afforded me considerable pleasure as well as profit. A German owned a blacksmith shop in our little city. After a lot of hard talking, I got him to install a small motor to operate his tools. Some time after, I called at his shop and inquired how he liked his power. He replied, "One boy put that thing in here, but it would take several good men to get it out again." As he is a very profane man, he used much more forcible language to ex-

1. Abstract of a paper read before the National Electric Light Association, Atlantic City, N. J., June 6, 1906. The author is manager of the Red Oak Electric Company of Red Oak, Iowa.

press himself on the subject. I have used this story many times since, and must say that it has helped to close up the sale of a good many motors.

It is not necessary to be a "hail fellow, well met." A man does not have to be a "mixer" in the accepted sense to get business. That fallacy has been exploded long ago. A pleasant, cheerful manner, and character to back up his arguments, is his best stock in trade.

The manager of a small plant must keep posted regarding the latest and most efficient types of different apparatus, lamps, reflectors, and so forth. He should read all the trade publications; not only the reading matter, but should study the advertisements as well. He will miss a great deal of valuable information if he does not. He will often find the solution in those pages of some difficult problem that has bothered him for months. Many manufacturing concerns gladly furnish binders for their literature. This matter, when properly assorted, represents a mass of valuable information that can be acquired in no other manner, so there is no excuse, save that "tired feeling," for a central-station manager not being up to date.

It is somewhat difficult to convince a customer that if his requirements call for a 25-horsepower motor, he would only have to pay for five to 10 horsepower. A very large proportion of the load that can be secured by a small plant is intermittent. The customer averages a payment for only about 25 per cent. of his actual installation. By carefully studying the requirements of all prospective customers and familiarizing yourself with their actual costs, you are then in a position to go to any one of those customers with a proposition that will save them money. If you can show the average man that you can cut down his expenses or decrease his manufacturing costs, you will have no difficulty in getting his business.

One of the most desirable classes of customers is the small refrigerating plant, especially when they install brine cold-storage tanks. Arrangements can be made with this class of customers to shut down their motor during peak loads. The cost of this class of power would be only the net additional cost of fuel and proportion of your general expense, as it does not increase the peak load on the station. A careful analysis of costs will work wonders toward helping the manager of our small plants in building up that hollow of low business in daytime.

The manager must be able to plan the most efficient arrangements of machines. In very many cases, such as machine shops, grouping the machines will permit the most efficient operation. In other cases, such as printing plants, individual motor drive is preferable.

It pays to study every installation, giving your prospective customer your very best advice, for there is no advertisement so cheap and good as a satisfied customer. Above all, create confidence, for confidence is the foundation of new business. Pay every attention to the little things. The average user of power knows nothing at all about electricity or mechanics and cares less. What he wants is to see the wheels go around. Have your trouble man call at the various installations at stated intervals, making a report to you of any abuse or misuse of the equipments. The average patron will appreciate this. He can well afford to pay a small sum for this inspection to insure him against a shutdown.

One of the best means to increase your business is to co-operate with architects and builders. The advice of a disinterested party will go a long way with the house owner.

Be prompt in looking after trouble. Let your customers know that their troubles are yours. Make yourself and your service indispensable to them; keep posted in regard to the troubles of users of other sources of power. We have often taken advantage of a breakdown in both steam and gasoline engines to install a motor to help them out of a difficulty, and we have never had occasion to take the motor out afterward, as the engine would invariably pass to the second-hand man.

With all due respect to advertising, it must not be thought, however, that the getting of new business, in a small city, is dependent on advertising alone. There must be good and reliable service as a foundation for all this. The service must be continuous and free from interruption. Voltage must be steady. With such good voltage regulators on the market, there is no excuse for poor regulation. Customers' installations must be looked after by the central-station manager to insure their being maintained in good condition. He must watch the little things, keep dim or other inefficient lamps weeded out. At an early date we adopted a liberal policy regarding free lamp renewals.

It is also essential to have a schedule of rates that will attract the long-hour or all-day customers for both light and power.

You must educate the people away from the idea that electric light is for the well-to-do only, for the difference in the yearly cost for redecorating houses where electricity, gas or kerosene is used will often more than pay the entire electric-light bill for the year. Where electric light alone is used, the redecorating cost is about one-half as much as where it is where the other illuminants are used.

Regarding advertising, it [illegible], necessary to retain the good [illegible] can be spent in the [illegible].

A short time ago there [illegible] plate in our city. [illegible] paper [illegible] a news item, supposed to [illegible] with a reformed burglar, stating that [illegible] an electrically lighted house [illegible] he was in the business because he never could tell when a light would be snapped on from [illegible] upper floors.

To another paper we furnished [illegible] to appear as a statement by a noted [illegible] advising people to have their houses [illegible] that the light in the lower rooms could be switched on from an upper floor. We [illegible] electrical trade paper [illegible]. We [illegible] that we received more benefit from the one [illegible] in one issue of two newspapers than we [illegible] have received from a bona fide advertisement running a year in the same paper. The idea is to take advantage of the psychological moment to instill your proposition into the minds of your prospective customers.

Advertising novelties are of questionable value to small plants. Every manager finds upon his desk every morning a mass of advertising matter, which he immediately consigns to the waste basket. There may be valuable matter hidden somewhere in the mass. The average manager has too many duties that demand his attention to waste it in wading through so much trash to discover them. Every business man has similar experience. We have found that the better way is to install a number of the articles, the sale of which we desired to push, in a number of carefully selected places, where they will be seen and talked about; and this, after all, is the only result to be gained by advertising. It is then up to the manager or his solicitor to strike while the iron is hot.

Alternating-current Elevators.[1]

By W. N. Dickinson, Jr.

Summarized and compared, the application of the alternating-current motor to the regular type of direct-current direct-connected elevator machine, limited the duty of the latter and rendered it expensive to install and to operate. It also made it noisy in operation, detracted from its safety, necessitated mechanical or rectified magnetic control, and affected the lights when placed on a lighting circuit. On the other hand, the tendency of central stations toward alternating current made it clear that alternating-current elevators suitable for all classes of service would be called for, and that if real progress was to be made, existing conditions and known principles must be carefully analyzed and the latter applied to the former, singly and in combination, until a basis of present possibilities was established. This basis should constitute at least an advanced starting point for development.

Applying, in so far as possible, the experience gained in direct-current practice, it followed that the first requirement was a quietly running motor having a large starting torque per volt-ampere of input, a reasonably small rotor weight, and good efficiency and power factor through a range of load. It further appeared that a motor having direct-current shunt motor characteristics at full speed was necessary, and that if possible this motor should be subject to definite speed variation. The multiphase motor, as known, gave better promise than the single-phase motor of fulfilling the conditions, and the multiphase elevator was, therefore, taken up first.

The elimination of noise, the obtaining of an excellent efficiency and power factor at full load and the reduction of rotor weight and speed to the minimum could be provided for in the design and manufacture of the motor. The starting torque and speed-variation features did not so readily fall into line. The starting torque per volt-ampere was improved, but was not and has not as yet been brought to a point comparable with that of the direct-current motor. Speed variation similar to that obtained by series-armature resistance with direct-current motors was available, but, owing to the fact that in direct-connected elevator work, with a given live position of the controller, the motor may be driving the load or the load driving the motor—depending upon the instantaneous relation between the car load and counterweight—it is evident that such speed control is indefinite. Speed variation through a change in the number of poles in a single motor could be obtained, but, as already mentioned in connection with bringing the motor to rest, the use of this device entailed large starting current.

In elevator work the most important consideration is safety, and upon this the certainty with which the maximum speed may be limited and the elevator brought to rest has a direct bearing. The direct-current elevator is considered safe and it remains, therefore, to consider the difference between the application of direct current and alternating current to an elevator machine.

An induction motor has practically the same characteristics as the direct-current shunt motor and, with all resistance cut out of both primary and [illegible]

[illegible] line, and [illegible] of current being [illegible] the elevator [illegible] than the [illegible]. Safety [illegible] alternating-current [illegible] able if higher speed or [illegible] current work [illegible] was limited [illegible].

The importance of [illegible] not so apparent [illegible] clear that danger [illegible] circumstances and [illegible] vision should be made [illegible]. A device which, in the event of [illegible] lation, shall immediately open the [illegible] and apply the brake or prevent [illegible] bringing the elevator to rest if in operation or preventing its starting if at rest [illegible] specification. With some mechanical [illegible] current is cut off from the machine and the brake applied if the car passes the ordinary [illegible] travel, and provision is made whereby [illegible] two operations may at any time be performed from the car through some means other than the regular control.

With a magnetic control, perhaps [illegible] for automatically accomplishing the desired result makes use of the torque principle of a small multiphase motor inserted across the main-line circuit. With current across this small motor in the proper relation the circuit to the elevator controller is complete, but at the instant the phase relation on the main-line circuit is reversed the direction of torque is reversed and the control circuit is, in consequence, opened.

This object may also be accomplished by various applications of direction relation between the power motor and parts of the control. Direction of movement of the control for desired direction of movement of the elevator is definite. Reversal of this relation would disturb the relation existing between control and elevator direction. Devices mechanically or electrically operated, or operated in combination, may be applied to any part of the elevator system, whereby the elevator is brought to rest immediately this disturbance occurs.

It would seem, therefore, that with proper precautions safety may be assured. It may also be of interest to know that the problem of magnetic control has practically been solved. Something over a year ago a multiphase magnetic control was set up and operated and its action was positive. Chattering was obviated by the use of four-pole magnets acting on circular armatures. For a two-phase circuit, two U magnets were set at right angles to each other, each having its pole tips the same relative distance from the common armature. Each magnet was wound for a separate phase and its strength varied with the alternations of the current. As one magnet was of maximum strength when the other was zero, and vice versa, and both acted on the same armature, the pull on the latter was constant, and as this armature carried the moving contact of the control, the contact it made was firm and constant. Furthermore, its attractive action was instantaneous and its release prompt. Magnets of this type may be made as large as desired and are available for controls or for brake mechanisms.

For ordinary controls a single-phase magnet of the solenoid type has been developed, which is simpler in construction and wiring and lends itself more readily to the requirements of a control. Owing to the single-phase winding, the pull on the solenoid core is not steady, and if the contact were secured directly to this core it would chatter and the electrical contact would be uncertain. To avoid this the movable contact in the form of a copper disk is sleeved over an extension of the core and supported by a light spring. The energizing of the solenoid coil raises the core and completes the circuit through the movable and stationary contacts. During the time the current is passing through the coil the core has a longitudinal vibratory motion, due to the alternating nature of the current. The height at which contact occurs and the pressure of the spring are so adjusted that

1. Abstract of a paper read before the National Electric Light Association at Atlantic City, N. J., June 7, 1906.

even when the core is at the lowest point of this movement a firm electrical contact is maintained. This spring principle has also been applied to horizontal magnets with hinged armatures, but the vertical solenoid is the simpler type.

Accelerating magnets may be obtained by using the solenoid type in conjunction with dash-pots to furnish the time element, or by utilizing the differential action between two coils; one energized from the primary circuit and the other from the secondary circuit of the motor.

With the controller magnets developed the next step was to reduce the current required to release the brake and, if possible with safety, to provide that the brake-releasing current should not occur simultaneously with the peak of the motor-starting current. It must be remembered that a reduction in voltage on the line affects the torque of an induction motor very seriously, and the motor and the brake should be so related that it would be impossible to release the brake under operating conditions unless the torque of the motor was sufficient to hold its maximum load. This end has been attained by proper connections in the controller and by the introduction of a momentum type of brake in which the turning effort produced when the friction shoes of the main brake grip the revolving brake-wheel is transmitted to the lever of a second brake, which also tends to bring the moving parts to rest. As the braking effort is thus multiplied, a smaller brake magnet meets the requirements, and, in consequence, a smaller brake-magnet current.

Utilizing these single-phase control magnets and a multiphase brake magnet, any form of "switch-in-car" or "push-button" control for a multiphase elevator may be obtained without employing a rectifying process, and it is clear that this same combination is equally applicable to the control of a single-phase elevator by including a phase-splitting device to supply multiphase current to the brake magnet.

The single-phase elevator has not been developed to the same extent as the multiphase elevator, but the limitation is entirely in the motor. At present it is installed mainly for residence service, but higher duty seems quite possible.

Owing to its high starting torque the single-phase motor which starts as a repulsion motor and runs as an induction motor seems to be the type best adapted to higher duty single-phase elevator service. There are a few elevators in this country thus operated, and it is to be hoped that American motor manufacturers will continue the improvement of this type of motor. Foreign manufacturers have succeeded in reducing the noise in the motor, and at present their machines appear to be in the lead so far as motors suitable for direct-connected elevators are concerned. They have also reduced sparking at the commutator without the use of high-resistance leads between the commutator bars and the armature coils, thus diminishing danger of burnout if the motor should fail to start promptly. Furthermore, with the American motor, starting resistance is employed, while from installations including foreign motors it may be eliminated.

Thus, while single-phase apparatus is still somewhat backward, with automatic elevators multiphase operative conditions have been met for a maximum speed of approximately 175 feet per minute and with switch-controlled elevators a maximum speed of approximately 250 feet per minute, without the use of rectified current, and elevators of these types are now available. For automatic elevators the speed named meets all requirements, but for switch-controlled elevators a speed greater than 250 feet per minute is distinctly desirable.

That such higher-speed service is obtainable with a machine which will meet commercial conditions, the writer is thoroughly convinced.

The starting current for an alternating-current motor suitable for elevator work is greater than that of a direct-current motor, but it seems reasonable to assume that in any location in which high-speed service is demanded, provision for a high-starting current may be made. It was done when direct-current elevators were new and demanded large starting current, and it will be done for alternating-current elevators. It was justified then. It will be justified now.

It is not difficult to obtain a multiphase induction motor which shall have large starting torque, or one which shall have either good power factor, high efficiency, good speed regulation, low speed, stability, quiet operation or fairly low rotor weight, but to combine all these features in a single motor is an interesting problem. Compromises must be made and a design which will insure the highest starting torque per volt-ampere and high efficiency at average load seems most fair to both central station and customer, and much has been accomplished toward obtaining a satisfactory motor along these lines. If no better performance can be expected from the motor, high speed apparently means heavy starting current to multimotors or higher mechanical efficiency in the transmission between motor and load.

High-speed service requires some form of control for intermediate speed, in order that good landings may be made. The introduction of a double or multimotor arrangement with provision for individual and cascade connection, or with one electrodynamic machine arranged as a power consumer, appears to offer the best promise for definite speed control, but the introduction of the multimotor also affects the starting torque required and obtainable. By use of the cascade connection increased starting torque for the same volt-ampere input may be obtained, but in stepping from one set of connections to another the current jumps are apt to be large unless the control is complicated, and this situation has been quite thoroughly gone over in the application of the cascade connection to multiphase railroad work.

The cascade arrangement would permit efficient operation at the various speeds and, during the first portion of speed reduction would produce a dynamic breaking effect, but, on the other hand, any multimotor arrangement must naturally increase the weight of the rotor necessary for a given full-speed duty, and the disadvantages of an increase in the weight of the high-speed parts of a direct-connected elevator may not be fully appreciated. For the information of those who have not given thought to this phase of the subject it may be well to state that with an ordinary direct-connected machine using both independent and drum counterweight and arranged for a capacity of 2,500 pounds at about 300 feet per minute, the inertia value of the high-speed parts—namely, the worm, brake-wheel and rotor—constitutes about 85 per cent. of that of the entire elevator equipment; in other words, of the excess torque necessary to accelerate the elevator to full speed when starting, about 85 per cent. is required to get the rotor, brake wheel and worm up to speed, while the small balance of from 10 to 15 per cent. suffices to bring the car, load and counterweights to speed.

If necessary, the efficiency of the mechanism between the motor and the live load in the car may be increased, thus cutting down the running horsepower required of the motor, and, in consequence, the weight of the rotor. This reduces not only the torque required to move the load at constant speed, but also the torque needed to overcome inertia during acceleration.

Mention has already been made of two methods of reducing the maximum starting current by reducing and adjusting the brake current, and still another device includes the mounting of the stator of the motor in bearings concentric with the rotor bearing in such manner that it may revolve through part of a circumference, but, when not energized, will be held central between the limits of its arc of movement. The starting torque itself is thus made to release the brake through a cam on the stator, which acts upon the brake lever. This also provides for safety by interlinking motor torque and brake release, and includes in the same device the motion necessary for a phase reversal safety.

A type of accelerating device which has been advocated with particular reference to the acceleration of large units, employs a small direct-current generator and direct-current magnets. The generator is arranged to be positively driven by the elevator motor and is electrically connected to the accelerating magnets. Rotation of the motor is accompanied by corresponding rotation of the generator, and, as the electromotive force of the latter gradually increases, the accelerating switches consecutively short-circuit sections of rotor resistance until all starting resistance has been cut out. Current from this generator is also employed to assist in stopping, by passing it through an auxiliary brake-applying solenoid at the instant the operating circuit is opened. This is applicable to either multiphase or single-phase apparatus.

The direct-current type of accelerating device employing a magnetic clutch driven from the elevator motor may be applied to an alternating-current elevator by substituting alternating-current magnets. Any resistance cut-out, mechanically driven and employing a magnetic detent, and a holding magnet at the terminus of travel, may be made to accomplish the same object.

A non-chattering magnetic control may also be obtained by arranging for electrical contact through gravity or spring pressure rather than through the direct action of the control magnets. This may be accomplished by allowing the weighted core of a solenoid, through which no current is flowing, to hold open the contact. When the coil is energized, the pressure due to the core is removed and firm contact is then established by the action of gravity, or by a spring.

A direct-acting single-phase magnet may be made to insure continuity of circuit by introducing sliding contacts. The vibration due to the alternating current may move the contact, but it does not open the circuit.

Pilot motor controls may also be employed.

Compressed air may be applied to alternating-current elevator control substantially as in alternating-current railroad control.

For stopping, improved mechanical braking devices have been mentioned, and the dynamic action obtainable from multimotor arrangements may be employed through all or part of the period of stopping, as well as for intermediate speed control. It is evident that the introduction of direct current into the windings on the stator of an induction motor, after the alternating-current supply has been cut off, will produce a dynamic action effective in stopping. With a multimotor arrangement the application of this scheme to one of the motors is also available for intermediate speed control. The direct current required for this purpose may be obtained from a small direct-current generator mechanically driven by the elevator motor or from an exterior source.

It is no easy task to produce a high-speed alternating-current elevator that shall be satisfactory from every standpoint, but operative principles have been evolved, and its development really lies in the hands of the central stations. Mechanically and electrically controlled elevators for low and medium speeds are now on the market, and the higher-speed machines will, I believe, be obtainable if there is a persistent call for them. So long as the high-speed direct-current elevator meets the requirements, so long will the development of the high-speed alternating-current elevator be retarded, for this is a busy world, and the work first undertaken is that which is easiest or that for which there is the greatest demand.

Discussion (in Abstract).

President Blood: Mr. Dickinson referred to a number of engineers who were working on this single-phase motor. I think one of these gentlemen is with us today, and possibly Mr. Layman may have something to say to us on this subject.

W. A. Layman, St. Louis: I have been engaged for about a year in endeavoring to advance the single-phase elevator-motor business, and we have been endeavoring to introduce a type of motor which I think Mr. Dickinson has in mind as being employed on the other side, and I will say that our motor was designed by the engineer who has been doing most of this European work, and that he came to this country last fall to do the designing work for us here; and we have also had in our possession one of his European motors, and we have employed resistance up to date in our installations, because we felt that the American central stations would require its use in holding down starting current. The same equipments can be employed without starting resistance, and the starting current can be held down to reasonable dimensions, but we have been endeavoring to secure a type of motor that would develop full-load torque with practically full-load current, or develop torque at half load, which, as I understand it, is about the worst kind of conditions the elevators have to start under, torque at one-half, and current at one-half, and for that reason we employed starting resistance up to date. There is only one equipment which we have installed, in which there is any prospect of its coming out, and that may come out because it is disturbing slightly the lighting system on the circuit where it is installed. It is a 10-horsepower equipment, driving an elevator in a Chicago apartment house, several miles from the Chicago Edison Company's center of distribution, and the disturbance of the voltage on the circuit, according to Mr. Garey, of the Chicago Edison Company, is between two and three volts, and he says that anywhere else in Chicago a disturbance of that amount would not affect their service in the least, but in this particular circuit—the equipment is in the best residence district in Chicago—they do not like to have a variation on that circuit. The equipment has not been taken out yet, and we may probably make some refinements in the installation which will keep it there. But, mechanically, the Chicago Edison Company has been entirely satisfied with the results, and the apartment-house people, after they learned the difference betwen the direct-current motor, which had been there previously, and this alternating-current motor, have also been entirely satisfied. I will say that this particular motor replaced a 500-volt motor and was put on the same bed-plate.

The Flaming Carbon Arc Lamp.[1]

By L. B. Marks.

The lighting interests now have offered for their consideration another lamp of the open-arc type, popularly known as the flaming carbon arc lamp. Let us examine briefly some of the characteristic differences between the flaming-carbon arc, the ordinary open and the enclosed arc.

In the open arc lamp, as commonly used, the carbons are solid and comparatively free from impurity. The arc is about one-eighth of an inch long, and the light emanates almost entirely from the incandescent points, less than 10 per cent. coming from the arc itself.

In the enclosed arc the carbons must be as pure as possible. The arc, as ordinarily operated, is about three-eighths of an inch long, and, as in the case of the open arc, most of the light issues from the incandescent carbon tips.

In the flaming arc lamp, on the other hand, the carbons are cored and mineralized, that is to say, provided with certain mineral substances either in the core or body of the carbon, or both, which, when feeding into the arc, greatly increase the light-giving efficiency of the latter. The volatilization of the mineralized carbon produces fumes and a considerable quantity of ash, deposits of which are made largely in the portion of the lamp im-

1. Abstract of a paper read before the National Electric Light Association, Atlantic City, N. J., June 5, 1906. The author is an electrical engineer of New York city.

mediately above the arc. In the flaming arc lamp, unlike the open and the enclosed arc, the bulk of the light emanates from the arc itself, only a comparatively small portion coming from the carbon points. In the lamp with the carbons concentric arranged (see Figs. 2 and 3), the length of the arc is about five times that of the ordinary open arc, taking the same current and voltage, or about two-eighths of an inch. When both carbons are arranged to feed from above (as in Fig. 1) the arc tend to creep up the sides of the carbons unless special provision is made for holding it in place, so that in all flaming arc lamps with inclined carbons a magnetic field is provided in the lamp by which the arc is continuously blown downward, resulting in a long flame measuring one inch to [illegible] inches in length (See Fig. 4.)

Owing to the rapidity with which the carbons are consumed in the flaming arc lamps it has been found necessary to shield the tips as far as possible from "washing" of the air currents in the globe. For this purpose an "economizer" (Fig. 5) or chamber of highly refractory material is used, which surrounds the ends of the carbons (in lamps in which the carbons are arranged side by side) or encircles the upper carbon (in lamps in which the carbons are arranged one above the other).

The vapor which results from the burning of the mineralized carbons condenses for the most part

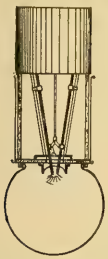


FIG. 1. FLAMING ARC LAMP WITH CARBONS FEEDING DOWNWARD.

on the economizer and contiguous portions of the lamp casing. Sometimes a special form of condenser is provided to receive the vapor deposits. As the color of the condensed vapor is whitish the deposits above the arc assist in reflecting the light downward. The arc is extremely sensitive to currents of air in the globe and to variations in the magnetic field and regulating mechanism of the lamp.

The regulating mechanism is housed as completely as possible to prevent access of the fine ash and the destructive fumes from the arc. It is not deemed necessary to give the details of the regulating mechanism of the various lamps of the flaming arc type, as in principle the mechanisms are the same as some of those of the older types of arc lamps with which we are familiar. It should be stated, however, that in most of the types of these

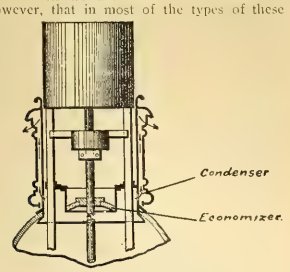


FIG. 2. FLAMING ARC WITH COAXIAL CARBONS.

lamps used abroad the mechanism is of the wheel and pinion type and far more complicated than that to which we are accustomed in lamps now used in the United States. In some of the more recent types of the flaming arc lamp the mechanism has been considerably simplified, but it remains to be seen whether the newer forms will meet the commercial requirements.

The following measurements of luminous efficiency are taken from a report of test made by the Electrical Testing Laboratories, New York, October 6, 1905, on a Koerting & Mathiesen flaming arc lamp, and on a standard five-ampere single-globe enclosed arc lamp. The enclosing globe in each case was slightly opalescent.

	Flaming Arc Lamp.	Enclosed Arc Lamp.
Positive carbon (diameter)	9 mm.	13 mm
Negative carbon (diameter)	8 mm.	13 mm
Mean amperes	8	5.1
Mean volts at arc	45	81
Mean watts at arc	360	412
Mean spherical candle-power	1,020	272
Watts per mean spherical candle-power	0.353	1.518

From these measurements it will be seen that the flaming arc lamp gives a little over five times the

FIG. 3. MAGNIFIED VIEW OF FLAMING ARC.—POSITIVE CARBON UNDERNEATH.

efficiency is materially decreased, the reduction amounting to from 25 to 40 per cent, depending upon the character of the mineralization. When carbons (containing strontium salts) producing a reddish pink light are employed the luminous efficiency lies about midway between that of the yellow and white light.

For the purposes of street illumination the highly efficient yellow light of the calcium carbon is in general suitable, but for interior illumination where color values are important the yellow light flaming carbon lamp is objectionable. Under the light of this lamp white material appears cream colored, the shades of yellow are intensified, and the color values at the violet end of the spectrum are naturally distorted. It is quite impossible to distinguish

FIG. [illegible]

are lamp, the difference in the cost of [illegible] and maintenance is [illegible]

STREET ARCS [illegible] Watts [illegible] Operating [illegible] Hours a Year.

	Two Enclosed Arc Lamps (600 Watts Each).	One Flaming Arc Lamp 600 Watts.
		Cost of Carbons per Trim.
		[illegible]
Carbons	$2.00	[illegible]
Trimming	[illegible]	[illegible]
Repairs	[illegible]	[illegible]
Inspection	[illegible]	[illegible]
Inner globe	[illegible]	[illegible]
Outer globe	[illegible]	[illegible]
	$8.[illegible]	$4.60

The cost of a pair of flaming carbons suitable for an all-night run is taken at 10 cents. It should

Cost of Energy, Carbons, Trimming, Inspection, Repairs, Globes 4,000 Hours.

Station Cost of Producing Energy per Kilowatt-hour.	Two Enclosed Arc Lamps (600 Watts Each).	One Flaming Arc Lamp 600 Watts.							
		Cost of Carbons per Trim.							
	2½c.	10c.	9c.	8c.	7c.	6c.	5c.	4c.	3c.	2c.
2½c.	$118.50	$101.51	$97.86	$94.21	$90.56	$86.91	$83.26	$79.61	$75.96	$72.31
2¼c.	108.50	96.51	92.86	89.21	85.56	81.91	78.26	74.61	70.96	67.31
2¼c.	98.50	91.51	87.86	84.21	80.56	76.91	73.26	69.61	65.96	62.31
2c.	88.50	86.51	82.86	79.21	75.56	71.91	68.26	64.61	60.96	57.31
1¾c.	78.50	81.51	77.86	74.21	70.56	66.91	63.26	59.61	55.96	52.31
1½c.	68.50	76.51	72.86	69.21	65.56	61.91	58.26	54.61	50.96	47.31
1¼c.	58.50	71.51	67.86	64.21	60.56	56.91	53.26	49.61	45.96	42.31
1c.	48.50	66.51	62.86	59.21	55.56	51.91	48.26	44.61	40.96	37.31
¾c.	38.50	61.51	57.86	54.21	50.56	46.91	43.26	39.61	35.96	32.31

different shades of dark blue from one another, all of them appearing black. With the white light flaming carbons, however, most of the colors have nearly their daylight value.

In the very nature of things the tendency of a long arc operated in the manner employed in flaming arc lamps is toward unsteadiness. The vari-

FIG. 4. FLAMING ARC BETWEEN INCLINED CARBONS.

ability of air currents in the globe, the lack of uniformity in the chemical constituency of the mineralized carbon, and the action of the magnetic field (where such is employed), these and other difficulties conspire to produce unsteadiness in the light.

The distribution of illumination of the type of flaming arc lamps now in use is quite different from that of the enclosed arc lamp. Most of the light of the flaming arc lamp is thrown downward in a zone from 30 to 90 degrees below the horizontal, the amount of illumination dropping off quickly toward the horizontal.

In order to compare the cost of operation of the flaming arc lamp with that of the enclosed arc lamp now commonly used for street illumination in the United States I have taken the case of a lighting circuit in which the lamps are run all night every night in the year on what is commonly known as the 4,000 hour schedule. The present practice in street lighting is to place the poles, on which the arc lamps are mounted, about 250 feet or more apart. Assuming that the flaming arc lamp gives five times the illumination of the enclosed arc

be noted, however, that the lowest price now quoted in this country for carbons for such service is 15 cents a pair in quantities. In the table herewith the difference in cost of operation should the price of carbons fall as low as two cents per trim (an extreme case) is given. The cost of the enclosed arc carbons is taken at 2.75 cents per trim, based on an average life of 77 hours per trim. This cost, it will be noted, is higher than that which obtains in most of the larger stations in the country. The enclosed arcs are assumed to be trimmed once a week, the stub of the upper carbon being used the succeeding week as a lower, which

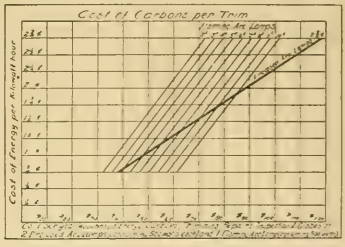


FIG. 6. DIAGRAM SHOWING COST OF CARBONS FOR STREET-LIGHTING CIRCUITS.

is the usual practice. The flaming arcs are trimmed once a day. The cost of trimming and cleaning the lamps is put at 2.25 cents per lamp, an average figure.

The cost of repairs per lamp is assumed to be the same in both cases, although with the present types of flaming arc lamps the cost of repairs would undoubtedly be very much higher than that of the enclosed arc. The cost of inner globes for the enclosed arc lamps is figured at 15 cents each, two globes per lamp per year being allowed. As an offset against the cost of inner globes for enclosed arc lamps the cost of the economizer for the flaming arc lamp should undoubtedly be taken

into consideration, but no allowance has been made for this destructible element in the flaming arc lamp. The cost of outer globes is figured at 45 cents each, the average life of a globe being taken as three years. In the flaming arc lamp the life of the globe would probably be considerably less than this.

The station cost of producing energy is taken at values from 0.75 cent to 2.75 cents per kilowatt-hour. This cost includes the cost of coal and water and that proportion of the station labor and maintenance account chargeable to the arc-lighting system.

It will be noted from the accompanying table and Fig. 6 that when the station cost of producing energy is less than two cents per kilowatt-hour, and the price of flaming arc carbons 10 cents per trim (which is one-third less than the present price in this country), it would not pay in this case to install the flaming arc even if the extra cost of new lamps and of installation of same be left out of consideration, and even though one flaming arc replace two enclosed arcs. When the cost of energy is high, however, the flaming arc lamp makes a more favorable showing than indicated above, particularly if the cost of carbons is reduced. For instance, at station cost of 2.75 cents per kilowatt-hour for energy, the cost of operation of the two 500-watt enclosed arc lamps is $118.50 per year, as against $101.51 per year for one 500-watt flaming arc with carbons at 10 cents a pair, and as against $83.26 with carbons at five cents a pair. On the other hand, if the station cost of energy is very low, say 0.75 cent per kilowatt-hour, the cost of two enclosed arc lamps is $38.50 per year, as against $61.51 per year for one flaming arc with carbons at 10 cents a pair, $43.26 a year with carbons at five cents a pair, and $33.31 with carbons at two cents a pair. The cost of operation per year of two enclosed arcs and of one flaming arc for costs of energy and of carbons other than above stated may be readily obtained from the chart.

Discussion (in Abstract).

Samuel Scovil, Cleveland: Mr. Marks made a special point of the cost of the carbon, and I would like to know what he thinks, in his judgment, is the probability of the cost of the carbons being materially reduced. No doubt he remembers what the cost of the original carbon was and what the cost is today. What is going, in his judgment, to be the probable cost of the carbons for these lamps when they come to be made in large numbers?

Mr. Marks: I have endeavored in the paper not to speculate any more than I could. There is a great temptation, in this particular field, to speculate on possibilities, when such rapid changes are being made in all directions; but if you refer to a carbon such as the Blondel carbon, I fear very much that we cannot look for any great reduction in price below what the present price is in Europe, say six or seven cents. It is necessary, in my opinion, to build up a carbon very carefully for good work. The ordinary cored carbon will not give the results we are after. During the years 1890 to 1893 I had some experience in a carbon factory and endeavored at that time to make an ordinary enclosed-arc carbon. We worked at it quite a while. It was in the works of the Washington Carbon Company, and the National Carbon Company worked at it quite a while, and took years to get at the present type, which is selling all the way from $27.50 per thousand for a half-inch, down to perhaps $5 or $6 less, I do not know. In the case of the flaming-arc carbon, we have a different proposition; as I brought out, you have to have homogeneity. You have a foreign substance which is giving you this light, and you have to place this substance in the carbon in exactly the right way; you have to build it up, so that, as far as the carbon expense is concerned, I do not look personally for any great reduction below the present prices which exist in Europe.

Regarding the complication of the mechanism, I believe the lamp in that respect will certainly show a very considerable improvement and cheapening. We have lamps on the market now in this country which are being sold at $30, and on the other side the Branlik lamp sells for $24, and the lamp manufactured by Johnson & Phillips, the Juno lamp, sells for the same price. They have a magazine lamp, the carbons side by side, to get a longer life. In this country, where we have been through the magazine business several times, I think the arc-light manufacturers over here are not looking for any radical improvements in that direction. So far as the long life is concerned, the point we want to reach, it does not look very encouraging in that particular type of lamp.

Louis J. Auerbacher: Mr. Marks, in his very interesting paper on flaming arcs, only discussed them in connection with street or municipal lighting. According to his figures, the flaming arc is apparently at a disadvantage in this capacity, but to not so great an extent as Mr. Marks makes it appear. He also does not take into consideration the very pleasing golden rays and the large amount of illumination per unit, which factors have been so large in making the flaming arc one of the largest factors in municipal lighting in Europe. It seems to me that this association is interested in learning the revenue-producing features of this form of illumination, and in the commercial field the flaming arc is sweeping aside all obstacles, helping the central-station man down his antagonist, the gas arc. The cost of carbons will be gradually reduced. In my recent trip abroad I visited many of the large carbon factories, and I find that very rapid headway is being made in this direction. Whereas, a few months ago, carbons were costing the consumer 15 cents per pair, a carbon burning the same number of hours can now be bought for 10 cents.

Exhibit of Central Station Advertising.

The committee on progress made a large and admirable exhibit of bulletins, posters and general advertising material employed by the central stations in their campaign for business and new customers. The first effort in this direction was made last year at Denver, but the present show was much larger and more successful in its illustration of the kind of arguments to be used with most effect upon the public.

Some idea of the intrinsic value of the exhibit may be formed from the fact that five handsome framed watercolors, sent by the Boston Edison Company, through the Bates Advertising Agency, had cost $250 each, unmounted; and there were a score of other large original pieces in color, and in pen and ink work.

Each large exhibit was grouped by itself, with appropriate placards, and the effect was extremely pleasing. These exhibits were made by the Philadelphia Electric Company, New York Edison Company, Boston Edison Company, Edison and Peninsular companies of Detroit, the Chicago Edison Company, Edison Electric Illuminating Company of Brooklyn, Denver Gas and Electric Company, United Electric Light and Power Company of New York, Portland (Ore.) General Electric Company, Public Service Corporation of New Jersey, Toledo Railways and Light Company, and Minneapolis General Electric Company, etc.

A further portion of the exhibit consisted of the bulletins of most of these companies and from the Buffalo General Electric Company, the Cleveland Electric Illuminating Company, and the Hudson River Power Company. Nearly all were of the current month, and were supplied in such large editions that the committee was able to make a liberal free distribution to the public, as well as to the members. It is estimated that of bulletins and other pieces of literature there were thus given out to the extent of over 25,000 pieces in the four days. The bulletin of the Philadelphia Electric Company, of which some 5,000 were used, was, in fact, a special Atlantic City number.

The chairman of the committee, Mr. T. C. Martin, was helped by Messrs. Nast, Gilchrist, Moler, Marchbanks, Seelman, Rae, Lee, Vredenburgh, Smith and other publicity managers, who are already making reputations for themselves in this new and promising field of central-station endeavor. It is the intention, at the next convention, to systematize and develop this convention feature, which has already enlisted much support and approval.

Some Physiological Factors in Illumination and Photometry.[1]

By Dr. Louis Bell.

The fundamental difficulty in the scientific study of illumination is that one has to define physical quantities in physiological terms. Illumination in all its phases deal with the sensation of sight, and between the one and the other there are no fixed relations, but only variable approximations. One can, therefore, rely only upon average conditions, restricted within somewhat narrow limits.

According to Fechner's law, the human eye can perceive a fixed fractional difference of illumination, irrespective, within wide limits of its absolute amount. This fraction varies in general from about one per cent. to about 0.55 per cent., assuming ordinary sources of illumination and normal eyes.

Now, for the purposes of practical lighting, the illumination should be generally kept within the range for which Fechner's law holds good, and once well within that range of normal sensibility nothing is gained virtually by increasing the strength of the illumination, so far as difference of luminosity is concerned.

But this is not all, for visual acuity also enters the problem. By this one means the power of discriminating fine details, assuming strong contrast between them. This, although it depends primarily on the retinal structure, also varies considerably with the illumination, as everyone knows. There is also a tolerably obvious but little understood relation between sensation and the area of the retinal image. The smaller the image the brighter must it be to produce a distinct sensation. Thus, for example, small objects seem distinct enough at moderate distances, and blend into the general landscape as their distances increase. In artificial illumination this phenomenon is seldom of importance. In order to see things with satisfactory distinctness the illumination must be sufficient to bring the eye to its normal acuity and to give to Fechner's fraction somewhere nearly its normal value. A curious case is cited by Kreuchel, in which a patient complained of not being able to see well enough to get about. On examination the visual field and visual acuity were normal, but a special test showed that for his eye Fechner's fraction was about 1-10, instead of 1-100, and hence only strongly contrasted objects were clearly visible to him.

Starting now from Fechner's fraction and from the facts of visual acuity, let us see whether a logical basis for illumination can be devised which shall thus rest not upon purely empirical observations of good and bad lighting, but upon the general data of physical and physiological optics. Thanks to the work of König and Brodhun and of Uhthoff, one can get a clear idea of the variation of Fechner's fraction and of visual acuity with the strength of illumination. In Fig. 1 these relations are plotted with the illuminations in foot-candles, as abscissæ. Curves (a) and (b) relate to Fechner's fraction, with $\frac{dI}{I}$ as ordinates.

Curve (a) shows the variations found up to 140 foot-candles, while curve (b) is on 100 times the scale as regards abscissæ, running, therefore, to 1.40 foot-candle. I use the foot-candle as unit, not because I prefer it, but because the English standard candle is the only legal unit for practical use.

A glance at curve (a) shows at once that by the time the illumination has reached the neighborhood of one foot-candle the curve is turning clearly toward the horizontal, and that beyond say five foot-candles the decrease in the sensibility is very slow indeed. Curve (b), in fact, shows that the curve is rapidly getting asymptotic at even one foot-candle. These curves are for white light, and the question may naturally be asked as to whether they also hold for colored light. At low intensities they do not, the sensibility for red being considerably less, and for blue somewhat greater than is here shown.

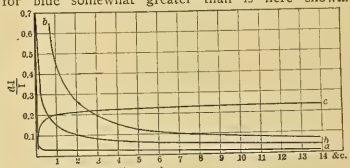


FIG. 1. CURVES SHOWING VARIATIONS OF FECHNER'S FRACTION WITH STRENGTH OF ILLUMINATION.

Curve (b') shows the approximate values for deep crimson. Eyes differ considerably in absolute and in color sensibility, but (b') will give an approximate notion of the color effect at its worst. At high intensities, say about 25 foot-candles, the color curves run together.

Difference of visibility in colored objects, however, is only in small measure due to the facts here noted, being mainly chargeable to mere differences in reflecting power.

Curve (c), Fig. 1, shows the variation of visual acuity up to 14 foot-candles, the ordinates being purely empirical values. It at once appears that the increase in acuity is very slow above about one foot-candle, but goes on increasing slightly, like the shade perception, above all working values of the illumination. In extremely intense light, several thousand foot-candles, the sensibility decreases slowly, and probably also the acuity, but these upper limits are quite beyond the limits of ordinary illumination.

It therefore plainly appears that at one or two foot-candles the eye is working so near its normal sensibility that further increase in illumination is of relatively very small value.

The essential point in good seeing, however, is that the values here specified should be those affecting the eye and not merely those by which objects are illuminated.

Since objects are seen in virtue of differences of reflected light the illumination which affects the eye is determined by the coefficients of diffuse reflection of the objects in the field of view.

The light reflected from any object is I K where I is the incident illumination, and for this to have the value required by the visual conditions just indicated $I = \frac{a}{K}$ where a is the absolute factor just found. For example, taking a = 1.5 as a mean value, and the case of working upon white paper for which k is ordinarily 0.6 to 0.7, I, the incident illumination should be two to 2.5 foot-candles, while with moderately dark colored papers having k equal to say 0.3, the necessary illumination would rise to five foot-candles. With black goods for which k is only 0.01 or 0.02 one can hardly get enough light to bring acuity and sensibility to their full values. For ordinary purposes not requiring extreme acuity a may generally be taken as one, while in observing very fine details two, or in very extreme cases three may be assumed. The surface observed acts as a secondary source of illumination, and for details small compared with the normal visual distance the law of inverse squares holds, hence the tendency to get the eyes close to the work in insufficient illumination. In weak light, say 0.1 or 0.2 foot-candle, variations of shade are perceived only with difficulty, and one finds himself in the condition of a patient who stumbled about because ob-

1. Abstract of a paper presented before the Illuminating Engineering Society, New York, June 8, 1906. Dr. Bell is an electrical engineer of New York city whose specialty is illumination.

stacles not strongly contrasted were invisible to him. At 0.5 foot candle, conditions are very greatly improved and useful illumination begins, and above one foot candle they may be considered normal, unless close detail is concerned, in which case more light is of some assistance. But the controlling factor in practical illumination is k, which varies widely, with the luminosity of the colors concerned, producing apparent color relations which entirely mask the real ones already described.

Any violent contrast in the field of vision is objectionable for the same reason, in less degree, so that, if conditions are such as to require powerful illumination in a part of the field, a very bright background in the rest of the field should be avoided, it being preferable to have there merely enough light to avoid excessive contrasts.

As most objects are colored the relative luminosities of various colors are important considerations in illumination. That the eye is affected by various colors in very different degress is well known, and the fact is responsible not only for great difficulties in photometry, but also for serious limitations on the possible efficiency of illuminants.

At first sight the eye would seem to be very inefficiently organized. Such, however, is not the case, for the eye has been evolved, not for artificial light, but to meet the exigencies of natural light, and its point of maximum luminosity falls very near to the point of maximum energy of the solar light, in fact, between that and the maximum-energy point for skylight, so that the adjustment of the sensibility for natural conditions is excellent.

Moreover, were it not for the adjustment of the eye for a sharp maximum of sensibility, we should be totally unable to see clearly, on account of the effect of chromatic aberration. When the eye is accommodated for yellow light, images due to deep red and deep blue light are badly out of focus, and were they comparable in brightness to the yellow image, near vision would be very indistinct, and aside from this we should lose much of the contrast which helps to render objects visible.

As was long ago noted by Purkinje and Dove, the relative luminosity of different colors is greatly affected by the absolute intensity of the illumination, a fact at once curious in itself, and in photometry very troublesome. The comparison of colored lights involves this phenomenon to a very serious extent, and in particular all extinction methods are vitiated by it, save when used merely for the comparison of lights of similar color or for the actual measurement of very low intensities.

In fact, any photometric device which can be used on colored lights with coherent results by both the normal and the color blind, owes its apparent efficacy to disregard of part of the spectrum generally useful.

Now, in using artificial illuminants, the real usefulness of the light evidently depends upon the amount of energy which falls within that part of the visible

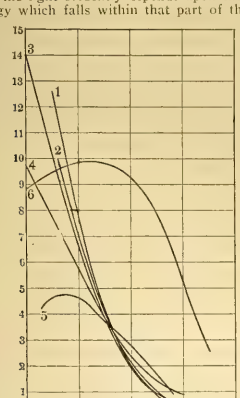


FIG. 2. CURVES SHOWING DISTRIBUTION OF ENERGY IN VISIBLE PART OF SPECTRUM.

spectrum to which the eye is reasonably sensitive. In fact, the photometric principle laid down by Crova, of comparing lights by their respective components in the neighborhood of 590-millimeter wave lengths, had much to recommend it in dealing with sources which give a continuous spectrum.

The position of the energy maximum in the spectrum of an incandescent body is a function of the temperature, and, unfortunately, the temperatures available in flames, incandescent lamps and so forth are too low, say 1,800° to 2,200° absolute, to place this maximum where it will do the most good. In fact, to put the maximum where it ought to be requires the solar temperature itself.

Fig. 2, from the researches of Nichols, gives with arbitrary ordinates the distribution of energy in the visible part of the spectrum for various familiar sources of light. The first three curves are for ordinary incandescent solids and bear a striking resemblance to each other. Curve (4) from the electric arc shows relatively more blue and less red than the others, [illegible] temperature. [illegible] shows a considerable departure from the distribution of the normal [illegible] temperature [illegible] tion. It indicates a very high [illegible] since the maximum lies [illegible] spectrum. Curve (6) is the solar radiation, which [illegible] temperature [illegible] pushed up into the orange. [illegible] radiation is quite non-selective [illegible] for the solar temperature could be [illegible] it is only [illegible] that the temperature is probably between 5,000 and 6,000.

The efficiency of an illuminant in the sense in which the expression is ordinarily used is the ratio between the luminous energy and the total energy. In this estimate the luminous spectrum is commonly taken as beginning at wave length 760 [illegible].

Angstrom has found for the particular energy curve of the Hefner lamp that one square centimeter of surface one meter from the flame receives 8.3 ergs per second of luminous energy, which gives for this particular source a luminous efficiency of 0.9 per cent. Other things being equal, if all the energy were converted into light on the basis of this mechanical equivalent of light, we should have a possible duty for a radiation wholly within the visible spectrum of 0.115 watt per candle. But the visible light is really

$$\sum_{\lambda_1}^{\lambda_2} \sigma_\lambda \, \Delta E_\lambda ,$$

in other words, the summation within the visible spectrum of each element of energy multiplied by its corresponding coefficient of luminosity, and this summation is very different for different energy distributors. Nichols, from the application of Crova's criterion that lights of equal intensity at wave length 590 meters are equal, has made some most interesting approximations to the mechanical equivalents as derived from other illuminants reaching, for sunlight, 4.85 ergs per second, and for the Welsbach, on account of its selective radiation, as low as 4.39 ergs per second. A rigorous summation made as above would change these quantities somewhat, but the main point of the matter is that if one could confine radiation to the visible spectrum with as good a distribution as is given by the Welsbach or by sunlight one could secure artificial light on a duty of about 0.06 watt per candlepower. This, however, is not the limit, for if in addition one could crowd all the radiation into the neighborhood of wave length 590 so as to keep σ near its maximum, one could get light at a duty of approximately 0.01 to 0.02 watt per candlepower, which is about the theoretical minimum. This would, however, be practically monochromatic light, by which color vision would be impossible.

The flaming arc is the most efficient illuminant yet found, and M. Blondel has been able to obtain from it a duty in the vicinity of 0.1 watt per mean spherical candle, due to the very high luminosity of the two calcium fluoride bands near to wave length 600 millimeters. But the light has a large color error which can be corrected only by a considerable sacrifice of efficiency. Undoubtedly a discontinuous spectrum gives the best chance for high efficiency, but only at the cost of serious color errors. Even if one could obtain a discontinuous spectrum of the three primary rays only, it would be at a sacrifice, and there would be some doubt of its value as an illuminant on account of chromatic aberration in the eye.

Could one steal the firefly's secret the result would be, if Langley's experiments correctly represent it, a light of high efficiency, it is true, but of about the color of a superannuated Welsbach. From all appearances it will be extremely difficult to do much better than a duty of 0.5 watt per candle with an illuminant of reasonably good color quality.

Discussion (In Abstract).

Dr. Friedenberg: First I will say a word in regard to Fechner's law, in which he says that the human eye can perceive a fixed fractional difference of illumination, within wide limits, irrespective of its absolute amount; that is to say, a fractional difference of one per cent. or one-half of one per cent. But when we translate this into practical terms it means that there is a very large difference in the perception of different light, in regard to the initial illumination, whether it is high or low. If we have a room lighted with 1,000 candles, the addition of one candle will not be perceptible; but if we have only 10 candles, an addition of one candle will make a considerable change in the apparent illumination. And this should be borne in mind—the question of contrast and the question of proportional illumination.

There are one or two pathological questions which we must consider—that is, those relating to the disease of the organs, the eyes. The questions are often asked which light is the best for the eyes? Is the arc light best? What is the effect of the Welsbach? Is the incandescent light good? While I must admit I haven't studied this question with sufficient exactness and thoroughness to give a scientific answer in regard to the various lights, I think the main stress must be laid on practical consideration. I think the question of light intensity is of much more value than questions of light value, wave length or of physiological consideration.

[illegible] that wall [illegible] In that way [illegible]

[illegible] The room in which a [illegible] black-board [illegible] of a gymnasium [illegible] ferent form of illumination [illegible] The [illegible] broad diffuse illumination [illegible] gymnasium, will not be [illegible] where you are [illegible] board, or a chart, or reading [illegible] writer. In these last mentioned [illegible] tion should be brilliant [illegible]

Dr. Hepburn: The main question is the matter of the intensity of light and [illegible] the cases the object has been to get [illegible] powerful light, with the resulting [illegible] where I work I find the [illegible] best results, and they are certainly [illegible] tating to the eye. There was a curious observation made during the war between the allied forces and China in regard to the visual [illegible] of the men there representing the different powers. [illegible] up, I think the conclusion was that those contingents that came from countries where there was a large number of cloudy days had better vision than those that came from the sunshiny districts. All of which went to prove that the quality of light, rather than the intensity, was the main factor.

Another thing borne out by that conclusion was that the yellow lights, rather than the white lights, were the most grateful to the eye, and when we go to our ordinary work I think we find pretty much the same thing. I think in actual orthomoscopic work we find the yellow flame is better for the patient and gives better results than the clean incandescent light.

Dr. Dennett: The old-fashioned idea is to put an old-fashioned light as close to you as possible, and having no light on the rest of the room and a dazzling, direct light flashing on a book in front of you, and then you could read and think you were happy. That is all over with me now. The thing I am in the habit of telling people who ask me what they shall read by at night, and whether it shall be a Welsbach light or an electric light, I tell them that an authority by the name of Cohen said you could not get too much light. It is pretty hard to get more light than you can get from the sun. However, you can get it from inconvenient places. I put my light overhead and I sit where the gloss of the paper doesn't irritate me, and I take pains to see that my hand does not throw a shadow over what I am writing. If you have enough light and it is steady, I think that is sufficient. It is a question for illuminating engineers to tell whether it is best to do your reading by a red, a yellow or a green light. It is easy to find that out; at least, I suppose it is from the paper we have heard to-night. This is one of the most valuable papers I have ever heard on this subject.

V. R. Lansingh: I want to say a word in regard to what is the standard practice of the United States government. In all its work it is trying to get an intensity of six square inches per candlepower, or one-sixth candlepower per square inch, with an extremely low intrinsic brilliancy. If a globe was six inches in diameter, it has a superficial area of 96 inches, and they would say it had six square inches per candlepower. This is much lower than is ordinarily used, and I simply wished to state that the government is working on that line. I had a letter from Mr. Bushnell. I wanted to get an opinion as to the relative effect on the eyes of red and blue rays. Mr. Bushnell maintained that the red light is extremely painful on his eyes, and that he had to undergo a long siege with the oculist, but when he got blue glasses, then the light was much easier on his eyes and he has recovered.

Books Received.

"Modern Polyphase Machinery." By Andrew Stewart. Published by S. Rentell & Co., London. Price, $1.25.

"Alternating-current Windings, their Theory and Construction." By C. Kinzbrunner. Published by the D. Van Nostrand Company, New York. Price, $1.50.

Independents May Get Into Cincinnati.

A correspondent of the Western Electrician in Cincinnati writes as follows: "In Cincinnati, Ohio, the telephone field has been cleared. The Queen City Telephone Company, after a strenuous fight, in which it carried its case to the Supreme Court, was finally defeated, and since this decision the company was again defeated by the Cincinnati City Council, which refused its renewed application for a franchise. This, after the adverse decision of the Supreme Court against all companies with no franchise and having no exchange in operation, pivots the Independent situation in Cincinnati on the Fitzsimmons' franchise, owned by the Fitzsimmons Independent Telephone Company, with office at 616 Johnston Building, which is the only company in Cincinnati having both franchise and vested rights, and which, with its miles of wire, is now open for both rural and long-distance connections, affording immediate service."

Southeastern Telephone Developments.

The Long-distance Telephone Company has been refused admission into the town of Athens, according to a message received in Birmingham, Ala., although the company has completed its line of poles up to the city limits. It is said this is an Independent concern. In the city the local exchange is said to be controlled by the Bell company.

The annual meeting of the stockholders of the Virginia Telephone Company was held at Ashland, and a dividend of 10 per cent. was decided upon by the board of directors.

A number of petitions are being circulated at Charlotte, N. C., asking for a reduction of the rates of the Bell Telephone Company. The present rates are $4 per month for business telephones and $2.50 to $3.50 for residence telephones.

Manager N. O. Wood of the Asheville Telephone Company has made arrangements with the Gates Hotel at Hendersonville, N. C., to install a telephone in the rooms in the hotel for the use of guests.

The Southern Bell Telephone Company has entered into a sub-license contract with the Wadesboro (N. C.) Telephone Company and will carry its long-distance wires into the town, connecting with the wires of the Wadesboro exchange.

On account of increased long-distance business the Southern Bell Telephone Company will add three new circuits to the eight already in operation north of Greensboro, N. C., and a large amount of material has already been placed on the ground. L.

Indiana Telephone Items.

The Indianapolis Board of Public Works has denied the petition of the Indianapolis Telephone Company for a change of franchise by which the life of the franchise would be extended and the company allowed to charge a higher rate and pay less tax than now. President Elliott of the board said he believed the relief asked for by the company was equitable and just, and he thought the company ought to have an increase of from $40 to $48 a year for business telephones and have a franchise extension. In his judgment it would be fair to provide for an increase of $1 a telephone a year for each 1,000 telephones in use in excess of 15,000 up to 35,000. However, Mr. Elliott was outvoted, even a motion to defer the matter for further conference on the present petition was denied. It is the purpose of the company to file another petition after the fall election, since political interests, it is said, had something to do with the denial of the petition.

The Farmers' Mutual Telephone Company of Columbia City is preparing to build a number of rural lines and announces that it is in the market for material.

The Citizens' Telephone Company of Columbus held a directors' meeting and decided to install a new exchange in East Columbus.

The Daleville Telephone Company at Daleville, the Roanoke Telephone Company at Roanoke and the Whitley County Farmers' Mutual Telephone Company of South Whitley are planning for extensive improvements and extension of their lines.

The Spurgeon Independent Telephone Company has been incorporated to build an exchange in Spurgeon and extend the lines throughout Pike County. The stock has all been subscribed and work on the new system will begin soon. B. A. Humphreys is president.

The interurban railway company which will operate between Indianapolis and Danville will install a telephone system along the line. The road is owned by the Schoepf-McGowan syndicate.

A new telephone company is being organized at Shelbyville to compete with the Bell company, which recently took over the Citizens' company. The farmers are greatly interested and are encouraging the movement for a new company. It is understood the Shelbyville council will grant the company a franchise.

The Central Union Telephone Company at Indianapolis has leased the church property at the corner of Meridian and New York streets for a period of 99 years. It was first announced that a sale had been effected. Under the lease the company will pay the owners $676,800 for the use of the site, on which will be erected an eight-story building.

The Fifth District branch of the Indiana Independent Telephone Association held its third quarterly meeting in Muncie recently. This district embraces what are known as the gas-belt counties—a territory covered by the United Telephone Company, which went over to the Central Union a little over a year ago. The representatives present reported progress, and declared that the territory was being reclaimed rapidly. The new automatic system to be installed in Marion and the plan of co-operation of all the Independent companies of the district was ratified. After disposing of some important business, J. A. Browne, H. G. Miller and O. L. Barger were elected delegates to the national convention in Chicago. S.

Telephone News from the Northwest.

The telephone linemen's strike has been declared off by the national executive committee and the men ordered back to work in the Twin Cities. The Federal Court has issued an injunction forbidding the Brotherhood of Electrical Workers from interfering with the property or the employes of the Tri-State Telephone and Telegraph Company.

J. E. Rheud seeks to interest local capital at Sauk Rapids, Minn., in the formation of a local telephone company.

The Town and Country Telephone Company has been formed at Dawson, Minn., and takes over the lines formerly owned by Mr. Ewing at Dawson and Canby.

Albinus E. Gregory, superintendent of construction for the Tri-State Telephone and Telegraph Company, Minneapolis, died at his home in Minneapolis on June 1st. He is survived by his parents, a widow and three children. The interment was at Keokuk, Iowa.

A. King of Frazee, Minn., seeks a franchise at Eagle Bend, Minn., with a view to installing a local exchange.

The Star Telephone Company has sold the local exchange at Savage, Minn., to the Shakopee Telephone Company of Shakopee, Minn.

The Northwestern Telephone Exchange Company has let contracts for a new building in Crookston, Minn., to cost $10,000.

The Chadron (Neb.) Telephone Company has filed articles of incorporation, with a capital of $25,000. It will take over the exchange now owned by A. W. Rickman, who is the principal shareholder of the new company. R.

GENERAL TELEPHONE NEWS.

The Pioneer Telephone Company has been granted a 20-year franchise in Ravia, I. T.

W. A. Ambler of Vinson, Okla., has sold his telephone business to G. F. McCauley.

David N. Sowers and associates of Guthrie, Okla., have incorporated as the Northwestern Telephone Company.

The Southwestern Telegraph and Telephone Company is arranging to put in a telephone system at Angleton, Texas.

The Town and Country Telephone Company of Dawson, Minn., has been incorporated with a capital stock of $50,000.

The Ord Telephone Company of Ord, Neb., has purchased the business of the local telephone company at North Loup, Neb.

The Citizens' Telephone Company of Centerville, S. D., has been incorporated with a capital of $50,000 by J. A. Crowe and others.

The Keystone Telephone Company of Philadelphia is said to have acquired control of the Eastern Telephone Company of Camden, N. J.

The Bell long-distance telephone lines now extend from Portland, Me., to Hastings, Neb., and from Duluth, Minn., to Houston, Tex.

It is said that the Kinloch Long Distance Telephone Company of St. Louis intends to extend its line from Paris, Ill., to Terre Haute, Ind.

The Village Trustees of Bathgate, N. D., have granted a franchise to F. E. Carson for the purpose of constructing a telephone exchange. Work has been commenced.

The Boynton Telephone Company of Pleasant Plains, Ill., will build a new central and supply office. The company has sold its exchanges at Tallula and Ashland.

The following-named telephone companies are among those recently incorporated: Bloomington Mutual Telephone Company, Douglass, Kan.; Farmers' Mutual Telephone Company, Rossville, Okla.; Everest Mutual Telephone Company, Everest, Kan.; Ann Car Telephone Company, Ann Car, Neb.

George Horton, American consul at Athens, writes that there is a growing discontent in Greece over existing telephone conditions, and he thinks it probable that the government would grant a concession to some reliable private company that would install modern telephones. The appliances in use are inadequate and unsatisfactory and consequently poorly patronized and unprofitable to the government, which controls them. There is apparently a profitable opening for American capital in that country.

Judge McEwen, in the Superior Court, Chicago, has issued an injunction against the Chicago Telephone Company, whereby the company is restrained from interfering with the telephone service of 80 complainant subscribers. The proceedings grew out of a dispute between the company and subscribers regarding extension telephones and improved equipment.

The Consolidated Telephone Company of Pennsylvania, Allentown, Pa., has leased the Easton and Bethlehem Telephone Company's 500 miles of lines and 1,400 subscribers for 999 years. The company at the same time purchased outright the Honesdale Company, which operates a line from Hawley to Carbondale, 32 miles, with 400 subscribers, and the Berwind Telephone Company, which operates a line from Lime Ridge to Nanticoke, 25 miles, with 500 subscribers.

MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for the following places: Exeter, Neb.; Portsmouth, N. H.; Bedford, Ind.; Hartford, Conn.; Rochester, N. Y. Also a 3,000-line multiple board for the People's Home Telephone Company of Morgantown, W. Va., and one for the Marietta Home Telephone Company of Marietta, Ohio.

Electrical Concessions in Colombia.

P. P. Demers, United States consul at Barranquilla, Colombia, forwards to the State Department at Washington translated copies of a Colombian government concession given Francisco E. Baena, president of the Barranquilla tramway, prolonging for 39 years a previous concession for the building and operating of an extensive tramway. The new concession includes the obligation to put into service modern cars, substitute electric traction for that of animals and to extend the lines to Soledad and Sabanalarga. Barranquilla has about 50,000 inhabitants, having gained 30,000 in the last 20 years. Soledad and Sabanalarga are respectively six and 36 miles distant from Barranquilla, between which there is extensive cart and mule-back traffic over hot sandy roads.

The tram company has also been granted an electric-light franchise. The concession is of interest, it being the intention of Mr. Baena to develop the enterprise with American capital and equip the whole service with American cars and machinery. Copies of the concession can be seen at the Bureau of Manufactures.

The successful establishment in Colombia of a modern trolley and electric-light system under American management and capital will be a good step toward the introduction of American commerce there. Today there is practically nothing American in the Barranquilla district except the ownership of a few outlying mining industries in adjacent states.

A. O. Wallace, vice-consul at Managua, reports that the city of Leon, Nicaragua, has given an electric-light and power plant contract to René John La Villebouvre, an American residing at Managua. The city takes 100 arc lights of 1,200 candlepower each, and absolves the contractor from all taxes, gives him the free use of any municipal lands and all the building material for construction; also guarantees to obtain free of duty the importation of all needed machinery and tools for 30 years—the life of the contract. The plant is to be installed within 18 months and to be sold to the highest bidder at the end of the 30-year term.

Chicago Drainage Canal Power Offered at Lower Rates.

The Sanitary District of Chicago has offered a portion of its power generated by the Drainage Canal to the city of Chicago at $15 or $16 a horsepower-year. This, however, is not for 24-hour service, but for arc lighting for the streets, which will run from 10 to 14 hours each night, according to the season of the year. Last January the best price made on canal power was $26.40 a horsepower-year. The actual cost of generating the power is said to be about $5.76 a horsepower. The city believed at first that it was going to obtain the power at cost, so when the price of $26.40 was made there was much dissatisfaction. The compromise just made gives a margin of profit for the Sanitary District, while the city will be getting power at a remarkably low figure.

It is reported that Father Murgas' system of underground transmission of wireless messages has reached a stage where it may be termed a success, and that messages have been transmitted between Wilkesbarre and Scranton, Pa. The system is one in which the vertical wires are placed in deep holes in the earth. The present holes are 200 feet in depth and six inches in diameter.

Niels A. Christensen.

Niels A. Christensen, the brilliant young Danish engineer, has been engaged by the Allis-Chalmers Company, and the immediate result of the new arrangement is that one of the Allis-Chalmers Company's shops is being fitted with a mechanical plant of original design for the construction of the Christensen air brake and compressors, and, according to the company, the next few months will witness the employment of 800 or 900 additional mechanics in this branch of the business.

The story of the development of the Christensen air brake is an interesting chapter in industrial and electrical development. To tell the story is to tell the life history of the man whose genius conceived it.

Niels A. Christensen is not yet 41 years old, and the air brake, his greatest achievement, was perfected when he was only 27, although not put into practical use until three years later. Its immediate success led to the formation of the Christensen Engineering Company, which was subsequently merged in the National Electric Company.

Mr. Christensen is a Dane, a descendant of the vikings. He was born August 16, 1865, at Torring, a village on the east coast of the peninsula of Jutland, on the shore of the Cattegat, a part of the strait connecting the North Sea with the Baltic, where his family has occupied the same estate for centuries. He attended the local public school until he was 14 years of age, when he was apprenticed in Veile, a near by city, and at 18 became a journeyman, performing master workmanship in accordance with ancient usage. During this apprenticeship the lad attended evening school and became proficient in the fundamental laws of physics and electricity, and gained such knowledge of, and proficiency in, mechanical drawing as was a necessary preparation for

NIELS A. CHRISTENSEN.

the polytechnic institute, which he entered at 18, in Copenhagen. In Copenhagen he also engaged in practical work in the best machine shops, especially in those devoted to shipbuilding and marine engineering, and, besides, gained a thorough knowledge of stationary steam engines, pumping engines for waterworks, air compressors and lighthouse and signal service equipment. One of the instructive jobs upon which he then worked was that of designing and installing the then largest lighthouse in the world, erected at Hanstholmone, in the North Sea, on the west coast of Jutland, which included a steam boiler plant, steam engines, dynamos for electrically lighting the tower, and a complete air-compressor plant for blowing the sirens.

Mr. Christensen made the first quick-firing Maxim gun built outside of England and America. It was built according to the designs of Hiram S. Maxim, modified and improved by Mr. Christensen, so that the Danish government adopted it quite largely. He also had quite large experience in naval construction, having assisted in the designing and building of the Danish semi-ironclad battleship Valkyrien, one of the swiftest vessels of its size at that time. He also assisted in designing and building several ships and imperial yachts for the Russian government. The works where the young man was employed, in Copenhagen, was the largest shipbuilding and marine engineering establishment in Scandanavia and employed 2,000 to 3,000 men.

Having grounded himself well in theoretical and practical engineering, Mr. Christensen, in 1888, at 23, made up his mind to see more of the world and to enlarge his range of study and experience by visiting other lands. He turned first toward England, and in the latter part of 1888 sought an engagement in London as designer in an engineering plant, but he found deficiency in the language a drawback. He could read English, but did not speak and write it readily. So he made up his mind to remedy the defect, and shipped on an English vessel as third engineer. [illegible] Mediterranean [illegible]

Returning to [illegible] an engagement [illegible] that had [illegible] a branch office [illegible] London [illegible] Connection [illegible] with new problems. He [illegible] made the general plans [illegible] Calcutta, India, and [illegible] side of the world [illegible] general layout for the [illegible] North, the celebrated [illegible] being transferred to the Liverpool [illegible] engaged in a wide variety of work [illegible] and interesting.

Later Mr. Christensen [illegible] department of a manufacturing concern [illegible] Lancashire, which manufactured Corliss engines and textile and paper making machinery, and [illegible] engaged at Darwen he constructed a new form of Corliss engine valve motion, designed to retain the benefits of the wrist plate motion without its complexity and multiplicity of parts.

It was at this point in his career that, attracted by the mechanical progress [illegible] of the United States, he resolved to see this side of the Atlantic, and landing in New York in 1891, he pushed on toward the heart of the continent, stopping first in Chicago, where he got work at once with the Fraser & Chalmers Company, as designer of Corliss engines. Here he tried to introduce his Corliss engine valve gear, but the company had just made a new set of designs and was not disposed to alter them at once. Remaining in the drafting room until the spring of 1892 he was then given his first taste of the commercial end of a large engineering establishment, being put in charge of the engine and power house contracting and correspondence.

It was this situation which opened for the young man his first opportunity to exercise his great inventive ability and led to his first successful studies of the brake problem. While inspecting the then new electric railway, known as the "Cicero and Proviso" system at Oak Park, a Chicago suburb, an accident occurred resulting in the killing of two people and the injury of many others. It was due to the inefficiency of the hand brake, which was but an adaptation of the old hand brake previously used on horse cars. The young mechanic made up his mind that a power brake was needed, and set to work upon the problem. He found that there was no such thing as a power brake in use on electrically propelled cars; he therefore developed the Christensen scheme of applying air brakes to such cars, and subsequently protected it by patents in this and all the European countries. He was thus the originator of this great forward step to provide safety in electric transportation, and is still premier in this field.

From the first practical tests, which were made in Detroit, Mich., in March, 1893, the device was accounted a success, but the panic of that year prevented the successful organization of a company to manufacture the new safety appliances, and, somewhat disheartened, as many an inventor before him has been, by the indifference of capital, he changed his base to Milwaukee and entered the designing room of the E. P. Allis works.

It was after coming to Milwaukee that Mr. Christensen married a young Norwegian girl of noble family and rare accomplishments, whom he previously met in Chicago. To this happy event he attributes much of his subsequent success, for his wife was his friend and counselor through all his earlier struggles, helping to keep him in good courage and sustain him through many a long and hopeless looking controversy.

Early in 1894 a new problem in air brakes arrested Mr. Christensen's attention, and the result was the development of a new system of quick-acting automatic brakes for steam railroad cars. Having studied the master car builders' rules as to the exact requirements of such a device, he succeeded in constructing one with but three working parts and with service mechanism acting entirely independently of emergency mechanism, and vice versa. Its simplicity was a long advance, for none of the devices in use had less than seven working parts. In 1896 he secured financial help to make an experimental apparatus and secure patents on the device, then two years old.

The Christensen triple valve brake has, in competition, frequently shown the best of results, in certainty of operation, quickness and simplicity, as well as in other points of excellence, and with financial power behind it, is certain of wide application.

Electricity for British Dockyard.

At the Devonport (England) dockyard provision has been made for the use of electricity throughout the establishment. Ultimately there will be four 1,000 horsepower engines and one of 500 horsepower in the plant driving direct-current generators. The installation, which is fast nearing completion, will rank among the largest of its kind in the country, and has involved not only a large expenditure of money but the exercise of much care and ingenuity in carrying it out, so as not to interrupt the ordinary working of the different departments into which the dockyard is divided.

William H. Schott.

[illegible]

he undertakes. Nothing could be better proof of the above than the enviable position which Mr. Schott has attained in the engineering world as the designer and builder of the Schott systems.

The demand for central station steam and hot water heating plants arises from the numerous residence districts, apartment buildings, office buildings and similar constructions in which the consideration of heating is of first importance. Such work requires great efficiency and perfect design and construction, the engineering problem being of primary importance in that connection. If the design is not correct, the fault may result in a complete failure of the plant. If the construction is not perfect, it will not give the highest efficiency, a requisite of utmost importance in modern heating plants.

Mr. Schott's designs and construction have been of the highest order, and in this line he is eminently successful, and throughout the West "the Schott systems" is a term synonymous with success, and which applies to all of his designs for heating, gas and electric plants. The same principles apply to the transmission of light and power, and his special study and application of these principles has resulted in making him a leading authority in the West on these subjects.

Mr. Schott's general offices are at 1100-1128 American Trust Building, Chicago.

Peculiar Steam Turbine Accident.

There was recently installed at the Kent Avenue station of the Brooklyn Rapid Transit Company a 5,500-kilowatt steam turbine, the maker of which claims certain superiority of design in various details. It now transpires that for a considerable time this turbine has been operating under conditions tending to subject this construction to abnormal strains of an unforeseen and severe character, and the way in which the claims of the maker have been borne out under these conditions must necessarily be taken into serious consideration in future turbine design.

Previous to April 25th the turbine had been in continuous daily operation since March 30th, on which date it had been opened up for inspection after operation under severe overload conditions.

Summed up, briefly, this turbine was run daily from March 30th to April 25th with a knife leaf wedged in between the rotor and stator, and the latter part of the time with the shrouding of the blades grinding against the stator. Yet, when opened up, no destruction of the parts had occurred, and no distortion of the blading. Considering the high speeds and centrifugal strains involved, such a result is as remarkable as it is unexpected.

Such an operating condition as the above does not, of course, need to be taken into consideration in steam-turbine design, but the above result would appear to establish, without question, that this form of construction overcomes entirely the difficulties and dangers arising from attempts to secure a minimum steam clearance between rotor and stator, a point upon which high efficiencies depend.

The steam turbine referred to is the product of the Allis-Chalmers Company of Milwaukee, which developed and controls this form of construction. The following is a brief description of the starting of the turbine and the subsequent mishap.

Fig. 1 shows a general view, looking down upon

the interior of the station; the turbine at the extreme end being the one described, and the other two Westinghouse turbines in process of erection. Although the turbo-alternator had been run only a few days at reduced speed to dry out the generator and had never been operated under load, it was promptly put into commission to meet urgent demands for power on March 27th, and as fast as additional boilers could be fired up, the load was increased until the peak for the first day was reached at over 4,000 kilowatts. On succeeding days the demands of the service reached 7,000 kilowatts.

Service was resumed on April 1st for the morning and afternoon peak loads, and has since been continued daily without interruption, excepting a

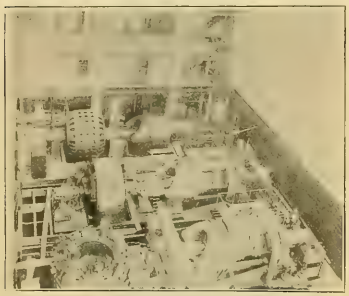


FIG. 1. SCENE OF PECULIAR TURBINE ACCIDENT.

short stop on the morning of April 25th, which was due to the incident referred to.

Shortly after starting up the turbine on the morning of April 25th a peculiar noise was heard in the turbine cylinder, and the turbine was therefore stopped and opened. It was found that a piece of steel had gotten between the spindle and the shroud of the first row of stationary blades, and, acting like a lathe tool, had cut into the body of the drum for a width of about three-eighths of an inch and for a depth of nearly three-sixteenths inch, this cut being alongside of and opening into the groove which holds the first row of spindle blades.

This had loosened the calking strip which held the ring of blades in place. For a distance of five or six inches this strip had come partly out of its groove, thereby loosening the ring of blades. This latter, under the influence of centrifugal force, had bent outward, so that the channel-shaped shroud ring had rubbed hard in the bore of the cylinder. This rubbing had been so severe that the flanges of the shroud ring had worn almost down to the heads of the riveting which holds the shroud ring to the blades.

The fact which will most interest the user or prospective user of turbines is that, under these severe conditions, not a single blade had come out or even become loosened or injured in any way. Seeing that it would be unsafe to attempt to hold blades in the damaged groove, and not wishing to keep the turbine out of service long enough to make permanent repairs, the erecting engineer re-

FIG. 2. PARTS OF JACK-KNIFE AFTER PASSING THROUGH 5,500-KILOWATT TURBINE.

moved this one ring of blades, closed the cylinder and immediately put the turbine back into service.

An examination of the removed ring of blades showed that one half is as good as when put in, while the other half is damaged only as to the wearing away of the flanges of the shroud ring. With a new half shroud ring this ring of blades would be in perfect condition.

An investigation as to the cause of the mishap showed that the piece of steel which had cut the groove in the shaft was apparently one of the leaves of a pocket-knife handle. A further search discovered the remainder of the metal parts of the knife—a large jack-knife—but the outer covering of the handle had disappeared. The large blade of the knife shows that it also had been rubbing hard. Fig. 2 shows the parts of the knife that went through.

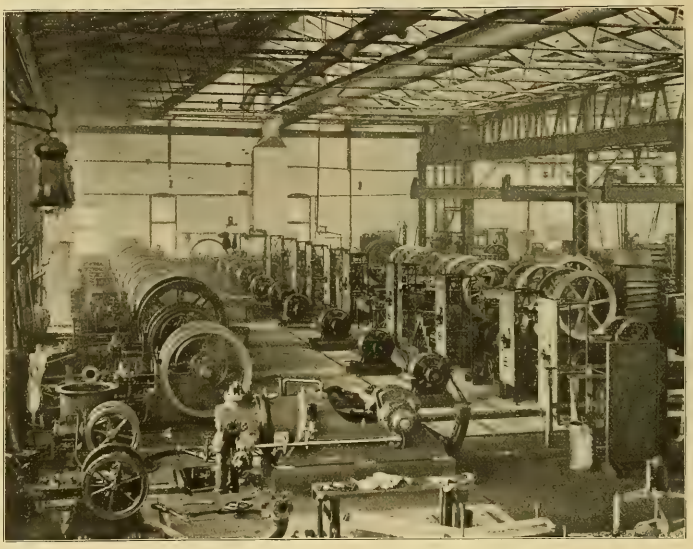
The turbine had not been opened up since March 30th, and the knife must have gotten into the turbine at that time or previously, as it would be impossible for it to get into the interior except when the turbine is opened.

Engines Under Test Supplying Power for Factory Purposes.

The building occupied by the Olds Gas Power Company of Lansing, Mich., is laid out in the form of the letter L, with the top projecting toward the west. The castings for the engines manufactured by this company are made in the foundry of the Olds Motor Works, and are delivered into the west end of the engine factory, worked through the cleaning department and machine shop, and assembled near the east end.

The castings and other engine parts are handled by means of three five-ton, three-motor, electric traveling cranes from the point of entrance at the west end of the main part of the building to the north end of the wing, and the progress of the work is entirely in one direction from the time the parts enter until the completed engine leaves the factory

A novel feature of this operation is that nearly all the power used is generated by engines under test. On a long foundation adjacent to the testing stand there are located eight generators, as shown in the accompanying picture, with an aggregate capacity of 168 kilowatts, and ranging from 35 kilowatts to 10 kilowatts. Each generator has its individual switchboard. These generators are compound-wound for 250 volts, direct current, constant potential, and, with the exception of one Westinghouse type M, all are Westinghouse type S. Generators of different capacities were installed to provide one of suitable size to load each engine manufactured by the company, the engines ranging from 18 to 50 horsepower. Beneath the floor on which the switchboards are located is a passage about six feet six inches deep, in which are run the bus-bars and connecting conductors. From the south end of the main bus-bars four 500,000-circular-mil lead-covered cables connect to the distributing switchboard in the southwest corner of the testing department, from which the several sets of distributing mains run to the various parts of the factory and to the office building.



ENGINES UNDER TEST SUPPLYING POWER FOR FACTORY PURPOSES.

The general lighting is obtained from 122 constant-potential direct-current 120-volt arc lamps, each controlled by a snap switch on an adjacent column, and 476 120-volt 16-candlepower incandescent lamps are installed for special lighting at tools, benches, etc. Three-wire mains are employed in this service with a four-kilowatt motor-generator balancer connected to the three-wire bus-bars for the purpose of equalizing the voltage should the load between the neutral wire and either of the outside conductors become unbalanced. As a safeguard against unbalanced loads, the lamps are connected alternately between the neutral and the positive and negative leads.

All power circuits are 240-volt two-wire, and are connected to two-wire mains controlled by double-pole switches at the distributing switchboard. The heating fan motors are all connected to one set of mains controlled by a switch, and a set of mains is run to each of the three traveling cranes with a switch, all switches being mounted on this distributing switchboard. A circuit-breaker is connected in the bus-bar circuit leading to the traveling cranes, so that, in the event of a short-circuit on any of the cranes or upon the trolley wiring, this circuit-breaker will open while those on the generator switchboards will remain closed, and the other operations of the plant will not be interrupted.

The method used in testing engines in this factory is a unique departure from the old established practice, and is considered much more accurate than a prony brake by the engineers and architects, Field, Hinchman & Smith of Detroit, who designed the building and its electrical equipment. After each engine is taken from the working-down stand it is placed on the testing stand and run for a short time with its own power. It is then belted to a generator of suitable capacity and run on a water rheostat until it is capable of carrying sufficient load to warrant connecting its generator in parallel with the other machines, at which time it is connected in parallel with the others by throwing over a three-pole double-throw switch on its switchboard. A pilot light is provided upon each generator switchboard, which is lighted whenever a generator is carrying a water-rheostat load, thus preventing the accidental connection of two generators in parallel on the rheostat without notice.

After the engine has run for a sufficient length of time to enable it to develop 10 per cent. more than its rated brake horsepower, the generator is again connected to the water rheostat and the engine is given its test run. The power developed by the engines is at all times shown by indicating wattmeters, one of which is mounted on each switchboard

In addition to the three-pole double-throw generator switch, the water rheostat, pilot lamp and the indicating wattmeter already mentioned, each generator switchboard is equipped with a circuit-breaker, an ammeter, a voltmeter, the field rheostat for the generator, a ground detector and two lamps, one connected to the main bus-bars and located over the voltmeter, and one connected to the generator leads and located over the ammeter.

Equalizers for the generators are all connected through the middle blades of the three-pole switches to a short equalizer bus-bar near the 35-kilowatt machines, the endeavor being made to keep the connection to the generators of such size and length that the drop in potential over them will be the same in each case if the equalizer connection carries the full load of the generator.

It might be interesting also to note the method of operation of the water rheostats. Each rheostat consists of an open steel tank, which forms the negative electrode, and a steel plate suspended inside, and insulated from the tank, which forms the positive electrode. The tank is also insulated from the ground. The electrical connections to the two electrodes are made by means of lead-covered cables.

The saline solution, which may be made of any desirable strength by the use of variable quantities of salt and water, is forced, by means of compressed air, into the tank from a closed supply tank in the basement. The connection from this tank to the

rheostat is of lead pipe covered in extra heavy rubber hose, and the supply tank is mounted on insulating supports. An air line containing compressed air is run along the horizontal ceiling under the switchboards, and a connection is made to two three-way cocks at each switchboard, from each of which an air pipe runs to the top of each supply tank. A scale has been provided on the inside of the wall of the building, opposite each rheostat, and a pointer, operated by a float in the rheostat tanks, indicates the level of the water in the tank. The operator can then stand at the switchboard and, by throwing a three-way cock in one direction, admit compressed air to the supply tank, and the level of the solution in the rheostat tank will be raised and the load increased. By throwing the handle of the three-way cock in the opposite direction, the air in the supply tank is released to the atmosphere, the water in the rheostat tank runs back into the supply tank, and the load is decreased

Electric Motor Passes Ordeal of Fire.

The accompanying illustration is instructive as a demonstration of the excellence of modern electrical machinery. It shows a General Electric 20-horsepower induction motor, as it appeared after a fire in a leather warehouse, where it was installed by the Salem (Mass.) Electric Lighting Company. After the building and its contents had cooled off sufficiently to be entered, the motor was removed, and after being cleaned and dried and fitted with another pulley, started immediately on application of the current. The motor has since carried its rated load without trouble, and does not appear to be damaged in any way except as to appearance. At the time the photograph was taken the armature had been cleaned with compressed air

MOTOR AFTER PASSING THROUGH FIRE.

The intensity of the heat to which the motor was subjected is shown by the appearance of the half-burned walls, but still more strikingly by the litter surrounding the motor, consisting of shafting, pulleys, etc., as they fell from the ceiling to the floor. The heat was sufficient to render the paper pulley of the motor useless. The post in the foreground was not in the fire, having been put in place immediately afterward to support the ceiling.

A Compact Type of Gasoline Torch.

In the manufacture of blow torches no element of excellence can be sacrificed for reduction in cost, if an article is to be produced which will fill the stringent requirements for reliable operation which are made on this type of apparatus. The blow

A COMPACT TYPE OF GASOLINE TORCH.

torch is one of the important articles in the electrician's kit, and if he is provided with one of poor make he will lose much valuable time in coaxing it into operation. A new type of torch which combines the qualities of compactness and ease and reliability of working is manufactured by the Zeidler Lamp and Brass Company of Lomira, Wis., and called by it the Baby torch. The accompanying picture shows the simplicity of its construction. The device is especially adaptable for use in small quarters, and a point of advantage is that it requires no pumping up, and is automatic in its action. The company's experts made a thorough examination before deciding upon the design of the torch, and they believe that an article of unequaled excellence has been produced, an article which can be relied upon at all times to give entire satisfaction.

CORRESPONDENCE.

Great Britain.

London, [illegible]

[illegible] to attract a [illegible] detailing [illegible] dition to [illegible] ment of the principle [illegible] argued by many [illegible] a depreciation fund [illegible] to maintain the [illegible] meet the case. During [illegible] one apprehension [illegible] engineering quarters [illegible] posed life of certain [illegible] taking have not been too [illegible] vergence of opinion [illegible] way formerly the case. A [illegible] weight has been made concerning the [illegible] principle by Sir A. B. W. Kennedy, in connection with Mr. E. A. Newington, these gentlemen being the consulting and resident electrical engineers, respectively, to the Edinburgh corporation. They express the decided opinion that provision for payment of interest and sinking funds on municipal electrical undertakings should not be considered as in any way superseding the necessity for the establishment of a reserve or depreciation fund which could be used for the same purpose as a depreciation fund in an ordinary commercial undertaking. The policy at Edinburgh hitherto has been to prefer to take sums from the gross profits and place them to the credit of the city rather than to build up an adequate reserve fund. Thus it is reported that the reserve fund would be wholly inadequate to meet any extensive renewals of plant within the next 10 or 12 years. While not exactly anticipating this, the warning is uttered that signs are not wanting that the actual life of certain classes of plant will be less than has been universally accepted. Having in view all these circumstances, the provision of a larger amount out of gross profits to reserve fund is strongly recommended, and it is a point that might well be seriously considered by numerous other local authorities.

The committee dealing with the problem of how best to give London an adequate supply of electrical energy has almost completed its labors, and although it is difficult to hazard a guess as to which way the result will go, yet it is a fact that the proposals of the companies have considerably impressed one or two members of the committee. However, two things stand out prominently in connection with the inquiry. The first is the almost obvious political character of the proceedings, so far as the expressions that have fallen from the committee are concerned, and the second the number of alternative proposals that have been made. Thus the suggestion has been made that before a large capital expenditure is incurred on a completely new system of electric supply all the existing generating stations should be linked up for mutual supply and the utmost advantage taken of existing facilities. Another proposition was that the London County Council should own the transmission system, while a company should own and work the generating station and do all the selling. Yet another proposal is that anything in the nature of companies should be abolished and boards of control established dealing with wide areas—many counties—who would deal with the matter. It is only to be hoped that the municipal trading side of the problem will not assume too great importance in the eyes of the committee to the detriment of the interests of London as a whole

A further system of electric tramways on the surface-contact system is contemplated, this time at Folkestone, where parliamentary sanction has been granted for some 12 miles on the Dolter system.

It would look as if England is making good headway in the matter of telephonic communication, a branch in which we have always been very much behind compared with Europe and America. No less than 73 additional exchanges have been erected during the last 10 months, while in the same period the number of subscribers has increased by 50,000. The messages sent have increased by 60,000,000. In fact the officials of the National Telephone Company will have it that Germany alone, of continental countries, can compare with us, for she has 10.2 telephones per 1,000 population against 10.15 for Great Britain and Ireland. Mr. Gaine, general manager of the company, says that America cannot be compared with us, or rather vice versa, because the degree of development here is not to be compared with that of America; but this has been largely due to the fact that the company had, until the agreement of last year, been under the heel of government control, and there has never been any settled government policy until last year. These remarks were made on the occasion of the annual dinner of the telephone company last week.

Last year the government tried the experiment of illuminating the historic clock over the House of Commons by means of mercury-vapor lamps. The green effect was so striking that several jokes were perpetrated at its expense. The light was

New York.

[illegible]

Metropolitan [illegible]

[illegible] changed, under [illegible] agreement

The Board [illegible] matter of the [illegible] the New York [illegible] city for a regular [illegible] pensation for it and in addition [illegible] of the city for the [illegible] ways, it would be perpetual [illegible] without competition. The New [illegible] Company has already intimated [illegible] to accept conditions [illegible] tion of the telephone service in the [illegible] mitted. The Atlantic [illegible] to have little chance of getting the [illegible] which it has applied for the operation [illegible] service in this city. The board decided [illegible] action on the application of the Atlantic [illegible] until the expiration of 30 days' grace given the New York company. The board will adjourn on July 6th until September 14th.

When the decision was made known, the officials of the Atlantic company said that it is the city attempt to enter into any agreement with the New York Telephone Company by which that company may be given a monopoly of the telephone business in New York City an injunction will be served upon the city of New York to prevent it from violating the monopoly laws of the state of New York.

Bids for the establishment of an electric-light plant in the capitol at Albany were opened recently by J. G. White & Co. at their office in this city. Lieutenant-Governor Bruce was present representing the commission. The bidders and the aggregate amount of their bids were as follows: Manning, Maxwell & Moore, New York, $65,000; Edward Jex, Syracuse, $48,812; the Thompson-Bonney Company, New York, $44,042; William M. Sheehan & Co., New York, $41,880; Lord Electric Company, New York, $47,038; Mackenzie, Quarier & Ferguson, New York, $46,845.

F. B. Behr, inventor of the monorail, wants to build a high-speed railroad, to be operated by the monorail system to Coney Island. He wants to build a Coney Island line into Manhattan to connect with the present subway by way of the Williamsburg bridge, and to build a monorail road on Jerome Avenue by putting it over the trolley road on that thoroughfare. Mr. Behr has notified the Rapid Transit Commission that he will bid for the construction of one of the north and south subway lines planned for Manhattan and the Bronx, provided he will be allowed to operate it with the monorail system instead of building a subway. He told the Committee on Plans and Construction that there is no difficulty in adapting his system to these routes.

The Court of Appeals, deciding on Tuesday in favor of the insurance companies in the test suit of the German-American Insurance Company against the New York Gas and Electric Light and other companies, including the Edison Company, for damages growing out of alleged negligence of the latter in causing a fire. C. I. C.

New England.

Boston, Mass., June 9.—The time for the completion of the interstate electric railway which the Danbury and Harlem Traction Company is building has been extended to January 1, 1907. The power plant will soon be equipped and the company expects to have cars running between Danbury and North Salem within the next two months.

Apparatus bought for the new electrical engineering laboratory of the Worcester Polytechnic Institute includes two Siemens flaming-arc lamps from Felix Hamburger, New York; a five-horsepower two-phase induction motor from the Wagner Electric Company, St. Louis; two two-kilowatt 125-volt compound generators from the Triumph Electric Company, Cincinnati; a six-horsepower 110-volt shunt motor from the Western Electric Company, and a motor-generator set and a three-horsepower 110-volt shunt motor from the Northern Electrical Manufacturing Company, Madison, Wis.

The motor-generator set consists of a 110-volt shunt motor driving a low-voltage generator delivering 1,000 amperes at five volts, or 500 amperes at 10 volts.

The attempt to amend the Cambridge Subway bill in the Massachusetts House of Representatives, so that the Boston end—between Haymarket Square and the Charles River dam—should be a subway instead of an elevated road, was defeated last Monday. The House also refused to pass a referendum amendment to the bill.

The Massachusetts railroad commissioners have approved the grant of freight and express rights to the Brockton and Plymouth Street Railway Company, which operates an electric railway between East Whitman and Plymouth, Mass., connecting with the Plymouth and Sandwich Street Railway Company at the latter place. It uses the Old Colony company's tracks between Brockton and East Whitman, and the two companies will probably institute a freight service between Brockton and Plymouth.

L. S. Ford and S. L. Tabor, who have been taking a post-graduate course in electrical engineering at the Worcester Polytechnic Institute, have accepted positions with A. B. Herrick, a New York consulting engineer.

The Rhode Island Contract Engineering Company of Providence, R. I., has obtained the contract to build a power plant and dams for the Solomon River Power Company, near Leesville, Conn. The contract calls for the expenditure of $50,000.

This is commencement week at the Massachusetts Institute of Technology. The class-day exercises were held on Monday, the graduating class presenting a hygienic marble fountain to the Institute. The graduating exercises were held on Tuesday, President Pritchett presenting diplomas to 277 men and four women—the largest class which ever graduated from the institution. Each of these received the degree of bachelor of science and nine men received the degree of master of science. Of the graduates, 37 took the electrical engineering course.

Governor Guild has signed the bill by which the Massachusetts Highway Commission is given supervision over telephone and telegraph companies in the state.

The Consolidated Railway, Electric Lighting and Equipment Company has been organized at Augusta, Maine, by Isaac L. Rice, James L. Watson, W. B. Lord and George W. Hoyt of New York, M. H. Simmons of Hallowell, Maine, and Lewis A. Burleigh, T. L. Fairbanks, J. Berry and T. E. Chadbourne of Augusta, Maine. It has an authorized capital of $13,000,000 and it proposes to deal in gas and electricity and to build railroads and steamships. B.

Southeastern States.

Charlotte, N. C., June 9.—The Louisville Lighting Company has acquired a site on Third Avenue, and will expend $75,000 for a distributing station and other improvements. An ordinance requires the company to put its wires underground within a certain prescribed area. The cost of the underground system will be $300,000.

The lower board of the General Council of the city of Louisville has passed a resolution permitting the licensing of small corporations furnishing electricity within a limited area.

Preliminary surveys for the Appalachian Interurban electric railway have been started, the road to run from Hendersonville, N. C., to either Rutherfordton, in the same state, or to Gaffney, S. C.

A company having in view the develpoment of electricity by waterpower on the Roanoke River near Boydton, Va., has been organized, and a charter granted to the Eagle Falls Light and Power Company. The concern is capitalized at $5,000,000. Henry G. Merry of Baltimore is president.

The City Council of Suffolk, Va., has granted a franchise to the Williams interests to build a local electric railway and insure trolley connection with Norfolk, Va.

The question of a municipal electric-lighting plant at Richmond, Va., is still the all-absorbing topic under consideration in that city, and upon the report of the consulting engineer, E. W. Trafford, it was decided to postpone further action to June 14th.

The Roanoke and Salem (Va.) Traction Company is chartered with a capital stock of $25,000. O. L. Stearnes is president and R. W. Kime general manager.

The Georgia Railway and Electric Company has increased its capital stock to $1,550,000.

J. C. Lavin and associates of New York have returned home after inspecting the proposed route of a trolley line from Orangeburg, S. C., to the Seaboard Air Line Railway. They have sent a check as their part of a forfeit, agreed upon with the Business Men's League of Orangeburg, for the carrying out of their part of the agreement.

Monroe, La., is said to be one of the first towns in the country to attempt the municipal ownership and operation of electric railways, and for this reason the experiment will be watched with interest. The street-railway system is now in course of construction. The secretary of the Progressive League of Monroe is H. D. Apgar.

Representatives of the Alamo Manufacturing Comapny of Hillsdale, Mich., visited Columbia, S. C., recently for the purpose of giving demonstrations in the workings of small electric-light plants to be operated by gasoline engines. Several plants of a similar nature are now being operated in Columbia at this time, according to advices from that city. L.

Ohio.

Cleveland, June 9.—The decision of T. P. Linn, as master commissioner of the United States court, in the suit of the Columbus Railway and Light Company against the city of Columbus, is to the effect that an ordinance regulating the price of a public-service commodity cannot be enforced if it is so low that the ordinance would operate to confiscate the plant. The Columbus City Council passed an ordinance fixing the price of lighting current at five cents a kilowatt-hour, and the company brought an injunction suit in the federal courts to prevent its enforcement. The master commissioner found that in this case the operation of the lighting plants would be a losing proposition. Investigation showed that 75 per cent. of the customers would receive their lights at cost, without any margin for depreciation or profit. This, it is said, would have amounted to a violation of the constitutional rights of the company.

The proposition to issue $50,000 bonds to improve the electric-light plant at Ashtabula was defeated by the voters of that place a few days ago. It is thought that the municipal plant will now be sold.

The control of the Cleveland, Painesville and Ashtabula electric road will formally pass into the hands of the Cleveland, Painesville and Eastern Monday. Charles W. Watson is president and Henry A. Everett and E. W. Moore are members of the board.

The telegraph companies at Cleveland some time ago employed a number of girls as messengers, and it was found that they were more reliable and would do much more work than the boys. However, complaint was made that the girls would have to go to undesirable places in the course of their work. A decision has, therefore been reached to dispense with the services of the girls, and in their places men are being placed as far as possible. This is the first time that men have been employed for such work, but it has been found that they attend to their business and render good service.

The Lake Shore Electric Railway Company has made application to the commissioners of Erie County for a franchise for the Fremont and Sandusky line, which is to be built within a short time.

The consents of the preferred stockholders for the sale of the Canton-Akron road to the Northern Ohio Traction and Light Company are being secured rapidly, and as soon as they are in the transfer will be made. It is said that the preferred stock is to be exchanged for bonds of the Northern Ohio Traction and Light Company.

Stockholders of the Eastern Ohio Traction Company are responding readily with the first assessment of $18 a share on the stock for the purpose of effecting a reorganization, and it is thought it will be out of the hands of the receiver within the next two or three weeks. Plans have been made for connection with Youngstown, and this will place the road in a much better position than it has ever occupied.

A report from Tiffin is to the effect that Columbus, Pittsburg and Philadelphia men have been planning for some time to take advantage of the waterpower afforded by the Sandusky River. Dams will be built and the water conducted in a flume to a power house, which will generate electric power for both industrial use and the operation of electric railways. Options have been secured upon six waterpowers between the two places, and it is not improbable that the men may be planning an electric line between Fremont and Tiffin.

O. M. C.

Indiana.

Indianapolis, June 9.—Traction men in this state are watching with interest the efforts of the Everett-Moore syndicate of Ohio to consolidate the various interurban lines of Northern Ohio and Southern Michigan. Indiana interurban men are interested in the merger plans for the reason that the lines, control of which is now being obtained by the syndicate, form the outlet for the lines owned in this state by the McGowan-Schoepf-Morgan syndicate. Connections for the North and East are now made at Toledo, which is reached by way of Fort Wayne and Lima. Traffic agreements with the Northern Ohio lines are necessary if the Indiana roads develop an interstate or through business. The interest of the Indiana men centers in the fact that they do not know whom the Everett-Moore syndicate is representing. If it should develop, they say, that the New York Central Railroad is backing the Everett-Moore people, the McGowan-Schoepf-Morgan syndicate might have to cast about for new connections to extend its business beyond Toledo and Columbus, Ohio.

The City Council of Logansport has granted a franchise to the Fort Wayne and Wabash Traction Company, giving it a right to extend its city lines either across the Wabash or Third Street, out Burlington Avenue. At the same time a franchise was granted the Logansport and Lafayette Traction Company, giving the right to enter the city by a choice of routes.

The right of an interurban company to charge excess fare on its limited cars has been a mooted question for some time, and the question is to be settled in this state by a resort to the courts.

The Northern Indiana Electric Railway Company of South Bend announces that it will expend $75,000 in establishing and beautifying a summer resort and park at Chain Lake.

The Indianapolis and Cincinnati Traction Company has inaugurated a freight and express service on the Rushville division. The cars are new and conveniently arranged for the purpose. This line promises a heavy express and freight traffic.

The Murdock and Marshall syndicate, which recently purchased the Evansville and Princeton electric line, is asking the county commissioner and city authorities for a new entrance to Evansville by the First Avenue road, thus avoiding the steep grade at Locust Hill.

The Muncie-Portland interurban line, which was recently opened for business, ran an excursion from Portland to Muncie during the week, picking up all the city and town officials and carrying them to Muncie, where a reception was held in the Commercial Club to celebrate the opening of the new line. The company has employed 18 experienced motormen, and the schedule is being kept up without any trouble.

Gilbert Henderson of Bloomfield is promoting an extension of the Indianapolis and Martinsville traction line from Martinsville to Evansville. Mr. Henderson represents the Indianapolis, Vincennes and Evansville Company, which was incorporated in January to build a large system of interurban roads through the coal fields of Southwestern Indiana. The extension he is promoting will afford connection with Indianapolis.

The steam railroad companies in Indiana that have interurban competition have concluded to compete for the Sunday excursion business, and in some instances have announced a rate much lower than that charged by the interurbans. Both are claiming superiority of service, and it will be interesting to observe which will draw the heavier crowd. So far the interurbans are in favor, because of frequency of cars and freedom from cinders and dust.

The Indianapolis Street Railway Company has declared a semi-annual three per cent. dividend.

The Wind Mill Electric Company of Noblesville has been incorporated to establish a plant for the manufacture of a device for operating electric generators by the aid of windmills. The capital stock is $20,000. The directors are C. C. Curtis, Fred E. Heylman, J. C. Jones and R. W. Wilson.

A merger of the local light companies of Anderson into a new corporation, to be known as the Union Gas, Light and Fuel Company of Anderson, is announced. The consolidation of the three companies represents a capital stock of $500,000. C. W. Hoover, J. H. Millspaugh and Jasper Vance are directors of the new company. S. S.

Michigan.

Grand Rapids, June 9.—H. A. Sprague and Walter Bush of Corunna have been before the Village Council of Vernon with a view of securing a 10-year franchise to light the streets with electric lights from the Shiawassee power plant at $50 a light a year. About 10 lights would be used to start.

The Northern Light and Power Company, a waterpower company organized with $625,000 capital to develop the waterpower on the Flint River in Montrose Township, Genessee County, has filed articles of incorporation. Chicago men are holders of the stock in the enterprise, $500,000 of which will be common and $125,000 preferred.

C. A. Applegate of the South Haven Traction Company, W. E. Dodson, J. H. Dodson and J. H. Hosmer will make preparations for the continuation of work on their line. It will probably be begun at the Saugatuck end.

The Detroit United Railway is preparing to extend its system from Flint to Saginaw and Bay City. The extension will be built largely on the old Silsbee right-of-way, between the Pere Marquette Railroad and the Flint River, going east of Mt. Morris, but touching Clio and Bridgeport.

The organization of the Detroit and Grand Rapids Railroad Company has been completed. The road is to be a gasoline-motor road and starts from Farmington, now reached by an electric road from Detroit, and runs west to Byron, Corunna and other Shiawassee towns to Saginaw. From St. Charles a branch will run to St. Louis, Alma, Ithaca, Maple Rapids and St. Johns. Farnham Bros. of Pontiac have commenced surveying. The capital for the company was fixed at $1,600,000, and the proposed mileage is 200 miles. The officers are: President, E. P. Sherman of Bancroft; first vice-president, J. S. Smart; second vice-president, Isaac Hewitt; third vice-president, C. H. LaFlamboy; secretary, James P. Gibbs of Ithaca; treasurer, William T. Maldrett.

An ordinance granting privileges to the Detroit, Flint River and Saginaw Valley Railway in cer-

tain streets of Saginaw was passed by the council. The franchise is good for 30 years.

The Grand Rapids, Grand Haven and Muskegon interurban has put into commission three new cars. The cars are especially designed to carry furniture and it is possible to remove the entire back end to allow the loading of big pieces, which cannot be handled through the side door. L. W. B.

Dominion of Canada.

Ottawa, June 9.—The Canadian section of the International Waterways Commission has received a communication from Colonel Ernst, chairman of the American section, stating that the secretary of war had approved of the commission's report recommending a joint division of the flow of water at St. Mary's Rapids, available for power development over and above that required for navigation purposes. Geographically, Canada would only be entitled to one-fifth.

Halifax (Nova Scotia) interests have purchased the Dartmouth Electric Light, Heat and Power Company of Dartmouth, N. S. The motive power of the company is water. The company has been in operation for about 15 years. The new proprietors have taken possession of the property and will improve and extend the service and will make the effectiveness of the water supply more complete.

Rodolphe Forget, M. P., has been elected a director of the Quebec Railway, Light and Power Company. This company furnishes light, power and a trolley service to the city of Quebec. Mr. Forget's appearance on the board of directors is said to be another step in his plans to construct an electric railway along the north shore below Quebec city to Murray Bay, with Tadousac as an ultimate point.

At the annual meeting of the Montreal Light, Heat and Power Company it was pointed out that the surplus account now stood at $991,000 and that many of the stockholders were desirous of applying at least a portion of this amount to increased dividends. The president intimated that if the company's business kept up there was no reason why the stockholders should not be given an increase of dividend, which is now four per cent. per annum. The percentage will likely be increased to five per cent. yearly. W.

Pacific Slope

San Francisco, June 7.—Bids will be received by the city of Pasadena, Cal., until July 3d for the sale of a street-railway franchise upon South Lake Avenue, from California Street, south to the city limits.

R. J. Dunn of Redlands, Cal., is the chief promoter of the plan for an electric-light and telephone service for Elsinore, Cal. According to the present plans, a company will be formed to carry on the business. The plant will be erected at once at a cost of $9,000.

The Phœnix Light and Fuel Company of Phœnix, Ariz., has been purchased by E. B. Gage of Tombstone, and the company has been reorganized under the name of the Pacific Gas and Electric Company. It is reported that the object of reorganizing is to carry on extensive improvements.

The Tustin Improvement Association has presented a petition to the Pacific Electric Company of Santa Ana, Cal., asking for an electric railway from the Southern Pacific Railway depot on Fourth Street to the town of Tustin, a distance of about two miles.

The Board of Supervisors of Los Angeles, Cal., has deeded strips of land so that the Los Angeles, Pasadena and San Fernando Railway Company has been able to secure about all of its right-of-way. The first work will be the construction of the line from Los Angeles to Pasadena, via Eagle Rock. M. A. King is president of the company and M. C. Marsh secretary.

The Westminster Company of Los Angeles has asked the city trustees of Long Beach, Cal., for permission to build a tunnel under Pine Avenue from Ocean Avenue to Third Street. The object is to construct a plant on the beach to furnish light, heat and hydraulic power for the First National Bank block, at First and Pine, now under construction.

The Lewiston-Clarkston Company will soon shut down for repairs to its steam power plant at Clarkston, Wash. The company is also increasing its electric power capacity from 1,500 horsepower to 3,600 horsepower. The company will move its present 500-horsepower plant at Asotin to Pomroy Gulch, back of Clarkston, where much more power will be developed.

F. M. Ogle, a well-known mining man of Lewiston, Idaho, reports that a site has been selected on the Salmon River, near the mouth of the Crooked River, for the building of a power plant to supply the mining districts and opearte the mills in the Orogrande, Elk City, Dixie and Buffalo Hump sections. The cost will be about $200,000 and will be divided among the 15 or 20 properties benefited.

E. H. William of Missoula, Mont., states that a mammoth electric plant, costing $2,000,000, is to be built at Thompson Falls, Mont., on the Clark's Fork River, and the owners will invade the Cœur d'Alene country. The deal is being financed by J. Stuart [illegible] and Boston [illegible]

The [illegible] Railway Company [illegible] with a capital [illegible] operat[illegible] will also construct [illegible] Helena and [illegible]

Mexico.

Mexico City, Mex. [illegible] have been granted [illegible] ernment for the [illegible] Cupatitzio River, in the [illegible] generating electricity. [illegible] granted a concession by the federal government [illegible] install an electric power plant near [illegible] of Tamaulipas.

J. A. MacNaught is making good progress with the plans for the construction of an electric railway between Puebla to the town of [illegible] Mr. MacNaught has organized the Puebla and Southeastern Electric Railroad Company for the purpose of carrying the project to consummation. The power is to be furnished by the Portezuelo Electric Power Company.

A strong British company which has its headquarters in London, England, is said to have purchased the celebrated Portezuelo Waterfall, situated in the state of Mexico. The company will install an electric power plant at the waterfall and transmit the electrical energy to Mexico City.

An electric-light plant is being installed at Jimenez. Phil Head of Torreon, Mexico, has the contract.

The installation of the electric power plant for Pedro Alvarado at Parral will soon be completed. The plant has a capacity of 1,000 horsepower and it will furnish power for operating machinery in the famous Palmillo mine and the large stone quarries which are owned by Mr. Alvarado.

The San Pedro Analco Mining Company is erecting a large hydro-electric plant at San Pedro Analco, state of Jalisco. The plant will have a capacity of 5,000 horsepower.

An electric-light and power plant is being installed at the ranch of Dr. H. B. Tanner near Tamosopo. The plant will furnish power for operating the machinery of a sugar mill and other plantation machinery and will furnish lights for the buildings on the place.

It is reported that Jose M. Trevino of Monterey, Mexico, who has held an option to purchase the street-railway system of Chihuahua for several months, has arranged to close the deal. It is understood that the system is to be converted into electric traction, and other improvements of an important character made.

W. C. Byrne of New York and a number of capitalists of that city have taken steps to construct a system of electric street railways in the city of Oaxaca. The same men have obtained concessions from the municipal and state governments of Oaxaca to construct waterworks and sewer systems there. Governor Emilio Pimenthal of the state of Oaxaca is interested in these enterprises. W. D. H.

Northwestern States.

Minneapolis, June 9.—The Stillwater (Minn.) Gas and Electric Light Company has announced that it will construct a conduit system for its high-potential wires, and that plans will also be prepared at once for a new sub-station.

M. B. Locke of Waterloo, Iowa, is considering the building of an electric interurban line from Waterloo to Des Moines. The estimated cost of the system is $7,000,000. It will pass through Tama and Traer.

The Des Moines (Iowa) Interurban Railway Company will proceed at once with a new line to Knoxville, via Carlisle.

The proposed sale of the gas and electric properties at La Crosse, Wis., to Stone & Webster of Boston has fallen through. The properties include the city heating plant, the gas works, Edison light and power and Brush electric companies.

The Des Moines City Railway Company is planning the construction of an interurban line to Marquisville, Iowa.

The Milwaukee Electric aRilway and Lighting Company will be granted permission to extend its lines at Racine, Wis., to the city limits. R.

PERSONAL

William M. Rothschild, the president of the St. Mary's (Pa.) Incandescent Lamp Company, has been making an extensive tour of the West.

D. M. Therrell, superintendent of the seventh district of the Southern Bell Telephone Company, with headquarters at Charleston, S. C., has been appointed superintendent of the second district, with headquarters at Atlanta, Ga., succeeding R. L. West, resigned. W. B. Roberts, manager of the Atlanta exchange, has been named as assistant superintendent of the second district, retaining an interest in the management of the Atlanta exchange. H. L. Smith, superintendent of the fifth district, with headquarters at Savannah, Ga., is [illegible]

[illegible]

George B. Foster [illegible] Company, to work in [illegible] the United St[illegible] West, the [illegible] Mr. Foster [illegible] tically every large [illegible] heavier type power and lighting [illegible] year or two [illegible] nected with the Allis-Chalmers [illegible] manager at Chicago. Mr. Foster's [illegible] from now on will be [illegible] in Milwaukee, from which [illegible] Stranahan operate. For the present [illegible] former will divide his time between Milwaukee [illegible] Chicago until his business relations [illegible] that he can make a permanent residence [illegible] waukee. During the [illegible] Mr. Foster received many congratulations [illegible] deserved advancement.

ELECTRIC LIGHTING.

Relative to the project for a municipal lighting plant in Milwaukee, Wis., City Attorney Kelly holds that the ordinance creating the Municipal Lighting Commission, under which the plant would operate, is illegal. Mr. Kelly is quoted as saying that the commission cannot purchase a site for the plant, because that power rests in the Common Council. The power to lay conduits rests with the Board of Public Works, and the Common Council cannot delegate to the commission the right to adopt plans.

Sealed proposals will be received at the office of the clerk of Red Cloud, Webster County, Neb., until June 22d for furnishing any or all of the following: Boiler, engines, feed-water heater, boiler-feed pump, generator, switchboard, 25 series alternating arc-lamp equipments, line-construction materials, etc., all in accordance with plans and specifications on file in the office of the city clerk. Bidders may obtain copies of the complete plans and specifications by sending $1 to U. H. Fort, city clerk, or J. Marx, engineer.

The Chattanooga (Tenn.) Electric Company, which made improvements on its plant some time ago amounting to about $500,000, is now taking steps to spend about $100,000 in improvements in the way of new machinery, etc. The company will increase its capacity by about 2,500 horsepower. When these improvements are made the plant will have a capacity of about 5,500 horsepower. Manager B. T. Burt of the company says that the amount of electricity used now is almost double the consumption three years ago.

The lamp committee of the Lancaster (Pa.) City Council has awarded the contract for the arc street lamps to the Edison Illuminating Company, controlled by the Lancaster Railway and Light Company, for a term of five years at $80 per lamp per year. Last year the city paid the sum of $93.50 per lamp. The Lancaster Gas Light Company, controlled by the same corporation, was awarded the contract to furnish lamps for five years at $30 per lamp per year, and the contract for gasoline lamps was awarded to the Welsbach Company at $28 per year per lamp for five years.

At a meeting held in Montreal, Quebec, last week the directors of the Mexican Light, Heat and Power Company presented a satisfactory report from F. S. Pearson, the managing director. The report showed that there are now 15,000 horsepower in use, and an additional unit of 5,000 horsepower is ready to be turned on. This means that the company will be about able to dispense with steam for power purposes, as the water conditions are even better than was expected. The earnings were reported to be continually on the increase, as water replaces coal in the production of electric power. It was officially announced that

the directorate would remain unchanged until the next annual meeting.

The Mobile (Ala.) Electric Company was formed a few days ago and will take over the electrical department of the old Electric Lighting Company of Mobile. The new company has purchased land adjoining the present plant, upon which, President Groesbeck announces, about $300,000 will be expended enlarging the plant to take care of any business that may be offered. H. M. Byllesby & Co. of Chicago are interested in the new company. Mr. Byllesby, accompanied by J. J. O'Brien, O. E. Osthoff, Weare Parsons and N. P. Zech, was in Mobile recently looking after the interests of the company.

ELECTRIC RAILWAYS

Paul Deledin of Fort Smith, Ark., is interested in a proposed electric railway to be built from Fort Smith to the mineral regions in the northern part of the state.

Southern Railway has placed orders with the Crocker-Wheeler Company of Ampere, N. J., for two alternating-current generators of 75 kilowatts 2,300 volts, 300 revolutions per minute, to be installed at the power plant at Atlanta, Ga.

The Mount Hood Electric Railway Company has been incorporated to build a road from the Union Depot in Portland, Ore., to the southern base of Mount Hood. The capital stock is $5,000. G. P. Copp, C. W. Callett and C. M. Miller are the incorporators.

Alexander Brown has announced that the Maryland and Pennsylvania Railroad will be operated by electricity instead of steam. The company has engaged electrical engineers connected with the General Electric Company to go over the road and make an estimate of the cost of the necessary equipment. The road will likely be made into two sections, the one operated from York, Pa., and the other from Baltimore, meeting at Belair. The York end will probably be operated by current from the Susquehanna River power plant.

The contract for the construction work on the new power house for the Ottumwa (Iowa) Railway and Light Company has been let to the Ottumwa Mill and Construction Company. New barns and sheds for the storage and maintenance of cars have been completed at a cost of $25,000. The equipment of the plant will be almost entirely new. The machinery will be more than ample to meet the present demands, but the company expects the growth of the city to call for this augented service within a short time. Two large new generating units will be installed, one for the lighting system and the other for power to operate the street-railway lines, thus making the two systems entirely separate instead of being on the same countershaft, as is the case at present. A conveyor system will handle the coal and ashes. The total cost of the new plant, when completed, is expected to be about $150,000.

The Cincinnati, Milford and Loveland Traction Company of Cincinnati, the extensions of whose present line beyond the original 10-mile run between Cincinnati and Milford, were undertaken early last fall, have been rapidly nearing completion. The company, which is backed by local Cincinnati capital exclusively, had up to the undertaking of these extensions purchased its power from the outside. Upon the decision of the company to extend its system from Milford to Blanchester, a distance of 21 miles, it became necessary to consider the installation of a power outfit of its own. As a result a complete equipment of Allis-Chalmers power and electrical machinery was purchased and is now being installed preparatory to the opening up of the new section. The power plant, when completed, will consist of two horizontal cross-compound heavy-duty engines for direct connection to two 500-kilowatt generators, 25 cycles, three-phase, 400 volts. In addition to engines and generators the equipment will include two 22½-kilowatt belted exciters, two 400-kilowatt 25-cycle rotary converters and miscellaneous auxiliary apparatus.

POWER TRANSMISSION.

The Northern Light and Power Company has been organized with a capital stock of $625,000 for the purpose of developing waterpower on the Flint River at Montrose, Mich.

The Eagle Falls Light and Power Company of New York has been incorporated to develop southern waterfalls for the purpose of generating electrical energy to operate cotton mills and other large industrial plants in Virginia and North Carolina. Paul T. Brady, Oliver Todd Smith and Henry A. Root of New York city are the incorporators.

The Southern Power Development Company of Altus, Ark., has been incorporated by D. A. Allen, John Allen and J. D. Crockett. It is proposed by this new company, which is capitalized at $50,000, to build a dam across the Little Missouri River near Altus and erect a water and electric-light plant for the purpose of furnishing water and light to the adjoining section, the power to run the plant being secured from the river.

The Roanoke Rapid Power Company, Roanoke Rapids, N. C., has ordered one 750-kilowatt, 2,300-volt, 200 revolutions per minute, Crocker-Wheeler alternating-current generator, to be installed at its power plant at Roanoke Rapids.

The Telluride Power Company is getting everything in shape as rapidly as possible to begin operations on the power plant near Grace, Idaho, and on the works at Dingle. The company is having difficulty to secure a sufficient number of men to carry on the work at both places.

PUBLICATIONS.

The General Storage Battery Company issued a special bulletin for the Atlantic City convention explaining the features of interest in its exhibit on Young's Pier.

Applications of the Chloride accumulator in railway and central-station lighting service are set forth in a new bulletin from the Electric Storage Battery Company of Philadelphia. Numerous illustrations of plants in actual operation are given in the bulletin, with a little data concerning each.

Much of an interesting nature is contained in the new bulletin of the Allis-Chalmers Company relating to steam turbines and generators. The details of the construction of the Parsons steam turbine, as manufactured by the Allis-Chalmers Company, are given in the bulletin. Then the generator is described, and, finally, the combined machine is shown in several illustrations. The bulletin is well worthy of careful study.

Some new advertising literature from the General Electric Company includes three bulletins and an illustrated pamphlet on electric radiators. The bulletins describe 25-kilowatt Curtis steam turbine generators, alternating-current, two and three-phase induction motor panels for 2,080 volts, 25 to 60 cycles, and the GEA-605-A railway motor. The pamphlet describing the electric heater is particularly attractive, and will open the eyes of the ordinary householder to the possibilities of electric heating.

Already preparations are well under way for the electrical show in Chicago next year, and much space has already been sold. To help things along and arouse still more interest, the management of the Electrical Trades Exposition Company, of which Mr. Homer E. Niesz is managing director, has issued a very attractive little booklet, setting forth the plans of the company and also many complimentary testimonials from last year's exhibitors. It is also distributing a neat little button, urging everybody to go to the show next January.

Those who were at the Atlantic City convention were pleased with the convention issue of the Wagner Bulletin, an official quarter-yearly publication prepared by the Wagner Electric Manufacturing Company of St. Louis. The convention issue was No. 1 of Vol. I., and is especially interesting to central-station men. It contains a complete programme of the convention which was found available by the convention delegates. The pages of the first number are given up principally to information concerning the organization of the Wagner Company and the products for which it is justly noted.

The Central Electric Company of Chicago, general western agent for D. & W. material, is sending out copies of the new D. & W. price list No. 11. This price list is an attractive little booklet, small enough to be carried in the pocket, and quotes revised prices on D. & W. enclosed fuses and safety devices. The company is also general western agent for Deltabeston magnet wire, and is sending out new lists announcing a sharp reduction in price on this wire. The company says that the only objection heretofore against the use of Deltabeston wire in preference to a cotton-covered magnet wire for winding field and armature coils on railway motors has been the cost, and this objection has now been removed.

The Chicago, Burlington and Quincy Railway Company, in a little folder entitled "Marcus Aurelius to Manufacturers," sets forth the advantage of the Mississippi Valley as the coming industrial center of the country. To meet the growing demands for information and co-operation, the Chicago, Burlington & Quincy Railway Company has organized an industrial department. This department has made a careful study of the territory traversed by the road, its economic conditions, sources of fuel and raw materials, and has taken a complete census of every town and city on the Burlington System, with data of interest to manufacturers, such as value of assessed property, tax rate, number and amount of deposits, of banks, schools and colleges, cost of electricity and gas, street railway lines, drainage and sewerage, raw material, its nature, power, fuel, class and amount of labor, number of people owning their own homes, railroad facilities, available factory sites and special advantages each town presents to different kinds of industries.

SOCIETIES AND SCHOOLS.

The next convention of the Colorado Electric Light, Power and Railway Association will be held in Denver, September 18th, 19th and 20th.

S. H. Granten, C. D. Richardson and E. B. Howe have been appointed assistant instructors in electrical engineering at the Massachusetts Institute of Technology.

The British Institution of Electrical Engineers, of which Mr. John Gavey is now president, has issued a circular which gives an outline of the proposed circular tour of the engineers visiting Europe. In London the headquarters during the visit will be at the Hotel Cecil. The stay there will be from June 23d to 27th; Birmingham, June 28th; Manchester, June 29th; Liverpool, June 30; Windermere, July 1st; Glasgow, July 2d and 3d; Edinburgh, July 4th; Newcastle-on-Tyne, July 5th and 6th; Leeds, July 7th.

MISCELLANEOUS

The flouring mill owned by W. H. Friedrich & Co. at Bronson, Mich., has been destroyed by fire. The electric plant in connection with the mill will be rebuilt at once.

Report from the annual convention of Dunkards, held in Dayton, Ohio, says that the use of telephones and automobiles was decided to be wrong, and delegates said that members of the church should refrain from the use of both.

A dispatch from Manchester, Eng., dated June 11th, says that the public-ownership commission of the National Civic Federation of the United States made a tour of the electrical works of the Manchester city government on that day. The commissioners congratulated the members of the electrical committee on their efforts to induce users of steam to substitute electricity.

Consul R. S. Chilton, Jr., writes from Toronto, Ont., that a prominent Canadian manufacturer calls his attention to the fact that the lectures given throughout Canada by Prof. McLennan, under the auspices of the Canadian government on the subject of the metric system of weights and measures are for educational purposes only, and are not to be taken as indicating an intention to adopt that policy in the near future.

Thomas A. Edison, who has just recently been on a prospecting tour near Asheville, N. C., says that there are extensive deposits of cobalt in that locality. He believes that when this supply is taken advantage of the price of cobalt will be greatly reduced, and as this may be made one of the elements in his new storage battery, the discovery will make the manufacture of the batteries possible on a more extended commercial scale, which will mean much to the automobile industry.

The general movement in many cities of the South for electrical ordinances is one of the most promising evidences that that portion of the country, like the middle West, is awakening to the importance of the proper electrical equipment of its towns and cities. Wilmington, N. C., has just passed an ordinance regulating all installations there, and R. Hunt has been appointed as deputy to Building Inspector H. E. Barnett, to have supervision over that work. At Asheville also this requirement has been put in force by the City Council, and a man will soon be appointed. Over thirty cities in the South are now in line on this proposition.

Engineer William Cobourn of the Lenape power house (Coastville, Pa.) would like to have a pet cat. He has tried keeping cats in the power house, and all the men about the place would be kind to the animals, but for some reason the cats do not thrive. When a new cat arrives it moves in the usual way for a day or two, but soon becomes stupid, and will not go far from the machinery. The wildest cat known will become tame there in a little while, and sit day and night beside the humming dynamo as though under a spell, refusing to eat heartily, and taking no interest in what goes on about it. Recently a new cat began acting thus, and it was taken away in order that its life might be saved.—Reading (Pa.) Eagle.

TRADE NEWS

The Independent Electric Company of St. Louis, Mo., has been incorporated with a capital stock of $10,000.

Owing to increasing business, the Reynolds Electric Flasher Manufacturing Company was compelled to move to larger quarters, and is now located at 191-193 Fifth Avenue, Chicago, where it will be able to give orders prompt attention.

Application for a charter has been made to the Pennsylvania state authorities by the Westinghouse Consolidated Foundries Company of Pittsburg, Pa. The object is for the various Westinghouse companies, which now have foundries at Pittsburg, Allegheny City, Cleveland and Attica, N. Y., to have all their castings made in one factory, which is located at Trafford City, near Pittsburg. This plan is to assure greater economy and uniformity in the making of foundry products.

On file at the Bureau of Manufactures, Washington, D. C., is an inquiry (No. 167) from a firm of European olive oil exporters, which is considering the purchase of a number of electrical centrifugal pumps for pumping olive oil from one part of the warehouse to another and from the [illegible] tanks to the bottling and packing department. These pumps are required to be of 1½ horsepower each and the metal parts, which in operation come in contact with the liquid, must be tinned, in order to avoid contaminating the oil, which deteriorates in taste if other metals are used. The firm will be glad to receive catalogues and prices for pumps of the above description.

A new corporation, known as the Ramsey Engine Company, with offices in the Bullitt Building, Philadelphia, has been formed for the purpose of exploiting the Ramsey crank mechanism, which is a device applicable to all single-acting engines. The officers of the Ramsey Engine Company are: President, Robert H. Ramsey, who is the inventor of the Ramsey crank mechanism; vice-president and general manager, Russell H. Ramsey; secretary and treasurer, R. Howard Eisenbrey. Mr. Russell H. Ramsey and Mr. Eisenbrey were formerly connected with the Harrison Safety Boiler Works of Philadelphia. It is understood that the new company will not manufacture engines, but that it will issue license rights to engine manufacturers.

The General Electric Company, which established its main office in the Union Savings Bank Building at Oakland, Cal., immediately after the San Francisco disaster, as well as a local office at No. 1759 Geary Street, in the burned city, has already leased a suite of rooms in the new Monadnock Building, which it expects to occupy about June 15, 1907. For handling the present business, a half a block of land has been leased in Emeryville, in close proximity to both the Santa Fe and Southern Pacific Railroad tracks. A temporary building is now about completed on this land for taking care of stock, and work has already been started on a new warehouse, containing about 80,000 square feet, which [illegible] block, bounded by [illegible] and Alameda Street [illegible] 40 cars of [illegible] of additional [illegible] to be unloaded [illegible] from Schenectady [illegible] shipped from the [illegible] stock at San Francisco [illegible] prevent the company [illegible] fill orders as rapidly [illegible]

The United States Circuit Court of Appeals for the Third Circuit, sitting at Philadelphia, handed down a decision on May [illegible] in the case of the Westinghouse Electric and Manufacturing Company against the Cutter Electrical and Manufacturing Company. The case involved the [illegible] of an automatic circuit-breaker, which the complainant alleged had been infringed by the Cutter company. In a previous decision of February [illegible] 1906, the court decided against the defendant, but the latter asked for a rehearing, and the present decision is that after a reconsideration of the matter it is of the opinion that the Westinghouse patent is valid. The patent involved was granted to Wright and Aalborg, September 26, 1899, and is numbered 633,772.

The Wagner Electric Manufacturing Company of St. Louis desires to advise the trade that the Denver territory will be handled and controlled by the Hendrie & Bolthoff Manufacturing and Supply Company, located at 1621 Seventeenth Street, Denver, Colo. The Hendrie & Bolthoff company has been well and favorably known to the trade a great many years, having built up a large business in its particular field, and the Wagner company assures its former customers that all inquiries for Wagner product will be handled in the best possible manner. The Hendrie & Bolthoff Manufacturing and Supply Company has given a great deal of attention to posting its salesmen and traveling men on the characteristics and operation of Wagner product.

BUSINESS.

[illegible]

[illegible] handle all orders promptly at prices consistent with the grade of material. [illegible] of this company are due in [illegible] handling only hig[illegible] to control the [illegible] equipped and [illegible] companies east of the M[illegible] cials of the company [illegible] ing named gentlemen: President, J. C. [illegible]lain, New York city; vice-president and treasurer, A. J. McKinnon, Maxton, N. C.; secretary, R. M. Williams, Maxton, N. C.; sales manager, Walter E. Mitchell, New York city.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 5, 1906.

822,234. Magnetic Cut-out Apparatus. Leonard Andrews, Hastings, England, assignor to the Stanley Electric Manufacturing Company. Application filed March 13, 1901. Renewed September 22, 1904.

A stationary series winding, horseshoe-shaped cores within and excited by the winding, stationary shunt windings mounted in proximity to the series winding and a movable core within the shunt-coils are the parts of the device.

822,237. Electric Switch. Charles S. Barkelew, Middletown, Ohio, assignor to the Barkelew Electric Manufacturing Company, Middletown, Ohio. Application filed November 11, 1904.

Combined with a movable member having a contact plate and a grooved handle-supporting member secured thereto is a fixed contact member having a flat blade formed with a projecting shoulder adapted to be engaged by the handle-supporting member, for the purpose of limiting the throw of the switch.

822,240. Arc Lamp. Samuel H. Blake, Jersey City, N. J., and George R. Davison, Pittsfield, Mass., assignors to the General Incandescent Arc Light Company. Application filed September 22, 1904.

In an arc-lamp support a member is bent to form an inclosure for a lead secured at one end to the support but insulated therefrom. An electrode holder is secured to the other end of the member but insulated therefrom, and a lead passes through the inclosure but insulated therefrom and electrically connected to the electrode holder.

822,250. Electric Cableway System. Maxwell W. Day, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 6, 1905.

In a cableway system are a cable and electrical means for driving the cable and for maintaining a tension in it both when the cable is moving and when at rest.

822,269. Motor-starting Rheostat. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 10, 1905.

Co-operating with a series of contact-studs are a pivoted mercury-containing arm biased from the horizontal and having a series of contacts mounted thereon for engagement with the studs, the contacts having terminals within the arm, and means whereby the mercury is caused to engage the terminals to cut out resistance when the arm is moved to a substantially horizontal position.

822,270. Electrically Heated Hollow Body. Ernst Haagn, Hanau-on-the-Main, Germany, assignor to the firm of W. C. Heraeus, Frankfort-on-the-Main, Germany. Application filed July 7, 1905.

A form of electrically heated oven is described, the heat being obtained from wire-netting resistances surrounding the oven.

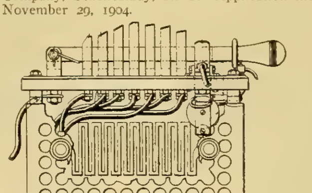
822,275. System of Motor Control. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 17, 1904.

In a system of train control there are a train bus line, local motor connections to the current-collecting devices on the cars, and means for connecting the bus line to the current-collecting devices and for automatically cutting out any of the motor connections when the corresponding current-collecting device fails to receive current from the source of supply.

822,282. System of Motor Control. Sigvald Krohn, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 25, 1904.

A pilot motor operates the controller, pneumatically operated means being connected between the pilot motor and the controller. Electromagnetically actuated means control the pneumatically operated connecting mechanism.

822,290. Starting Rheostat. David Miller, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 29, 1904.



NO. 822,290.—STARTING RHEOSTAT.

In a starting-rheostat are a resistance and a contact means for varying it comprising a fixed portion, a spring-pressed controlling lever mounted for sliding engagement therewith and a movable portion. Electromagnetic means operate upon the movable portion to retain the lever in any position of the engagement. (See cut.)

822,293. Transformer. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 18, 1904.

Associated parts are a transformer case or receptacle, a cover therefor, a transformer comprising a core of laminæ assembled between end members and means for securing the end members together and means engaging one of the end members for securing the transformer to the cover.

822,304. Dynamo-electric Machine. Robert H. Rogers, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 30, 1904.

Details are described.

822,305. Production of Steel Containing Titanium. Auguste J. Rossi, New York, N. Y., assignor of forty-two and one-half one-hundredths to James MacNaughton, Tahawus, N. Y., and fifteen one-hundredths to Philip C. Peck, New York, N. Y.; Janet MacNaughton, executrix of said James MacNaughton, deceased. Application filed May 20, 1902.

The process embodies the use of an electric furnace in the production of the steel.

822,311. Alternating-current Motor. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 26, 1904.

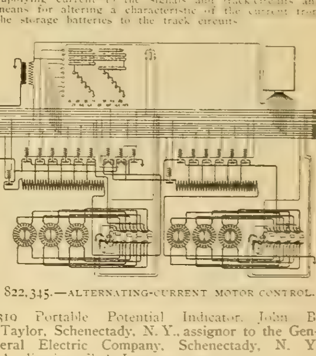
In an alternating-current motor are an armature winding provided with a commutator and brushes, [illegible] field approximately uniformly distributed [illegible] and having a portion [illegible] which are short-circuited by the brushes, reduced in cross-section so as to be saturated through a portion of the working range of the motor.

822,312. Rheostat. George E. Stevens, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 12, 1904.

A movable contact-carrying member comprising a member movable into and out of frictional engagement with a fixed surface, means for throwing the member into engagement with the surface and moving it over the latter, and means for retaining the parts in frictional engagement at the end of their movement so as to lock them against return are the features of the invention.

822,314. Railway Signaling System. Jacob B. Struble, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed July 13, 1904.

Combined with several railway signals are track circuits for controlling the signals, storage batteries for supplying current to the signals and track-circuits and means for altering a characteristic of the current from the storage batteries to the track circuits.



NO. 822,345.—ALTERNATING-CURRENT MOTOR CONTROL.

822,310. Portable Potential Indicator. John B. Taylor, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 10, 1905.

A potential-indicator comprises an insulating handle, a metallic sleeve mounted therein, a glass tube fitting inside the sleeve, an inner glass tube, an electrode inclosed in the inner tube, a liquid insulator in the space between the tubes and conducting particles in the liquid.

822,323. Thermostatic Control. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 1, 1904.

In a thermostatic device are a movable armature of magnetic material, a permanent magnet for energizing the armature and a magnetizable alloy lying in the magnetic field of the magnet and subject to variations in permeability by the action of a heating fluid.

822,325. Contact Device. Knut Tornberg, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 3, 1904.

In a contact device are an endless closed tube having opposite portions bent so that its sides cross at an angle to each other, contacts mounted within the tube, mercury contained within the tube and means for rocking the tube.

822,332. Induction Coil. Montraville M. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 15, 1904.

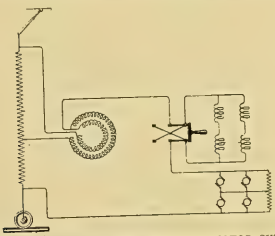
The composite winding is composed of an edge-wound conductor in the form of a helix and a circular conductor lying between successive turns of the helix.

822,336. Thermal Cut-out for Electric Circuits. James C. Armor, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed June 8, 1903.

In combination with the lamp glower that is a non-conductor at ordinary temperatures are an electric heater, a thermal cut-out in the heater circuit comprising a solid metal body having a cavity in one end, vaporizable material in the cavity and a terminal plug removably fitted into one end of the cavity.

822,338. Pyrometer. Edward Bennett, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed October 27, 1900.

A pyrometer comprises an elongated resistance body composed of one or more of the stable refractory oxides and being a non-conductor of electricity, when cold. It has a negative temperature coefficient, and relatively low resistance. Refractory terminal conductors are cemented to the ends and a protecting device is provided.



NO. 822,376.—ALTERNATING-CURRENT MOTOR SYSTEM.

822,345. Controlling Alternating-current Motors. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 25, 1904.

Combined with several alternating-current motors are compensators therefor, switches adapted to vary the points of connection of the motors to the compensators, switches adapted to vary the relative connections of the compensators to each other, reversing switches for the motors and a control system comprising devices adapted to operate the switches. (See cut on preceding page.)

822,365. Method of Applying Terminals to the Glowers of Electric Lamps. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed March 23, 1901.

A cylindrical glower for electric lamps is composed of one or more dry electrolytes and having metal terminals in the form of globules or beads fused directly and externally to the circular flat ends of the glower body.

822,376. System of Applying Alternating-current Electrical Energy. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 22, 1904.

The combination consists of a source of alternating current and two or more motors having series-parallel-connected field magnet windings and series-connected armature windings. A transformer winding has connections to the outer terminals of the armature windings and an intermediate connection is made to the armature-winding terminals which are connected together. (See cut.)

822,424. Process for Fusing Silica and for Shaping the Mass While Plastic. James F. Bottomley, Wellsend-on-Tyne, and Arthur Paget, North Cray, England. Application filed June 9, 1905.

The fusing process is carried out electrically by an internal resistance core.

822,429. Electric Controlled Street or Station Indicator. Arthur J. Clark, Seattle, Wash., assignor of one-half to Rheneldo H. Hamm, Seattle, Wash. Application filed October 27, 1903.

Details are described.

822,464. Enclosing Case for Telephone Sets. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed December 10, 1904.

A casing for a portable telephone set is described.

822,466. Signaling System for Party Telephone Lines. James L. McQuarrie, South Orange, N. J., assignor to the Western Electric Company, Chicago, Ill. Original application filed January 29, 1903. Divided and this application filed December 10, 1904.

Distinctive audible signal-producing devices are provided at each substation with means at each station for transmitting an audible signal over the line. An operator's signal-receiving device is associated with the line at the central office responsive to such signals, means being supplied at the central office for applying current from the source to the line, to operate the signal device at any busy station, whereby the particular telephone in use is indicated to the central-office operator.

822,469. Terminal Conductor. Joseph Opitz, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed February 23, 1904.

In a terminal connector are an insulating supporting-plate, a flat metal punching passing through a hole therein, a recess in the rear face of the plate and an ear formed by the rear end of the punching and forced into the recess.

822,470. Telephone Transmitter or Audiphone Receiver. Hermann G. Pape, New York, N. Y. Application filed June 16, 1904.

Combined with a diaphragm are several electrodes coacting therewith, and a yielding washer interposed between the diaphragm and electrode and borne against them.

822,492. Bridging Connector for Telephone Lines. Maurice C. Turner, New York, N. Y., assignor to the New York Telephone Company, New York, N. Y. Application filed December 22, 1904.

In a connecting device are an axially slotted bolt having a nut-like head, a nut working upon the bolt, the proportions of the parts being such that the outer angles or points of the head and nut lie approximately in the surface of the same sphere.

822,508. Railway Traffic-controlling Apparatus. Clyde J. Coleman, New York, N. Y., Application filed December 4, 1905.

A system of electric signaling for railways is described.

822,579. Electric System of Transmission. Charles G. Burke and Edward J. Burke, Brooklyn, N. Y., assignors of twenty-one-thirtieths to John Q. A. Whittemore, Boston, Mass. Application filed January 9, 1904.

In an electric system for communication are combined a main line, means for charging the main line, a coherer, a transmitter for opening and closing the main line at one point and thereby sending signals, and opening and closing the connections of the coherer to the main line.

822,610. Lightning Arrester. Thomas J. Johnston, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 11, 1901.

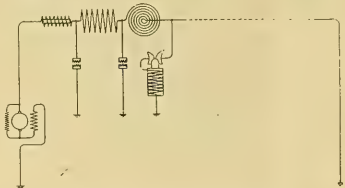
A lightning arrester comprises obstructive devices of differing impedance connected in circuit with the protected device for guarding against waves of different frequencies. Earth branches are connected at points between the devices. (See cut.)

822,611. Multiple Switchboard for Telephone Exchanges. Milo G. Kellogg, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed April 24, 1903.

Details are described.

822,625. Railway Signal Apparatus. Emil L. Nolting, Elgin, Ill. Application filed September 18, 1905.

In an electric signaling apparatus are a railway-track and switch, an electric switch, mechanical and electrical connections between the switches, a sectional third rail located adjacent to the track switch and between the rails of the track, electric connection between the rail and a line-telegraph wire and electric connections between the electric switch and one of the line-telegraph wires.



NO. 822,610.—LIGHTNING ARRESTER.

822,626. Railway Signal Apparatus. Emil L. Nolting, Elgin, Ill. Application filed February 16, 1906.

Electric conductors parallel to the track-rails are associated with a double-pole electric switch mechanically connected with the track switch. Line wires each have a separate electric connection with the electric switch and the electric conductors. A signal apparatus and an electric battery are carried upon the car.

822,642. Wood Strain Insulator. Thomas C. White, St. Louis, Mo. Application filed August 7, 1905.

In a wood strain-insulator are the combination of a wood body having conical portions at its ends and clips consisting of pairs of sections secured to the conical portions.

822,697. Dynamo-electric Machine. William Stanley, Great Barrington, Mass. Application filed May 25, 1905.

Combined with a stator winding is a rotor winding electrically connected thereto, the stator winding being dissymmetrical in form so that the center of flux produced by each phase of current does not coincide with the center of figure of the stator coils producing it.

822,709. Trolley Stand. John Zielinski, Detroit, Mich. Application filed October 22, 1903.

Mechanical features are set forth.

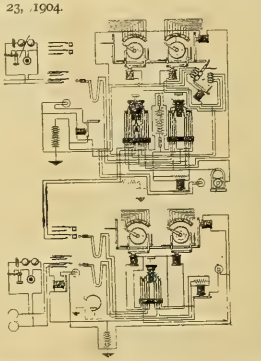
822,715. Bell Box. Sidney A. Beyland, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed May 17, 1904.

A mounting for a ringer and induction coil is described.

822,719. Telephone-call Meter. Charles T. Bradshaw, Philadelphia, Pa. Application filed October 3, 1903.

A meter for registering the number of calls on a telephone is set forth in the patent claims.

822,782. Current Distributor for Sparking Devices. James M. Smith, Philadelphia, Pa., assignor of two-thirds to Clarence L. Altemus and Herbert B. Bowles, Philadelphia, Pa. Application filed May 23, 1904.



NO. 822,888.—VISUAL SIGNAL-RECEIVING MECHANISM.

A shaft has on it a piece of insulating material, a ring of metal on the piece, a tubular guide and a spring-pressed plunger therein forming a brush, also carried on the insulating-piece and in electrical connection with the ring. An inclosed structure has a terminal or series of terminals placed to be engaged by the plunger and a contact-brush carried by and projecting into the inclosed structure, the brush contacting with the ring.

822,845. Trolley Wheel. George W. Jobe, Indianapolis, Ind. Application filed June 23, 1905.

A wheel comprises in its organization co-operating wire-engaging members movable to and from engaging position, and means for automatically actuating the members.

822,881. Electrical Piano-playing Mechanism. Carl E. Brown, Columbus, Ohio. Application filed June 5, 1905.

Electrical contact points operating through a perforated sheet close the circuits to electromagnets operating the piano hammers.

822,888. Visual Signal-receiving System. Ernest A. Faller, New York, N. Y. Application filed July, 1903.

Combined with signal sending and receiving means are line-terminals, means for electrically connecting any two of the line-terminals, and separate visual means for and adjacent to each line-terminal and operated by the signal-receiving means for directly indicating the location of a terminal to which connection is desired. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on June 11, 1906:

404,859. Regulation for Alternating-current Electrical Generators. G. Pfannkuche, Cleveland, Ohio.
404,860. Apparatus for Indicating the Strength of the Current in an Electric Circuit. G. Pfannkuche, Cleveland, Ohio.
404,861. Method of Indicating the Strength of the Current in an Electric Circuit. G. Pfannkuche, Cleveland, Ohio.
404,866. Electric Signal for Engine Shafts. J. C. Ricketson, Milwaukee, Wis.
404,867. Electric Indicator for Engine Shafts. J. C. Ricketson, Milwaukee, Wis.
404,873. Electric Railway. S. H. Short, Denver, Colo.
404,877. Underground Conductor. G. E. Tailleur, Schenectady, N. Y.
404,894. Electrically Controlled Engine. J. E. Byrne, Brooklyn, N. Y.
404,895. Electric Elevating Machine. J. E. Byrne, Brooklyn, N. Y.
404,902. Electrical Distribution System. T. A. Edison, Menlo Park, N. J.
404,906. Electric Alarm Clock. W. E. Hadlock, Wenham, Mass.
404,913. Insulated Electric Wire. H. W. Jones, Jr., New York, N. Y.
404,968. Method of Distributing Electricity by Secondary Batteries. W. W. Griscom, Haverford College, Pa.
404,980. Signal Sounding Apparatus. H. E. Pfannenstein, Dantzic, Prussia, Germany.
404,981. Alarm Signal for Cable and Electric-railway Cars. L. Pfingst, Boston, and S. A. Bemis, Springfield, Mass.
405,010. Electrically Controlled Engine. J. E. Byrne, Brooklyn, N. Y.
405,089. Electric Self-winding Clock. J. H. Gerry, Brooklyn, N. Y.
405,124. Discharge Device for Electrical Machines. A. Schmid, Alleghany, Pa.
405,151. Electric Temperature Regulator. L. F. Easton, LaCrosse, Wis.
405,170. Manufacture of Filaments for Electric Lamps. H. S. Maxim, Brooklyn, N. Y.
405,174. Regulation for Alternating Electric-current Generators. G. Pfannkuche, Cleveland, Ohio.
405,176. Electrode for Electrotherapeutic Body Wear. H. P. Platt, Chicago, Ill.
405,187. Electric Drilling Machine. E. A. Sperry, Chicago, Ill.
405,188. Electric Mining Machine. E. A. Sperry, Chicago, Ill.
405,194. Electromagnetic Transmitter. J. T. Williams, Mount Vernon, N. Y.
405,196. Galvanic Battery. J. A. Barrett, Brooklyn, N. Y.
405,206. Electric Alarm Clock. B. Dubinski, St. Louis, Mo.
405,211. Quadruplex Telegraphy. C. D. Haskins, Brooklyn, N. Y.
405,213. Secondary Battery. T. H. Hicks, Detroit, Mich.
405,218. Dynamo-electric Machine. O. P. Loomis, Somerville, Mass.
405,221. Testing Apparatus for Switchboards. W. E. McKivitt, St. Paul, Minn.
405,223. Electric Motor Starting and Stopping Device. F. A. Perret, Brooklyn, N. Y.
405,235. Municipal Signal Apparatus. J. C. Wilson, Boston, Mass.
405,239. Apparatus for the Manufacture of Filaments for Incandescent Lamps. H. S. Maxim, Brooklyn, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

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High-tension Single-phase Traction Experiments on the Seebach-Wettingen Line.

By Dr. Alfred Gradenwitz.

In order to have an opportunity of testing the practicability of its current collectors and locomotives, while obtaining some extensive general data for gauging the possibilities of standard gauge

Fig. 1. Locomotive Equipped with Converter and Operating with Direct-current Motors

Fig. 2. Alternating-current Locomotive Equipped with Two Single-phase Motors.

HIGH-TENSION SINGLE PHASE TRACTION EXPERIMENTS ON THE SEEBACH-WETTINGEN LINE.

electric-railway operation, the Oerlikon Machine Works a short time ago made an agreement with the Swiss Federal Railways, according to which the Seebach-Wettingen standard-gauge line was to be equipped for electric high-tension alternating-current traction, with a view of permanently electrifying that line in the case of satisfactory results of the trial service.

Some data as to the arrangement and results of these interesting experiments follows.

The current used in connection with these experiments is single-phase alternating-current at 15,000 volts, derived from a transformer station. This contains a rotary synchronous motor of

motive equipped with single-phase commutator motors. The normal speed of rotation of this set is 450 revolutions per minute.

The generators are connected to static transformers, raising the pressure from 750 to 15,000 volts.

The rolling stock comprises in the first place a transformer locomotive (Fig. 1), converting the high-tension alternating current of 50 periods derived from the trolley wire by means of a converter set into direct current serving to feed the motors that drive the axles. The locomotive includes two such motors of 220 horsepower each and four driving axles, and in working condition has a weight of 40 tons.

transformers from 15,000 volts to 750 volts. The two motors are connected in series. The weight of the locomotive in working order is 42 tons, while its speed and output are about the same as in locomotive No. 1. The patented rod collectors of the Oerlikon company are used in both locomotives to collect the current.

The experiments have in the beginning been confined to the Seebach-Affoltern section, three kilometers in length which has been equipped with a side trolley wire eight millimeters in diameter. Three types of suspensions have been tested simultaneously, viz., first, a rigid suspension (Fig. 3); second, an elastic suspension by means of spring

slides (Fig. 4), and third, an elastic suspension by means of supporting wires (Fig. 5).

The characteristic features of each of these three suspensions will be seen from the figures.

After having been opened on January 16, 1905, the regular trial service has been carried on up to date without any other interruption than two short intervals in April and June, respectively. Some constructive improvements were made on the locomotive in April last, while the temporary discontinuance in June was made with a view to further the definite installation work in the railway station of Seebach.

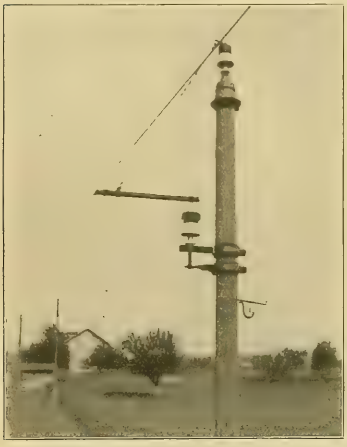


FIG. 3. RIGID TROLLEY SUSPENSION ON SEEBACH-WETTINGEN LINE.

All the trial runs were made in the presence and under the supervision of representatives of the Swiss Federal Railways, the first trials being made with the locomotive alone, while trains of a load varying between 150 and 250 tons have been run ever since the middle of March last. No less than 1,746 runs have thus been made, aggregating 5,206 kilometers traversed on the line, and 5,847 kilometers when including the train-forming operations, and runs on the connecting track from the Oerlikon Machine Works to Seebach Station. The number of gross ton-kilometers performed was 631,209.

In the course of these 1,746 runs only nine disturbances of quite short duration, due to the installation of the plant, were noticed, while nine other temporary interruptions were to be ascribed to the special conditions of power supply which may be said to be only provisional.

Eight of these temporary disturbances were due to the experimental condition of the plant, and were instantly and permanently remedied after some slight alterations in the latter. No disturbance whatsoever has been noted in the current collector equipment ever since August 9, 1905. Only one of the disturbances may be accounted for in the case of normal operation; this is relative to the breakdown of an insulator on the connecting track from the machine works to Seebach Station. No such breakdown has, however, been noted on the experimental track proper. The insulation of the collectors has been found entirely sufficient, even in the case of heavy rains and snowstorms.

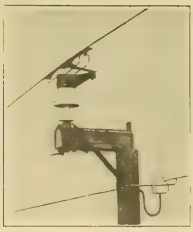


FIG. 4. SPRING SUSPENSION FOR TROLLEY WIRE ON SEEBACH-WETTINGEN LINE.

It may be said that the electrical installation work both in the stations and on the track, as well as the experiments themselves, gave rise to no disturbance in the normal steam operation of the railway line.

From the results so far given by this experimental operation it is distinctly seen that an electrical-railway service is quite practicable, even at a pressure of 15,000 volts in the trolley wire, while the various current collectors represent a satisfactory solution of the current-collecting problem in the case of standard-gauge railways.

Rotary-converter Sub-stations of the Long Island Railroad.

In the former articles upon the Long Island Railroad equipment which have appeared in the Western Electrician, there have been described, first, the main power station of the Pennsylvania Railroad, which furnishes electrical energy for train propulsion, and second, the power-transmission line. Attention is now invited to the general scheme of power distribution to the several railroad lines, through rotary-converter sub-stations, by means of which the high-tension alternating current generated in the power station and sent out over the transmission lines is lowered to the right pressure and changed to direct current, suitable for supplying the car motors through the third-rail circuits.

The lines which have been electrified comprise the Atlantic Division between the Flatbush terminal in Brooklyn and Belmont Park Race Track, about 14 miles to the east of it; that portion of the Rockaway Beach Division lying south of Woodhaven Junction, the Far Rockaway branch between Hammel and Valley Stream; the Montauk Division between Valley Stream and Springfield Junction, and the branch between Springfield Junction and Jamaica.

Woodhaven Junction is a natural sub-station site, for it is practically at the geographical center of the district to be equipped. Hammel, another junction point, about seven miles south of Woodhaven, on the Rockaway Beach Division, was also selected because of its natural advantage as an important point in the network of lines.

To meet traffic conditions, three other permanent sub-stations besides Woodhaven Junction were required on the Atlantic Division. The points originally chosen were Flatbush Avenue, East New York and Rockaway Junction; in other words, the two terminals of the rapid-transit system and its junction with the Manhattan Beach Division. Sub-stations were erected at East New York and Rockaway Junction, but a site at Grand Avenue, about one mile east of the Flatbush terminal, was finally adopted in place of the latter.

FIG. 5. SPRING SUSPENSION WITH SUPPORTING STEEL WIRE ON SEEBACH-WETTINGEN LINE.

The race tracks at Belmont Park and near Springfield junction are sufficiently removed from the permanent sub-stations to make the transmission of electric power at high tension much more effective and economical than the employment of third-rail circuits only. The loads incidental to race-track traffic are very heavy, but only occur once a day for four wekes in the entire year. It is thus desirable to avoid placing expensive and fully equipped sub-station buildings at either of these locations; so two portable sub-stations were devised, each consisting of a 1,000-kilowatt rotary converter, with transformers and switchboard mounted in a steel car.

The distances from Woodhaven to the various sub-stations are as follows: East New York, 3.2 miles; Grand Avenue, Brooklyn, 6.2 miles; Rockaway Junction, 3.4 miles; Hammel, seven miles. Belmont Park is distant from Rockaway Junction 3.5 miles. Springfield Junction is distant from Rockaway Junction sub-station 3.4 miles. The branch feeder lines to these portable sub-stations are manipulated from Rockaway Junction, where they can be thrown to one or both of the two main transmission lines, which connect Rockaway Junction sub-station with Woodhaven Junction sub-station and Long Island City.

The principal feature of each sub-station is its equipment of rotary converters and transformers. In a single instance, namely, at Hammel, a storage battery was installed as an adjunct to the sub-station machinery. The location and arrangement of all the sub-station buildings is such as to enable the ultimate use of a storage battery should future conditions justify it, and the apparatus in each building is so laid out that if the storage battery should be installed the necessary boosters

MAP SHOWING SUBURBAN LINES OF LONG ISLAND RAILROAD.

can occupy the space allotted to one rotary converter.

Station.	Rotary Converters.	Transformers.	Boosters.	A. C. Feeders.	D. C. Feeders.
Grand Avenue:	Kw.	Kw.	Kw.		
Present installation	3 1,000	9 375	.. ...	2	5
Ultimate capacity	5 1,500	15 550	.. ...	4	11
East New York:					
Present installation	3 1,000	9 375	.. ...	5	6
Ultimate capacity	4 1,500	12 550	.. ...	12	16
Woodhaven Junction:					
Present installation	3 1,500	9 550	.. ...	12	10
Ultimate capacity	6 1,500	18 550	.. ...	18	18
Rockway Junction:					
Present installation	2 1,000	6 375	.. ...	4	6
Ultimate capacity	4 1,500	12 550	.. ...	11	16
Hammel:					
Present installation	2 1,000	6 375	2 162	2	6
Ultimate capacity	5 1,500	15 550	2 162	5	13

Note.—At Hammel, the initial installation also includes one storage battery of 3,200-ampere hours capacity at the one-hour rate at 600 volts.

The sub-station equipment also includes the two portable sub-stations mentioned above, each consisting of a car containing one 1,000-kilowatt rotary converter, three 375-kilowatt transformers, and the necessary blower and switchboard panels, high-tension oil circuit-breaker, and connecting leads to the outside circuit-breakers.

After carefully investigating the applicability of the storage battery to the Long Island Railroad distribution system, its value as an adjunct appeared to be chiefly in proportion to the protection from interruption afforded by it. Consequently, it was decided to employ a storage battery at a sub-station, where the insurance feature could demonstrate its value to the best advantage. A battery was accordingly installed at Hammel, which is farther from the power station than any of the other sub-stations, and, by reason of the exposed position of the transmission line running across Jamaica Bay, might be considered somewhat more liable to interruption in service through accident to the transmission.

Sub-station Buildings.

The sub-station buildings are of a uniform type of construction throughout, except at Grand Avenue, where the reduced area of the lot made its adoption impracticable. This type consists of a central section of about 51 feet span, which is wide enough to accommodate two 1,500-kilowatt rotaries and the necessary transformers. The central space is flanked on each side by a narrow section, that on one side being devoted to high-tension bus-bars and switch gear, while that on the other side contains the low-tension switchboard and operating gallery.

All of the sub-stations, except Woodhaven Junction, received an initial equipment of 1,000-kilowatt rotary converters. The machine foundations and general interior arrangement are, however, such as will accommodate a complete outfit of 1,500-kilowatt units at all stations, should traffic requirements in the future make it necessary to fill the buildings with apparatus to their utmost capacity.

Each sub-station is served by a 16-ton crane, hand operated from its trolley, thus obviating the usual hanging chains. It spans the central bay and it is available not only for handling the permanent heavy sub-station machinery, but also the apparatus of the portable sub-stations, which (except at Grand Avenue), can be run under it upon

a track that enters one of the end bays of the building.

Rotary Foundations.

The foundations upon which the rotary converters rest are of concrete, each one of foundations being built in the form of two parallel walls, upon which the rotary converters are placed without anchor bolts. The interior of the foundation can be entered from the basement through a door in the side, thus permitting ready access to the rotaries from underneath.

The use of air blast transformers requires special provision for the air duct which carry the air supply to them from the blowers. One large air duct is formed by so disposing the foundations as to make a separate compartment in the basement surrounding the rotary-converter foundations on three sides, into which air is forced by the blowers. The transformers are set over openings in the main floor, which constitute the top of the air duct. There is ample space to permit of easy access to the transformers underneath, and room enough for the workmen to move about freely in the duct. It is entered through a fireproof door opening into it, which is sealed against the air pressure of one ounce per square inch maintained in the compartment, when the blowers are in operation. The cable connections to and from the transformers are carried into and out of this chamber through air tight bushings.

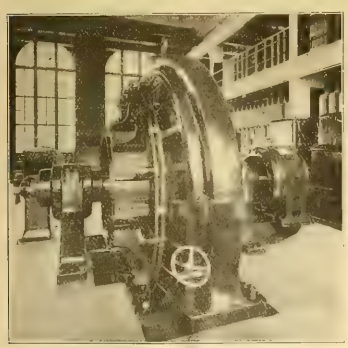
Portable Sub-station Buildings.

The portable sub-stations, while being used at the racetracks are housed in buildings especially designed to accommodate them. The buildings are located at Belmont Park and Springfield Junction, and are each 33 feet four inches long and 17 feet wide over all, with a tower at the end opposite the entrance, about 36 feet in height, for the purpose of affording a convenient entrance for the high-tension cables and providing an enclosure for the high-tension lightning arresters. Each building can accommodate two portables. The building is constructed of steel bents spaced 10 feet apart, joined together longitudinally by angle-iron girts, the walls being enclosed by metal lath secured to the structure and filled with Portland cement plaster two inches thick.

Rotary Converters.

Rotary converters are of the two-bearing type, with field frames divided in a horizontal plane. Each converter has a starting motor, whose frame is mounted upon an extension of the base frame is mounted upon an extension of the base of the rotary converter. The base frame is set into the floor so that the top of it is level with the floor line. It is entirely open below the commutator so that there is easy access to the lower brushes from the pit in the interior of the foundation, which can be easily reached from the basement.

The 1,000-kilowatt rotaries are rated to deliver 1,600 amperes at 625 volts, and 1,667 amperes at 600 volts. The three-phase potential at the alternating end is approximately 370 volts, for 625 volts at the direct-current end. The 1,000-kilowatt ma-



VIEW OF TYPICAL 1,500-KILOWATT ROTARY, LONG ISLAND RAILROAD.

chines have eight poles and operate at 375 revolutions per minute, corresponding to a frequency of 25 cycles per second. The 1,500-kilowatt rotaries are rated to deliver 2,400 amperes at 625 volts, or 2,500 amperes at 600 volts. They have 12 poles and run at 250 revolutions per minute.

In nearly all respects the two sizes of machines are very similar. The fields are compound wound, with the shunt winding arranged for self-excitation. The machines are so over-compounded that if operated as direct-current generators at constant speed the voltage will rise from 600 volts at no load to 650 volts at full load.

The converters are guaranteed to stand overloads of more than 2½ times the normal load at 600 volts direct current without falling out of step, providing the electromotive force at the alternating end is maintained within 14 per cent. of the normal. Angle at [illegible] per cent. [illegible] and also through the [illegible]

[illegible]

The transformers [illegible] the air blast type [illegible] 1,000-kilowatt rotaries [illegible] three 575-kilowatt [illegible] verter. For the [illegible] in groups of three [illegible] 1,600-kilowatt capacity.

The use of the [illegible] the core built up [illegible] ducts, through [illegible] transformer [illegible] ranged for receiving [illegible]

ROCKAWAY JUNCTION SUB-STATION OF LONG ISLAND RAILROAD.

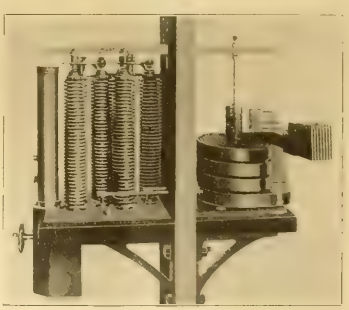
ing it at the top and side. Removable panels are fitted into the housing, which permit of easy access to the core for inspection and cleaning. Access can also be had to the coils from the air chamber underneath. There is a damper at the top of the housing to regulate the air for cooling the coils, and one on the side for controlling the air that ventilates the cores.

Both high and low-tension windings are divided into a number of flat coils. The layers of each coil are separated from each other by sheets of heavy insulating material, besides the insulation of the conductors. Special means are taken to mechanically brace the coils against any possible tendency to displacement due to sudden changes in load.

The high-tension winding is designed for a normal electromotive force of 12,000 volts, with taps arranged to enable other voltages to be utilized down to 10,000 volts. The low-tension winding is designed to normally carry 400 volts with taps, which will enable other voltages to be taken off it down to 340 volts. The high-tension terminals are at the top of the transformer. The low-tension leads are brought to suitable terminals in the bottom of the transformers.

In each station there are four sets of auxiliary transformers which supply current for the following purposes:

1. To the rotary converter starting motors.
2. To the motors driving the booster generators



CARBON REGULATOR FOR STORAGE BATTERY, LONG ISLAND RAILROAD.

and their exciters. At Hammel Station these transformers are made large enough to also drive rotary starting motors at the same time.

3. For driving the transformer, blower, motors, and an induction motor-generator set, used to charge the small auxiliary storage battery that supplies current for the electric switch-control system.
4. For house lighting.

Storage-battery Equipment.

As previously outlined, storage batteries are provided at Hammel sub-station only, though provision is made in the design of the other sub-stations for the ultimate installation of storage batteries should future conditions appear to require them.

The equipment installed at Hammel sub-station, with its auxiliaries, is made up as follows: The

EXTERIOR OF HAMMEL SUB-STATION OF LONG ISLAND RAILROAD.

[illegible] of the battery which [illegible] rotaries there are two direct-connected [illegible] separately excited boosters, each consisting [illegible] three-phase induction motor and one direct-current generator mounted on a common bedplate.

The effectiveness of the battery for [illegible] the converters depends upon the quickness with which the intensity of the booster field can be varied and its polarity altered. This is accomplished by means of a small booster exciter generator driven at a constant speed by an induction motor. The current from the armature of this exciter flows directly through the field of the booster. The desired change in the condition of strength and polarity in the booster field can therefore be effected by altering the output of this little exciter generator and reversing the polarity. This is done by strengthening, weakening or reversing the field coils of the exciter, which is introduced into the system simply because it can deliver the relatively large current needed for exciting the booster field, this amount being much greater than it would be possible to pass through the very sensitive regulator which can, however, easily and instantly change the small magnetic field excitation of the little exciter.

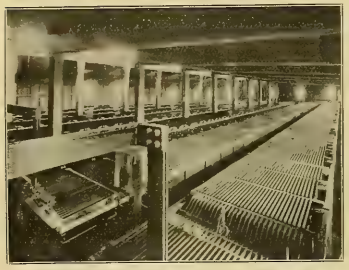
As mentioned above, the booster is in series with the battery across the 600-volt station bus-bars. From the opposite ends and from the middle point of a section of 100 cells of the storage battery

INTERIOR OF HAMMEL SUB-STATION OF LONG ISLAND RAILROAD.

three circuits are led, one of which passes through the field of the small exciter to a connection that joins together two piles of carbon disks which are subject to the pressure of a lever. The outer end of one carbon pile is then connected to one of the wires leading to the positive pole of the 100-cell section of storage battery, and the wiring from the outer end of the other carbon pile is joined up to the negative end of the 100 cells. Two circuits are thus formed, each including a separate half of the battery section and one carbon pile, while both have a common connection from the center of the battery section, which passes through the field of the little exciter. The resistances of the two carbon piles, when subjected to equal pressures, are equal, and current will then flow from the battery through both carbon piles and back to the negative pole of the battery, there being then no tendency

for any current to flow from the central point of the two carbon resistances back to the central point of the battery, or vice versa, through the field of the small exciter.

The lever which bears upon the tops of the two carbon piles is balanced upon a knife edge, and from one end of it is freely suspended the soft iron core of a solenoid, through the coil of which passes the entire output of the rotary converters. To the other end of the lever is attached a helical spring, whose tension may be adjusted by hand to counterbalance the pull of the solenoid at any desired load on the machines. Slight variations of load above or below this amount will, through the action of the suspended core of the solenoid, cause changes in pressure on the carbon piles by means of this lever, which results in wide variations in the contact resistance in the carbon piles. The pile that is compressed through the action of



INTERIOR OF HAMMEL SUB-STATION BATTERY ROOM, LONG ISLAND RAILROAD.

a small increase of current in the solenoid will have its resistance reduced, and more current will flow through it than through the other one upon which the pressure has been simultaneously released. If the carbon pile thus pressed happens to be the one whose outer end is attached to the positive pole of the battery section, for instance, the current will flow from the positive terminal of the battery around through the compressed pile and through the booster exciter field to the middle point of the battery, inducing polarity in one direction in the booster field to an extent corresponding to the increase of current that caused the solenoid to compress the carbon plates. When the current in the main circuit is slightly reduced, the solenoid action is reversed, pressure on that particular pile is released, and the other carbon pile whose outer end is coupled to the negative pole of the battery section is compressed, the current in the regulator circuit flows from the middle point of the battery back through the booster-exciter field in the opposite direction, and through the other pile to the negative pole of the 100 cells. The booster-exciter field is thus reversed, which reverses the polarity of the booster field, and consequently the polarity of the booster itself, finally resulting in the reversal of battery action. The action of the regulator is somewhat analogous to that of the Wheatstone Bridge.

[*To be concluded.*]

Chicago Edison-Commonwealth Ordinance Vetoed.

The new ordinance for the Chicago Edison Company and the Commonwealth Electric Company which was passed by the City Council last week with only 11 dissenting votes, was vetoed by Mayor Dunne, and the council at its meeting this week sustained the veto by a vote of 38 to 31. The provisions of the ordinance have been printed in the Western Electrician and are familiar to its readers. It lowered the present rates to consumers of electricity and permitted the two companies to consolidate.

In his veto message the mayor said that the rate reductions were inadequate and that the measure granted concessions to the companies that were unwarrantable. He advised the aldermen not to pass any contract ordinance, but to enact a police-power measure under the rate-regulating act passed by the Legislature, fixing a maximum rate for the sale of electricity and applying it to all companies. The mayor thought the ordinance might amount to a ratification of the 50-year ordinance of the Commonwealth company, passed in 1897, the validity of which, he said, the city is not willing to acknowledge.

Another objection was that the ordinance did not require, but permitted, consolidation. This would enable the companies to issue stock and bonds on the faith of the franchise, and they could put off the merging for six years and thus deprive the city of the three per cent. on the gross earnings of the Edison company if the consolidation were effected. It would be doubtful, the mayor thought, whether the city would receive compensation on electricity bought by the companies from other concerns. Other objections to the ordinance were that it contained no clause for the publicity of accounts and books; it placed no restrictions as to what meters should be used, and provided no supervision; it contained no waiver of rights held by the companies under ordinances granted by municipalities since annexed, and it permitted poles and overhead wires in Hyde Park.

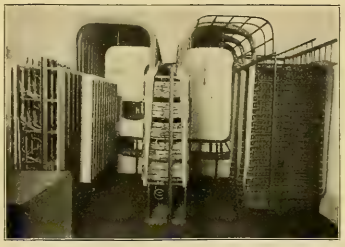
Modern Plant of the Meridian, (Miss.,) Home Telephone Company.

Independent telephone development throughout the South has thus far failed to keep pace with that of the territory lying north of the Mason-Dixon line, but this condition is being so rapidly overcome by the installation of new and modern systems in the leading cities of the South, that it may safely be predicted that in the not far-distant future that territory, which is a most promising one, will be as well developed as the more favored North.

At the present time there is a well-defined movement on foot to establish modern exchanges in the state of Mississippi, and to thoroughly cover the territory with copper toll lines, reaching every town and city of importance in the state. At Meridian, one of the leading cities, and the largest inland cotton center of the world, a city with a population of 22,000, there has recently been installed a strictly modern system.

The Meridian Home Telephone Company and the Rural Long-distance Telephone Company, both organized some time ago, own and control the telephone properties at Meridian, and are now rapidly extending their long-distance service and establishing other local exchanges throughout the state.

A telephone franchise was granted to Messrs. Jones & Winter, telephone engineers and contractors, of Chicago, at one sitting of the Common



RELAY RACK AND INTERMEDIATE AND MAIN FRAMES IN MERIDIAN PLANT.

Council, and this firm immediately set to work to establish a modern system without waiting to secure a list of contracts. The construction work was placed in charge of C. B. Luck, superintendent, and T. J. Wetsel, general foreman.

The underground area was rather large for a town of this size, consisting of over four miles of trenching, in which were laid something like 100,000 feet of three-inch bituminized-fiber conduits; these were laid on and surrounded with three inches of concrete. The manholes were built with brick sides and concrete tops.

The cable used in this installation was manufactured by the Standard Underground Cable Company of Pittsburg, double-wrap dry paper insulated heavy lead-encased cables from 50 to 350-pair being used. Distribution in the underground district was accomplished from poles in the alleys, Frank B. Cook's S. W. terminals being used throughout.

The poles used in this work were selected juniper, 30 to 55 feet in length, the cross-arms of long-leaf yellow standard, 3¼ by 4¼ inches, 10-pin, filled with locust pins.

The aerial construction of this system is largely cable, but where open wires are used they are No. 12 B. & S. gauge, hard-drawn copper. The guying of the aerial work has been very carefully considered, the rods taking the messenger strains being 1½ inches by nine feet in length, and all ironwork being galvanized.

The company started operating January 1, 1906, with 1,000 subscribers, and has now nearly 1,300 telephones in operation. The system is equipped with the very latest type central-energy full major multiple lamp-signal switchboard and telephones, manufactured by the International Telephone Manufacturing Company of Chicago.

The main exchange switchboard is built with a multiple capacity and power equipment for 4,800 exchange lines, all arranged for from one to four-party selective work. The present board equipment consists of 1,200 lines, arranged 150 lines to each of eight operators' positions.

The first position is used as a multiple annex to the operator's position containing the first 150 lines. It also contains 10 toll-line equipments, extensions of the toll-board equipment for night service.

The second to the ninth positions, inclusive, are each equipped with a complete operator's telephone,

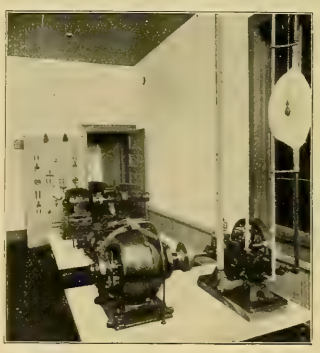
UNDERGROUND CONSTRUCTION FOR MERIDIAN HOME TELEPHONE COMPANY.

16-pair connecting appliances and 150 exchange-line equipments, together with the required multiple jacks, properly arranged, to enable any one operator to make direct connection between any two subscribers' lines without reaching beyond the positions adjoining the one in which the call is received.

Operators' transmitters are the regular telephone transmitters, provided with a special back, strongly constructed of cast brass, with the metal parts oxidized. The cord is so fastened in the transmitter as to relieve the conductors from any strain. The pilot lights consist of one-third-candlepower incandescent lamps, supported in a brass spring collet socket, provided with a brass cup, in which is spun the prism or bullseye, all so arranged that the lamp can be readily removed or placed in position from the front of the board. The lamps jacks are so constructed that the lamps can be inserted only in their required position to make proper contact.

Each operator's position is also provided with the necessary order-wire keys connected to the toll board.

Each pair of connecting appliances consists of a pair of two-conductor tinsel and spiral cords, with reinforcement at the plug end, together with plugs, weights; a combination listening key and four-party



POWER PLANT IN MERIDIAN HOME TELEPHONE COMPANY'S EXCHANGE.

selective listening buttons; also a pair of supervisory clearing-out signals with the necessary relays and auxiliary apparatus.

The plugs are constructed so that two or more may be inserted in adjoining jacks, built on three-eighths-inch centers, and are proportioned and made to avoid liability of breaking.

The combination listening key and four-party ringing buttons are self-contained and of the most convenient and approved design and strongly constructed. The springs are accurately punched from

highest grade spring german silver sheet and properly formed. They are firmly clamped between mica insulation to a brass base by tool binding screws passing through them, threaded with brass nut and insulated with hard rubber bushings. The spring base is supported on metal posts, securely riveted to the top plate, forming a rigid metal frame for the keys. The ringing buttons are of the indicating type, and the last key depressed is automatically mechanically restored when another is operated.

The pilot lights are one third candlepower lamps, held by a brass spring collet socket, which is provided with an opal, protected by an arched wire guard. This form of guard makes an efficient protection to the opal against impact of the plugs, and also provides a means for readily removing the lamp from the top of the board, and at the same time avoids the accumulation of dust over the lamp or opal.

The plug-board and the panel back of the plug board are covered with heavy sole leather. The line-lamp jacks and answering jacks are mounted in sets, with 10 sets per strip. The springs of the lamp jacks and the springs of the answering jacks are mounted on opposite sides of a brass supporting base.

The line lamps are one-third candlepower and are held in a brass spring collet socket provided with an opalescent disk, and are inserted into the jack from the front of the board. The jack springs are so constructed that the lamp can be inserted only so that it will make proper connection. The strips are fastened to the iron framework of the board from the front by heavy binding screws. The screws and ends of the strips are covered by a neat wood strip of the same finish as the cabinetwork. Immediately above the line signals in each position are mounted the pilot lights. Above the line-lamp panels are located the multiple panels, arranged eight to each three positions on the switchboard.

In the lower part of the multiple panel, space is provided for future trunking jacks, 20 of which are installed in each section. Above the trunk panels are placed the multiple jacks, duplicated in every six panels of the eight-panel sections, making the required reach of the operators less than an adjoining position.

Each multiple jack is arranged so that it may be provided with a designating plug, to denote whether the jack is on a one, two, three or four-party line. The jacks are built in strips of 20, each on three-eighths-inch centers. The springs of the multiple jacks are fully two inches in length, punched out of No. 18 highest grade spring german-silver sheet, and having the plug end resting on an insulated stop, to give them tension in their normal position to always insure a positive plug connection.

The frame of the board is in three sections of three positions each. Each section is a self-supporting iron frame, strongly braced and securely bolted and riveted, to make all parts rigid. The face and ends of the frame are covered with quarter-sawed oak cabinet work, finished in golden oak. The rear of the board is properly closed with paneled sliding doors through which access may be had to the rear equipment.

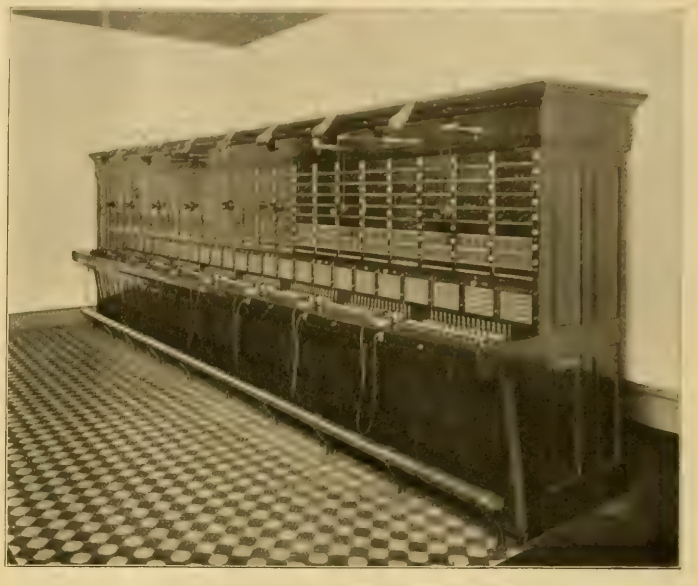
The chief operator's desk is of the cordless type, which allows of much more rapid operation than the usual method of using cord, plugs and jacks. The desk is provided with monitor lamps as extensions of the pilot lamps on the main board. The desk is also provided with a listening-in key for each equipped operator's position on the main board. This desk is also provided with private line to the toll board.

A toll and rural-line board was installed equipped with 10 toll lines, complete operating appliances, etc. The toll position is provided with four-party master key for ringing selectively local party-line subscribers, direct from the toll board through the common-battery half of the toll to common-battery cord circuits. The local half of the toll to common-battery cord are provided with a supervisory lamp, operating the same as those of the main switchboard.

Toll-line-position cord circuits are equipped with individual indicating ringing keys for four-party selective signaling. That is, the common-battery half of these cords have a four-party indicating ringing key for calling selectively any of the party-line subscribers on the main switchboard. A regular ringing key is provided in the toll half of each toll to rural-line cord circuit for signaling on a toll line; also a bridging listening key in all of the cord circuits of this position. The common-battery or local half of each toll to rural-cord circuit is provided with a cut-off [illegible] same manner as the [illegible] ing half of the [illegible] board. Each position [illegible] pilot call and pilot [illegible] night alarm.

Order-wire keys and [illegible] in the toll board for [illegible] board and the various [illegible]

The distributing [illegible]



SWITCHBOARD OF MERIDIAN HOME TELEPHONE COMPANY.

tectural iron, well braced and securely bolted to make them strong and rigid. They are built in sections of 100 lines each, so that additions may be made in 100-line sections at any time, up to the full ultimate capacity of the exchange. The main distributing rack is provided with carbon block lightning arresters and Kaisling self-soldering heat-coil protectors.

Distribution of the lines is done with flame-proof jumper wire. The switchboard cable work is done with No. 22 double silk and cotton Runzel-Lenz switchboard cable and wire.

The line and cut-off relays are of the non-inductive tubular type, individually enclosed in a brass tube cap. The relays are mounted on a heavy architectural iron frame, provided with the proper fuses for the various leads, mounted on a marble slab at the lower end of each rack.

The power plant contains the necessary lead-lined tank Chloride accumulator storage batteries in duplicate, each set consisting of 12 cells, with a present capacity for meeting the maximum requirements of the exchange for a period of 24 hours. The power plant also contains a 3½-horsepower alternating-current motor directly connected to a 3½-horsepower dynamo; also a ringing machine consisting of a single-phase one-half-horsepower motor directly connected to a one-quarter-horsepower ringing generator, as well as an auxiliary ringing machine consisting of a one-quarter-horsepower motor-generator. The machines are of the Roth Bros. make.

The storage batteries are set on racks, provided for the purpose, which are of neat design and strongly constructed. The power table for mounting the charging set and ringing machines is strongly constructed and provided in front with a marble slab to correspond with the power switchboard.

The combined power and fuse board consists of a marble slab, mounted in an iron framework, and contains the necessary switches, Weston voltmeter, ammeters, etc., with all the necessary apparatus to manipulate the various power circuits. This board is supported on an architectural iron frame of rigid construction.

Telephones used throughout the system are of the well-known central-energy type, equipped with a bipolar permanently adjusted receiver, and the transmitter is provided with a hard-coal grain carbon.

Canadian Electrical Association Meets in Niagara Falls.

The [illegible]

on the Canadian side of the river are very meager, and the hope that was entertained that a fine new hotel in building there would be completed and opened in time for this convention was not realized. There is so much of interest at Niagara to electrical engineers that those in charge of the meeting did not feel they should miss the treat of visiting the Falls and its great power development, and so the convention was simply carried across the river, duty free.

The convention was held in the Cataract-International Hotel, the opening session taking place last Tuesday afternoon, when the meeting was welcomed to Niagara in true international spirit, addresses of welcome being on the programme from Mayor Slater of Niagara Falls, Ont., and Mayor Cutler of Niagara Falls, N. Y.

The programme indicated that the following papers would be presented: "Engineering Features of the Ontario Power Company's Plant," by V. G. Converse; "Engineering Features of the Electrical Development Company's Plant," by F. O. Blackwell; "Engineering Features of the Canadian Niagara Power Company's Plant," by H. N. Buck; "Legal Points of Interest to Electrical Engineers," by Robert McKay; "Steam Plant Accessories," by John T. Farmer.

During the few days the delegates to the convention were at Niagara all the power plants on both sides of the river were visited. A more extended notice of the proceedings at the convention will be given in the Western Electrician next week.

Changes in Personnel of Indiana Railways.

Numerous changes affecting the traffic departments of the electric railways in Indiana recently merged by the McGowan-Schoepf syndicate have been announced. F. J. Wheeler, an old steam-railway man, has become general passenger and freight agent of the Indiana lines, with headquarters in Indianapolis, and Walter Hurd will assume a similar position relative to the Ohio lines, with headquarters in Columbus. Division passenger and freight agents are as follows: M. E. Graston, Muncie, Indiana Union Traction Company and Muncie, Hartford and Ft. Wayne Railway Company; C. S. Kitch, Lebanon, Indianapolis and Northwestern and Indianapolis Coal Traction companies; J. F. Starkey, Anderson, Indiana Union Traction Company; J. W. Fletcher, Greenfield, Indianapolis and Eastern Railway Company, Richmond Street and Interurban Railway Company and Indianapolis and Martinsville Rapid Transit Company; Frank D. Norveil of Indianapolis will continue as assistant general passenger and freight agent of these lines.

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CONTENTS OF THIS NUMBER.

High-tension Single-phase Traction Experiments on the Seebach-Wettingen Line. By Dr. Alfred Gradenwitz. Illustrated....515, 516
Rotary-converter Sub-stations of Long Island Railroad. Part I. Illustrated....516, 517, 518
Chicago Edison-Commonwealth Ordinance Vetoed....518
Modern Plant of the Meridian (Miss.) Home Telephone Company. Illustrated....518, 519
Canadian Electrical Association Meets in Niagara Falls....519
Changes in Personnel of Indiana Railways....519
Editorial....520
Electrical Contractors to Meet in Cleveland....521
Electric Power Development in and Around Winnipeg, Man..521
The Massachusetts Steam and Electric Railway Merger Bill..521
Chicago Trolley-permit Ordinances Modified....521
Line Construction for Overhead Light and Power Service. By Paul Spencer. Illustrated. (National Electric Light Association.)....521, 522, 523
All-British Atlantic Cable Proposed....523
Comparison of Two and Three-phase Motors. By Bradley McCormick. Illustrated. (American Institute of Electrical Engineers)....523, 524, 525
"Reasons Why" for the Merchant....525
Grounding Secondary Alternating current Service. By Sidney Hosmer. (National Electric Light Association.)....525, 526
The National Independent Telephone Convention Next Week....526
Automatic Telephone Exchange for Skibo Castle. Illustrated....526
Telephone News from the Northwest....526
Canadian Telephone Items....526
Indiana Telephone Items....526
General Telephone News....526, 527
Manufacturers and Dealers....527
Single-phase Equipment for Richmond and Chesapeake Bay Railway....527
Experience of Central Stations with Lightning Trouble....527, 528
New York Central Locomotive at Atlantic City. Illustrated....528
An Amateur's First Dynamo....528
Large Isolated Electric Plant in the Heart of Pittsburg. Illustrated....528, 529
A New Insulator Pin. Illustrated....529
Electrical Works of the Allis-Chalmers Company in Cincinnati. Illustrated....529, 530, 531
New Style of Cable Roller. Illustrated....531
Electrical Rope-fastening Device for Telpher System. Illustrated....531
Books Received....531

DEPARTMENTS.

Correspondence....531, 532, 533
Great Britain....531, 532
New York....532
Dominion of Canada....532
New England....532
Indiana....532, 533
Southeastern States....533
Northwestern States....533
Pacific Slope....533
Rocky Mountain States....533
Personal....533, 534
Electric Lighting....534
Electric Railways....534
Publications....534
Societies and Schools....534, 535
Telegraph....535
Space Telegraphy....535
Miscellaneous....535
Trade News....535
Business....535
Illustrated Electrical Patent Record....535, 536

DATES AHEAD.

National-Interstate Telephone Association (second annual convention), Auditorium Hotel, Chicago, June 26th, 27th and 28th.

National Electrical Contractors' Association (annual convention), Hollenden Hotel, Cleveland, Ohio, July 18th to 20th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

THE GOOD WORK that an organization like the National Electric Light Association may do is not confined alone to the results that may be attained by the gathering together at the annual conventions and discussing problems relating to the good of the industry in general. There is another phase of the work which is of great importance to the individual, and that is the efficient bureau of information maintained by the secretary and his staff. During the recent convention of the National Electric Light Association in Atlantic City many of the members attending took pains to look up Secretary Eglin and personally thank him for the prompt and efficient responses to requests they had made for information during the year. One member in particular had asked for certain information so late that he hardly expected it to reach him in time, but it came instantly and was of so much importance that it resulted in an award to his company of a 25-year contract for street lighting. Assistance such as this is appreciated, and it strengthens the position of the association among those who are connected with the central-station industry.

BEGINNING with the issue of July 7, 1906, the first of Volume XXXIX., the Western Electrician will enter upon the publication of a notable series of practical articles, to which attention is now directed. This series will be entitled "The Small Central Station: Practical Hints on Its Construction and Operation." Following the plan of Mr. W. J. Buckley's popular book on "Electric Lighting Plants," the present work has been prepared by practical men, and will prove, we think, of great value for the multitude of workers connected with the electric-light and power business, either as beginners or as non-technical business men, who seek practical power-house data. The work, the manuscript of which is now in our hands, is eminently practical and up-to-date, and will be accompanied by numerous illustrations, diagrams and tables. The articles will be run weekly, and will constitute one of the prominent and valuable features of the volume for the second half of this year.

The articles will be confined to the characteristics of small and medium-sized stations using overhead construction. With this understanding, a list of the titles of chapters will give a general idea of the scope of the series:

I. General Observations. II. Building and Foundations. III. Fuel and Waterpower. IV. Boilers and Setting. V. Operation of Boilers. VI. Engines. VII. Steam Turbines. VIII. Belting and Shafting. IX. Electrical Equipment—Generators—Switchboard. X. Lamps. XI. Instruments. XII. Transformers. XIII. Line Construction. XIV. Distribution. XV. Cost of Plants. XVI. General Data.

It will be seen that the field is well covered, and that a valuable series of articles is in store for all who are interested in the practical installation and operation of small electric-light plants.

ELECTRICITY as an agricultural and horticultural agent has been tried with success in numerous instances, and although no very wide application of it has been made there is reason to believe that it presents possibilities of a practical nature, especially to the market gardener. The Western Electrician has in the past called attention to this subject on a number of occasions, one of the most recent being on February 17th of this year, when the address of Mr. W. W. Rawson of Boston on "Vegetable Growing" was noticed. Mr. Rawson, who is a well-known horticulturist, believes that it is entirely practical to accelerate vegetable growth by the use of electricity. He has for some time used the arc light with success as a forcing agent, but his latest experiments have been along the lines of introducing electric current directly into the beds themselves. The experiments are of much interest, the chief danger seeming to be the use of too much current.

The soil of lettuce beds is first sterilized by heating, and then two plates, one of zinc and the other of copper, are sunk at opposite ends of the bed and connected by a conductor. A very slight current is then found to flow without the use of a battery, being generated by the chemical action of the ammonia and other salts in solution in the soil. A potential difference of about 0.5 volt was found to exist between the plates, and there was a current flow of about 0.4 milli-ampere.

Comparing the beds thus treated with others not provided with the electrical apparatus showed that the electrically treated lettuce grew enough faster to be ready for the market a week earlier than the other, and besides was larger in size. These experiments have been tried in beds of various sizes and with different sized plates and have been uniformly successful. The forcing of cucumbers in the same manner is also being tried and results so far obtained are favorable.

IT IS UNFORTUNATE that the rate-regulating ordinance for the Chicago Edison and Commonwealth Electric companies was rejected by the Chicago City Council, following Mayor Dunne's veto, after the measure had passed the council with only 11 dissenting votes. The ordinance was a contract measure. In return for a reduction in the maximum price to be charged for electricity by the Edison and Commonwealth companies, the new ordinance provided changes in the existing grants, among them the right of the two companies to consolidate. In his veto message Mayor Dunne gave it as his opinion that the reduction was not adequate and the privileges granted unwarranted. Those who supported the mayor's veto seem now to be opposed to any contract measure, and they advocate that the city exercise its power, granted last year by the General Assembly, to pass a rate-regulating ordinance fixing the maximum price to be charged for electricity for all current-selling companies. The police powers of the city would then be exercised in forcing recognition of the new schedule of charges. This course surely would be followed by endless litigation, and it is doubtful if, in the end, consumers of electric current would be saved any appreciable amount.

The representative of the two companies in question who conducted the present negotiations made it clear to the Council committee that the rates agreed to in the consolidation ordinance are the lowest the companies will consider under present conditions. Besides, it must be remembered that neither of these companies has ever conceded the power of the city to lower the rates to such an extent that the companies would be compelled to supply a large percentage of its customers at a loss. The ordinance just rejected provided a maximum rate of 15 cents a kilowatt-hour for the next two years and 13 cents for the following three years. This rate could be charged only to consumers using current in a quantity not exceeding the equivalent of 30 hours' use per month of the consumers' maximum demand or requirement as shown by meters. The rate for a supply in excess of the 30 hours' use of maximum demand, commonly called the secondary rate, is much lower, ranging from 10 cents a kilowatt-hour for the first year of the five-year grant to nine cents for the second year, eight cents during the third year and seven cents during the fourth and fifth years. The committee on gas, oil and electric light investigated the companies' affairs and inquired into conditions in Chicago and other cities and agreed that the concessions offered by the above reductions were sufficient to compensate for the privileges granted, and that the rates were just.

It must also be remembered that the consolidation clause of the ordinance provided that the Edison company, which pays no compensation to the city under its present grant, would be required to pay to the city, in case of consolidation, the same rate of compensation as the Commonwealth company, viz., three per cent. of gross earnings. The objection offered by the mayor to this clause is that it permits but does not compel consolidation. The Edison franchise does not expire for six years, while the Commonwealth grant has 41 years to run. The mayor thought that the companies would be able, under this clause, to issue stock and bonds on the faith of the ordinance and put off consolidation for six years, thus depriving the city of the three per cent. compensation for that period. But this is an unwarranted accusation in view of the past records of both companies. On the whole, it is very likely to transpire that a mistake was made in not passing the ordinance over the mayor's veto.

Electrical Contractors to Meet in Cleveland.

The annual convention of the National Electrical Contractors' Association to be held in Cleveland, Ohio, July 18th, 19th and 20th promises to be a pleasant and profitable occasion. From replies received from members of the association from Maine to California the attendance will be the largest of any convention yet held by the association. Cleveland is centrally located and is an excellent convention city.

There will be a number of important matters of interest to the delegates brought up for discussion and action at the Cleveland convention, and the programme will be of interest to every member. The spirit of goodfellowship is growing with the increasing importance and rapid growth of the association. A programme of entertainment is planned which will appeal to the delegates as well as to the ladies who go to Cleveland at that time. The weather in Cleveland is delightful during the summer months and the cool lake breeze which blows continuously will prevent the delegates from feeling any discomfort during their visit. The convention headquarters will be at the Hollenden Hotel. Special rates have been received from the hotels, and the committee is receiving many requests for hotel reservations for the three days. Communications may be addressed to Secretary A. Oppenheimer, Station B, Cleveland.

Electric Power Development in and Around Winnipeg, Man.

The official inspection of the power-generating station of the Winnipeg street railway at Lac du Bonnet was made on May 30th by the City Council and a number of the stockholders and officials of the company. The generating station is situated 67 miles from Winnipeg on the Pinnawa channel of the Winnipeg River, and is the first hydro-electric plant of any size established between Sault Ste. Marie and the west slope of the Rocky Mountains. Isham Randolph, the Chicago expert, has reported to the company that there are so many power sites on the Winnipeg River that 1,000,000 horsepower (electrical) can be developed from the falls and rapids along and between Lake Winnipeg and the Lake of the Woods, and including the Winnipeg River, either for long-distance transmission or for use on the spot. It is now about 3½ years ago that the Winnipeg Street Railway Company first began work on the Pinnewa channel of the Winnipeg River, and it has been constantly at work ever since. The first intention was to generate 15,000 horsepower, but owing to the demand for power outside the street-railway requirements and for lighting the streets it was found necessary to raise the output to 30,000 horsepower. This work has cost about $3,000,000. The street-railway company is now developing 7,000 electrical horsepower at its station on Assiniboin Avenue (by steam). This will now be retained as a reserve power in case of accidents. The start is to be 10,000 horsepower for handling of the Winnipeg street railway and tributary lines, but this can be doubled or trebled at any time when the large manufacturing concerns and the mills which have contracted for electrical power are ready to receive it. At the power house the energy is generated at 2,000 volts. From the generators it is wired to the transformer station, where the voltage is raised to 60,000 volts, which has been found economical for long-distance transmission. It is sent as a three-phase current to Winnipeg over a special transmission line, which is one of the features of the development work. This transmission line necessitated the purchase of a right-of-way 90 feet in width from the power house to the city. Steel towers have been erected to carry the six copper cables over which the high-tension current is sent. At Winnipeg another transformation station has been installed, where the current is stepped down to the different voltages and forms of current for local distribution. In the channel which leads the water of the Winnipeg River down to the main dam, a half million cubic yards of granite have been excavated. The dam itself is of concrete and 40 feet in height at its present elevation. In the dam there has been placed about 22,000 cubic yards of concrete, mixed in the proportion of one part of cement, three parts of clean sand and six parts of broken stone. The dam is practically in three sections. In the center there is the section, 260 feet in length, through which the intake pipes pass to the wheels. To the north is a wing wall running at right angles for 160 feet up-stream and then deflecting at an angle of 45 degrees to the north for another 120 feet. On the south side there is a similar wing wall for 105 feet, from the end of which is carried the overfall dam, 500 feet in length. This latter is for regulating the height of water in the forebay. When the water rises to tthe top of the overfall dam the surplus flow escapes by this avenue to the river below; it also allows floating ice to escape.

The power house and transformer station at the river form one long building about 700 feet in length. They are built of stone, with steel frames and sheet-metal window sills so as to be entirely fireproof. Inside are the waterwheels, generators and transformers, some of the individual pieces of ... [illegible] ... pounds. ... through ... the main dam ... The waterwheels ... directly connected ... first ... of good ... mechanically ... the mental ... take ... day, May 30th ... one of the ... tion staff ... assistant engineer ... foreman, H. Kingston ... ter, foreman ... foreman of ... vation foreman, C ... Gordon, M. Cunningham.

The Massachusetts Steam and Electric Railway Merger Bill.

Boston, June 14.—The ... street-railway and steam railroad merger bill has reached the House of Representatives of the state, where it has precipitated a struggle. The bill is intended to put Massachusetts railroad corporations on the same footing as foreign railroad corporations. As the law now stands, the New York, New Haven and Hartford Railroad Company, a foreign corporation, can buy or lease electric railways in this state, but the Boston and Maine Railroad Company cannot do so. The former corporation now controls 603 of the 2,220 miles of electric railways in the state.

As it left the Senate, the bill provides that a railroad company operating in the state may buy, acquire, hold stock in, or lease a street-railway company having a location in the state, if the facilities for travel on the railroad and street railway shall not be diminished or the fares increased; the transaction to have the approval of the State Railroad Commission. The bill also provides that a railroad or a street railway company may become an associate in the formation of a company for the purpose of maintaining a street or electric railway having for one of its termini a city or town in which the railroad or street-railway company has a location, and that an electric or street-railway company may acquire or hold stock in any connecting street-railway company.

When the bill was brought before the House, Representative Weeks of Everett moved the substitution of a bill which would make it unlawful for a railroad corporation operating a railroad in the state to acquire, own, or hold the stock or bonds of any street-railway company having a location in any city or town in the commonwealth, or to lease the franchise and property of any street-railway company, or to become an associate in the formation of a company for the purpose of constructing, operating and maintaining such a street railway. Railroads now owning stocks or bonds of a street-railway company are requested to dispose of the same, and provision is made in the bill for the appointment of a receiver to take control of street-railway property the stock and bonds of which are believed to be controlled by a steam road operating in the state. B.

Chicago Trolley-permit Ordiances Modified.

At the Chicago City Council meeting this week Mayor Dunne sent in a veto of the trolley-equipment ordinance passed last week. He offered an amendment to the ordinance, which was accepted by the aldermen, and the amended measure was passed unanimously. By the ordinance the Union Traction Company and the City Railway Company are permitted to abandon cable operation and install trolley cars on the former cable lines. The amendment provides that, should the city give proper notice so to do, the companies will be required to remove all poles, wires and other equipment installed under the temporary permits within 60 days. It is said the companies will accept the terms contained in the ordinance and proceed at once with the work of reconstructing the lines.

In his veto message Mayor Dunne said the ordinance had been passed by the council in view of the negotiations which are now pending for the settlement of the existing controversies between the street-railway companies and the city of Chicago. "If these negotiations should not result in a settlement within the next few months it may become highly advisable to have all of the poles, wires and equipment removed from the streets in which they have been constructed, under this ordinance, or that they pass to and become the property of the city of Chicago."

Line Construction for Overhead Light and Power Service.[1]

[illegible]

... seven-inch ... ground and ... against ...

... not the ... so-called red ... and which are made up of ... the good ... and flooring. They should be ... pole and should be braced.

Line wires should not be less than No. 6 B. & S. gauge in size, and they should be strung with ample clearance over highways and footways, and should be inaccessible to the general public from bridges or buildings.

The guy wires should be of stranded cable and not solid wire. They should be ... and as far as possible installed so they cannot be easily reached from the ground.

Ground wires should not be installed unless they can be connected to a permanent and efficient ground. A ground wire connected to a poor ground not only fails when it becomes charged to give the protection for which it is supposed to be installed, but becomes a positive source of danger to the passer-by.

For the safety of employes, pole wiring should be carried out in a systematic manner so as to leave space on the pole for climbing and working thereon.

To protect the trimmer, series arc lamps should have absolute cut-outs.

Due consideration should be given to the wires of other companies in the territory. We must remember that the telephone and fire-alarm wires have much less mechanical strength than the line wires used by electric-light companies, and that in case of sleetstorms they are the ones that are likely to break and come down, making possible contact with the electric-light wires.

Poles.

All poles used must be purchased under, and conform to the company's standard specification therefor. Round chestnut poles shall be used where possible, but wooden poles other than chestnut may be used in localities where it is difficult to obtain chestnut poles. If municipal regulations require a finished pole, yellow-pine poles, in accordance with the company's specification therefor, may be installed.

Unless taller poles are required by municipal ordinance, or by exceptional conditions, the standard height in cities or thickly settled localities shall be 35 feet for poles to carry either one or two cross-arms; 40 feet for poles to carry three or four cross-arms, and 45 feet for poles to carry over four cross-arms. For lines in suburban districts 30-foot poles may be used to advantage, and their use is recommended.

Pole lines on streets are preferable to those over private property. Where possible, poles shall be located at the corners of intersecting streets. Lines should be laid out to follow one side of the street, so that the number of street crossings shall be a minimum.

Guys should be used whenever they can be located so as to counteract the strain of the wires attached to a pole, and so prevent it from being pulled from its proper position in a line. The following general instructions cover some of the special cases where guying may be required. On straight lines carrying more than one cross-arm poles should be head-guyed at convenient intervals, i. e., guys should extend from the top of a pole to the butts of the adjacent poles in the line on either side, and, if possible, this same pole should be side-guyed, i. e., guys should extend from the top of the pole on either side at right angles to the line to guy stubs or other supports. On street lines, side-guying can be employed only in comparatively few instances. Straight-line guying is for the purpose of giving additional stability to a

[1] Abstract of a paper read before the National Electric Light Association, Atlantic City, N. J., June 4, 1906. The author is inspector of electric ... for the United Gas Improvement Company of New York City.

line in case of severe storms. Line terminal poles shall be head-guyed, and on heavy lines the two poles next to the terminal pole shall be head-guyed to assist the latter in taking the terminal strain. Poles at the terminals of long spans shall be buoyed to counteract the extra strain on the pole due to the long span. In turning a corner with two poles, guys shall preferably be located as shown in Fig. 1. On curved lines carrying not more than one cross-arm, locate guys in a line with the radius of the curve on every pole with an offset of more than 10 feet. On lines carrying more than one cross-arm, locate a guy on every pole having an offset of more than five feet. Poles on steep hills should be head-guyed.

Material used for guying shall be stranded cable, composed of galvanized iron or steel wire. The standard guy cable consists of seven strands of No. 12 B. W. G. galvanized-iron wire. All guy

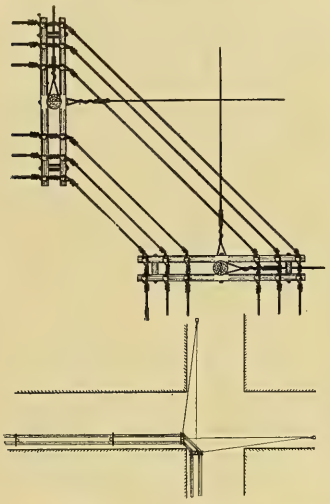


FIG. 1. STANDARD LINE CONSTRUCTION. — TWO-POLE METHOD OF TURNING CORNER.

wires shall preferably be attached to poles, guy stubs, trees or other ungrounded supports, and when so attached shall not reach within eight feet of the ground.

All guy wires attached to poles carrying electric-light or power wires shall be insulated by the insertion of at least one strain insulator. In the case of head guys and side guys, the insulator shall be located at the upper end of the guy, and at least six feet from the pole, measured horizontally. Where any portion of the guy passes under electric-light or power wires, other than those attached to the guyed pole, a second strain insulator shall be used, placed six feet from the lower end of the guy. Guy wires which are attached to a non-insulating support, such as a rock, iron pole, bridge or any other structure, and anchor guys, shall have inserted in them two strain insulators, one being so placed as to protect a man working on the pole from coming in contact with that portion of the guy beyond the insulator, and the other placed so as to be out of reach from the ground or structure.

Cross-arms.

When possible, cross-arms shall be fastened to a pole before the latter is set. Before being placed on a pole, each cross-arm shall be fitted with two braces. The braces shall be attached to the cross-arm by carriage bolts. When the cross-arm is placed in position, with braces facing away from the pole, an eleven-sixteenths-inch hole shall be bored through the center of the gain, and a five-eighths-inch cross-arm bolt driven through the cross-arm and pole. This cross-arm bolt shall be of just sufficient length to pass completely through the pole and cross-arm and receive its complement of washers and nuts.

At line terminals, corners, curves and other places where there is excessive strain on the cross-arms, pins and insulators, the pole shall be double-armed. Where on corner poles the use of double arms would reduce the clear space to less than 20 inches, the double-arming should be omitted and the line held by double-arming on the adjacent poles to the corner pole, as in Fig. 2. If the corner cannot be securely turned without the use of double arms on the corner pole, longer cross-arms should be used and the wires shifted to provide a clear space of 24 inches between the inside line wires and the nearest face of the pole.

The standard form of insulator for direct-current circuits of all voltage and for alternating-current circuits up to 3,500 volts shall be the deep-groove double-petticoat flint-glass insulator. For alternating-current circuits exceeding 3,500 volts and not exceeding 5,000 volts, the triple-petticoat glass insulator shall be the standard. Triple-petticoat glass insulators may also be used for alternating-current circuits under 3,500 volts, to reduce noise on telephone wires, due to leakage from electric wires on poles jointly used by electric-light and telephone wires. For constant-potential lines having a voltage exceeding 5,000, special insulators of approved pattern shall be used. Insulators should be placed upon the cross-arm pins only when the wire is to be immediately attached thereto, and should be screwed up tightly in every case. If a wire be permanently removed from an insulator, and no other is to take its place, the insulator should also be removed.

Wire and Wire Stringing.

High-tension lines shall not be supported upon trees, nor should they be attached to buildings. When they must be attached to bridges, every effort must be made to so place the wires that they will be entirely inaccessible to the general public. When a high-potential series circuit must be attached to a building in order to supply commercial series arc lighting therein, the wires must be installed in such a way as to be beyond the possibility of accidental contact by people in or about the place, and also so as to avoid possibility of contact with awnings, shutters, signs and similar fixtures on the building. Line wires shall not be attached to wooden bracket pins.

It is essential for the safe and uninterrupted operation of high-tension lines that they be free from possibility of grounding on trees. It is therefore important that tree branches interfering or likely to interfere with the lines should be cut away. Such trimming must be done with care and judgment and under the immediate supervision of the superintendent, line foreman or other responsible person. Before any trimming is done, the consent of the owner of the trees should be obtained. Opposition to tree trimming may sometimes be overcome by offering to employ a professional gardener for this purpose. If consent to trim trees cannot be obtained, tree wire shall be used. Trees can generally be best trimmed in the fall and winter months, when the leaves are off, and the result of the work will be less noticeable. When branches have been cut off they should not be left to litter the streets, nor thrown into the nearest vacant lot, but should be removed in the company's wagons. The stubs of branches should always be painted, for their protection and to make them less noticeable. When lines must be carried through trees that cannot be cleared or trimmed so as to give a clear passage for the wires, tree wire of approved insulation shall be used. This insulation consists of a three-thirty-seconds-inch rubber cover, taped and with two braids over all. Where tree wire is used, if there is danger of limbs or large branches chaf-

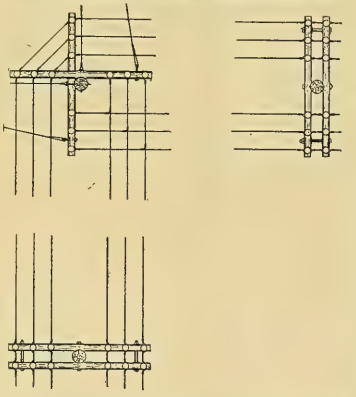


FIG. 2. STANDARD LINE CONSTRUCTION. — CORNER POLE WITH DOUBLE ARMS.

ing the insulation, it shall be protected by means of wooden abrasion molding. A satisfactory form of wood molding is shown in detail in Fig. 3.

Commercial circuits must be designed to furnish practically uniform voltage throughout a system of distribution; otherwise satisfactory lighting or power service cannot be supplied to consumers. To secure this end, so far as possible, all constant-potential circuits shall be laid out on the feeder and main system, feeders being run from the station or sub-station to some point of distribution centrally located in the district to be supplied. From this center of distribution the mains should radiate in such a manner and be of such a size that the drop in potential therein will be as uniform as possible, and as low as is warranted by the costs of construction.

Location of Wires.

Series circuits shall start from station, sub-station or other point of distribution on a given pin and cross-arm, and shall follow this same relative pin and cross-arm throughout its course. Circuits shall not jump from one location on a cross-arm to another location on the same cross-arm, or to a different cross-arm, but shall always be placed on their proper pin. Such a system of confining each circuit to a given pin throughout its course makes trouble-hunting and repair work much simpler than they otherwise would be, and is the only possible way in which circuits can be constructed, maintained, operated and extended in a satisfactorily systematic manner. As series arc and series incandescent circuits are cut dead during the daytime, and will not therefore hamper linemen working on a pole, these circuits can often be run to advantage on the pole pins of a cross-arm. Such an arrangement is also convenient for making lamp loop connections.

The wires of commercial circuits shall retain the same relative positions on pins and cross-arms throughout their course, and shall not jump from one set of pins to another set on the same cross-arm, or from one cross-arm to another cross-arm. To minimize the induction on alternating-current

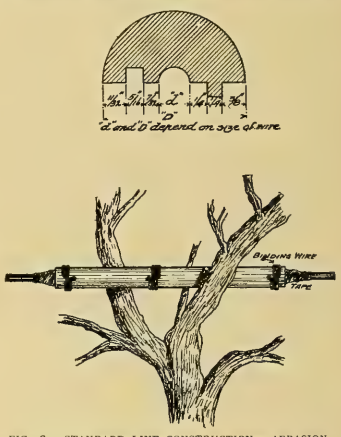


FIG. 3. STANDARD LINE CONSTRUCTION. — ABRASION MOLDING.

lines, the two wires of each circuit must positively be run on adjacent pins of a cross-arm.

Secondary mains shall be run on the lowest or lower cross-arms, and should preferably be run on the end pins of the arm nearest the side of the street on which the consumers are situated. If, however, secondary mains supply both sides of a street about equally, they should be located near the center of the cross-arm. Secondary mains shall positively be located on adjacent pins of a cross-arm, and three-wire mains shall be located on adjacent pins and with the neutral wire in the center.

Secondary Distribution.

Where the service connections of two or more consumers are located within a radius of about 500 feet, they may be fed by the two-wire system of distribution from one centrally located transformer. Where consumers are comparatively numerous in a given block or district, the secondary mains will be practically continuous, and three-wire secondaries should be employed.

Transformers must be installed only on poles or in fireproof vaults. They shall not be attached to walls, roofs or other parts of a building. When on poles, transformers shall be hung on the face, or cross-arm side, of the pole. Transformers of 3,000 watts capacity or less may be hung at the most convenient location on the line cross-arm and immediately under the primary wires feeding the same. Transformers of over 3,000 watts and up to 15,000 watts capacity shall be hung on the line cross-arms, and astride the pole, the hooks of the transformer hangers being attached to that cross-arm which carries the primary circuit feeding the transformer. Transformers of over 15,000 watts capacity shall be hung astride the pole and on special cross-arms bolted to the pole below the line cross-arms. Transformers larger than 30,000 watts capacity shall not be hung on regular line poles. Double arms may be used when they will make it possible to feed primary or secondary wires more directly from insulators to transformers than is possible with the single cross-arm.

All wiring on the pole and all apparatus thereon should be so located as to leave one side, namely, the back of the pole, free for climbing and working upon. Therefore, all primary and secondary connections of transformers, branch taps carried across the pole on spreader brackets, lightning-arrester connections, and all service connections, should be made on the face, or cross-arm side of the pole. Also, twin conductors carried down the pole for arc or incandescent lamps, and cables and conduits for primary and secondary underground-service

connections, should be located on the face of the pole. If necessary, in order to clear pole steps or cross-arms, they should be located toward the side, the location selected should be that quarter section of the pole lying between the pole face and the side toward the street curb.

To protect both line wire and transformer, there shall be inserted in each leg of a primary circuit, where it connects to a transformer, a single-pole cut-out of an approved type. Such cut-out blocks shall always be fused, and the fuse wire for same shall be of a size to carry not more than 50 per cent. overload on the transformer.

SERIES ARC AND INCANDESCENT LAMPS.

No method of suspension for arc lamps can be rigidly specified, owing to the various conditions and types of lamps to be covered. Whatever system of suspension is adopted shall be neat, simple and mechanically and electrically secure. Lamps hung from a rigid support will be much less liable to open-circuit troubles than if their method of suspension allows of much swinging, and for this reason the use of span wires should be avoided. When lamps must be so hung, the span cable shall be a stranded iron or steel cable, and be fitted with a strain insulator at each end. The insulators will be located six feet from the supporting poles, as specified for guy insulation. Arc lamps should be suspended so that the bottom of the lamp will be approximately 20 feet above the ground, and when at such a height the hanger insulator should be drawn close up to the tail pulley, but not touching it. When manila rope is employed to lower the lamp, the lamp pulley shall have some catch arrangement that will relieve the rope of strain. Every series arc lamp shall be equipped with an absolute cut-out of approved type, and shall have a double insulation between the lamp and the supporting rope or cable.

When the lamp loop runs down the side of the pole, and this method of construction is recommended as being both more sightly and reliable than when the conductors are suspended in the air, duplex conductor shall invariably be used. This conductor shall be No. 8 B. & S. gauge, and for arc lamps shall have a rubber wall of not less than three-sixty-fourths inch and a covering of braid or tape on each conductor, and with a covering of braid over all.

The use of series lamps in buildings or attached to buildings should be avoided. Series arc lamps so installed must be located at least nine feet from the floor, and in every way beyond the possibility of accidental contact by people in or about the place.

Series incandescent lamps will be run on constant-current circuits controlled by some form of regulator, preferably automatic, located at the station or sub-station. It is recommended that shunt box or similar systems be not used. Each series of lamps should be run from the regulator on a separate circuit, common returns for two or more series being avoided, and the series circuits throughout should be electrically independent of the commercial service. The lamps should be suspended from poles on fixtures of an approved type, having insulated heads, and lamp sockets with approved cut-outs. Fixtures shall be of such length and so attached that the lamp shall be three feet six inches from the pole and 14 feet above the street, unless otherwise specified by municipal contract. They shall be firmly attached to the pole by means of two four-inch lag bolts.

GROUND CONNECTIONS.

When lightning arresters are to be placed on a pole, special attention shall be given to making a good ground connection. A piece of No. 4 B. & S. gauge insulated copper wire shall extend down the pole from the arrester location to a suitable ground, as hereinafter specified. This ground wire shall be as short, straight and free from coils or turns as possible, and shall run down the side of the pole enclosed in a half-round wooden molding, which latter shall extend to a depth of at least six inches below the surface of the ground. The part of the ground wire below the surface of the ground shall be cleaned free of insulation. This ground wire shall preferably be carried under the ground in as direct a line as possible to the nearest service water pipe and connected thereto by being sweated into a lug attached to a clamp, the clamp being firmly bolted around the pipe. The water pipe should be cleaned bright before the attachment is made, and the clamp and part of the pipe adjacent to it painted with asphaltum paint after the connection has been made. If no water pipe is available for a ground connection, the ground wire should be attached to a plate of No. 16 B. W. G. copper, containing not less than 4½ square feet of surface, and should be riveted and soldered securely to both surfaces thereof. If the soil at the base of the pole is suitable for a good ground, the pole hole shall be dug one foot additional in depth, or, if the pole is already set, a hole not less than six feet in depth shall be dug beside the pole, and a six-inch layer of crushed charcoal or coke placed in bottom of same. The copper ground plate shall then be placed thereon and covered by an additional layer of six inches of crushed charcoal or coke. If the soil at the butt of the pole is not suitable, the [illegible] shall be placed in a bed of charcoal or [illegible] which will furnish a [illegible] pole as possible, the ground wire being run under the surface of the ground [illegible] as possible from the foot of the pole to the ground plate.

The neutral wire of [illegible] circuits shall be grounded at the [illegible] and shall be grounded [illegible] 500 feet on overhead lines. The secondary system of [illegible] formers shall be grounded. [illegible] be done at each consumer's [illegible] by a ground wire connection from the [illegible] to the city water-pipe system as called for and described in the paragraph covering the grounding of [illegible] arres in the company's wiring rules.

DISCUSSION [illegible]

S. J. Rhode of New York city asked W. D. Partridge, who read the paper, if he thought the best results would be obtained by putting all lines on one pole, rather than putting the electric light company lines on their own poles, and putting the telephone and fire alarm telegraph systems on their own poles.

Mr. Partridge: If you have a street to which you are going to send three or four kinds of service, it is impossible to maintain independent rights-of-way. It is certainly desirable if it could be done, and if one company can take one side of the street and the other company take the other side of the street. From the standpoint of the companies, that is the desirable thing. From the standpoint of the public, one set of poles is enough, and I think the companies ought to meet that proposition heartily from the standpoint of the public and attempt to set as few poles as possible on the streets.

E. H. McCabe, New York city: I ask Mr Partridge if he found a perfectly satisfactory strain insulator for 6,600 volts for guide wires in alternating-current circuits. I do not think there has been a satisfactory strain insulator manufactured for high voltage at all. What is his company doing to protect the guide wires from danger?

Mr. Partridge: Personally, I think the best protection for the guide wire is never to bring it within eight or 10 feet of the ground, the middle of the guide wire, but fasten it to the insulated support entirely away from the ground. There are a number of strain insulators more or less satisfactory, but I do not think that any of them meet all the requirements.

J. T. Hutchinson, Rochester, N. Y.: In talking about the use of ground wire, we find in Rochester that it works very satisfactorily in connection with a street-railway company, to use the track for a ground, and we can get a track ground in all the principal streets, and where we cannot get a track ground we make a ground to water pipes. There is one thing I want to speak about, and that is the joint use of poles. In Rochester we have the telephone companies, the city wires and the Western Union wires, and they all try to get in on one street, and we find there is only one way to get out of it, and that is a joint use of poles, and in accordance with the specifications as laid out by the United Gas Improvement Company, which is working out very satisfactory.

W. T. Morrison: I ask the last speaker, if he uses ground on the tracks, how they prevent the current from flowing over the neutrals, if they run the neutrals any distance? If you are carrying your neutral wires on your pole lines for some distance, and ground the tracks at different positions, how do you prevent any potential coming upon the neutral and throwing the neutral wires out of ground?

Mr. Hutchinson: We take care of that by a careful survey of the railway system in connection with the lighting system, and we have no trouble whatever.

All-British Atlantic Cable Proposed.

It is stated that cable connection between Jamaica, B. W. I., and its sister colonies, will be one of the important subjects to come up for discussion at the meeting of the Chamber of Commerce in London next month. The representatives of all the British colonies in this hemisphere will use their best endeavors to bring influence to bear on the imperial government to link together all the parts of the empire on this side of the Atlantic by means of an all-British cable. The island of Jamaica already has a direct connection with the mother country, and the idea is to carry the present cable lines from Jamaica to the Barbadoes or Trinidad, then around the smaller islands, and down to British Guiana. This would give the people of these colonies first-class service, with reduced rates. It is also claimed that an all-British West Indian cable would be of very great strategic value to Great Britain.

The North Shore Electric Company recently gave some practical demonstrations of cooking by electricity in its salesroom in Evanston, Ill., which proved highly interesting to the public and profitable to the company. Coffee, cereals and baked things were prepared by expert cooks.

Comparison of Two and Three-phase Motors.[1]

By [illegible]

In the [illegible] [illegible] two and three-phase [illegible] [illegible] [illegible]

The [illegible] two and three-phase [illegible]

1. [illegible] the effect on the [illegible]

2. [illegible] the field [illegible] edging field.

3. Current [illegible]

4. Leakage [illegible]

[illegible]

Suppose the [illegible] per phase per pole [illegible] (O A), (O B), (O C), [illegible] (O D) [illegible] gree behind the other [illegible] erated in each [illegible] polygon of [illegible] resultant pressure [illegible] (O A B′ C′ D) and (A B C D E) [illegible] pressure, if all the [illegible] slot, would be (O A) + (O B) + (O C) + (O D) instead of (O D′), so we may write

$$K = \frac{OD'}{OA + OB + OC + OD} = \frac{AE}{AB + BC + CD + DE} = \frac{AE}{bp}$$

$$= \frac{2V \sin \frac{1}{2} \angle b [illegible]}{2V b \sin \frac{1}{2} [illegible]} = \frac{\sin \frac{1}{2} [illegible] b}{b \sin \frac{1}{2} [illegible]}$$

where K = the distribution factor.

V = the pressure generated per slot.

b = number of slots per phase per pole.

When b becomes infinite, b p becomes arc A E and

$$K = \frac{2 \sin \frac{1}{2} \angle AOE}{2\pi \frac{\angle AOE}{360}}$$

Table I shows the values of distribution factor for various cases.

TABLE I.

Slots per Phase per Pole	Three-phase	Two-phase
1	1.	1.
2	[illegible]	[illegible]
3	0.96	[illegible]
4	[illegible]	[illegible]
5	[illegible]	[illegible]
6	[illegible]	[illegible]
Infinity	[illegible]	[illegible]

Let E = volts across lines.

Φ = flux per pole.

~ = frequency in cycles per second.

a = conductors per phase per pole = b s.

b = slots per phase per pole.

s = conductor per slot.

K = distribution factor.

p = number of poles.

n = number of phases.

The flux is given by the relation—

$$\Phi = \frac{10^8 E}{2.22 K p \sim a} \text{ and } a = \frac{10^8 E}{2.22 K p \sim \Phi} = b s.$$

Compare now a two and a three-phase machine having 12 slots per pole and suppose that the three-phase machine is Y-connected. In the two-phase machine b = 6 and in the three-phase machine b = 4. We then have the following:

Two-phase.	Three-phase.
$6 s' = \frac{10^8 E}{2.22 p \sim \Phi .903}$	$4 s = \frac{10^8 E}{\sqrt{3} \times 2.22 p \sim \Phi 0.958}$

$$\frac{s'}{s} = \frac{4}{6} \times \frac{\sqrt{3} \times .958}{0.903} = 1.225$$

So that for the same flux a two-phase machine should have 22.5 per cent. more conductors per slot than a three-phase Y-connected machine.

FLUX-VARIATION FACTOR.

Suppose we have a winding with n phases and a conductors per phase per pole. The current distribution along the winding at all points follows the sine law, so that if a and n are large, we may represent the instantaneous value of current by the smooth curve shown in Fig. 2. Consider now a group of conductors in which the currents all flow in the same direction, for example, those designated by the (−) plus signs. The magnetomotive force

1 Paper presented before the American Institute of Electrical Engineers, Milwaukee, May 28, 1906. The author is an engineer for the Allis-Chalmers Company at Cincinnati, Ohio.

at any point, such as (B B), is the difference between the ampere conductors to the right and those to the left of (B B), but in the same group. This fact defines the curve of magnetomotive force whose ordinates are in ampere turns per pair of poles. At (A A) the magnetomotive force will be that due to all the a n conductors in the group to the right, that is, a n times the average value of current in the group

$$a\ n\left(I\sqrt{2}\times\frac{2}{\pi}\right)=0.9\ a\ n\ I.$$

This is the ideal value (expressed in ampere turns per pair of poles) of magnetomotive force at the

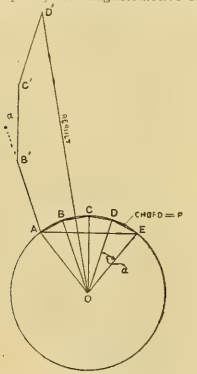


FIG. 1. DIAGRAM OF PHASE DISPLACEMENT OF ARMATURE-CONDUCTOR PRESSURES.

maximum point in the wave of magnetomotive force, and all polyphase revolving fields approach more or less this maximum value, the agreement being closer and closer as a and n approach infinity.

In all cases which are met in practice the maximum magnetomotive force should be expressed as 0.9 K′ a n I, where K′ is the variation factor to which reference has already been made. By plotting the magnetomotive-force curve for several actual cases, it is possible to obtain the law of field variation from which the values of K′ may be easily calculated for all cases.

Fig. 3 shows an irregular curve obtained from a three-phase winding, with six slots per pole per

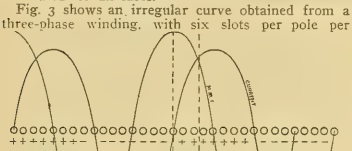


FIG. 2. CURVES OF CURRENT DISTRIBUTION IN ARMATURE WINDING.

phase, at the point when the current in the first and third phases equals half the current in the second phase. Fig. 4 shows the shape of the curve 30 degrees later when the third phase is zero. It will be noticed that there is considerable variation between the maximum ordinates, although the areas differ but slightly.

The area of the curve in Fig. 3 is

$$A=2\ (17+15+13)+(1+3+5+7+9+11)=126$$

and the area of the curve in Fig. 4 is

$$B=1.73\ (17+15+13+11+9+7)=124.5.$$

The average area is $\frac{A+B}{2}=125.25.$

Replacing the curves by a sine curve having an area equal to the mean value of A and B, we get as its average ordinate,

$$\frac{\frac{A+B}{2}\ I\sqrt{2}}{a\ n}$$

and as its maximum value

$$\frac{\frac{A+B}{2}\ I\sqrt{2}}{a\ n}\cdot\frac{\pi}{2}=0.9\ a\ n\ I\ K'$$

Solving for K′ gives

$$K'=\frac{A+B}{a^2\ n^2}\ 1.2344$$

For six slots per phase per pole K′ becomes

$$\frac{126+124.5}{6^2\times3^2}\times1.2344=0.9569.$$

Curves have also been plotted for two-phase windings for the extreme cases; first, with both phases equal, and then one phase at a maximum and the other at zero.

By examining the remaining diagrams, it will be seen that for any case A and B will be given by the following expressions:

Three-phase — b even.

$$A=2\left\{[3\,b-1]+[3\,b-3]+[3\,b-5]\text{ to }\frac{b}{2}\text{ terms}\right\}$$

$$B=1.73\left\{[3\,b-1]+[3\,b-3]+[3\,b-5]\text{ to b terms}\right\}$$

Three-phase — b odd.

$$A=3\,b+\left\{[1+3+5+7\text{ to b terms}]+2\left\{[3\,b-2]+[3\,b-4]+[3\,b-6]\text{ to }\frac{b-1}{2}\text{ terms}\right\}\right\}$$

$$B=1.73\left\{[3\,b-1]+[5\,b-3]+[3\,b-5]\text{ to b terms}\right\}$$

Two-phase—b even.

$$A=\sqrt{2}\left\{[2\,b-1]+[2\,b-3]+[2\,b-5]+1\right\}$$

$$B=2\left\{[2\,b-1]+[2\,b-3]+[2\,b-5]\text{ to }\frac{b}{2}\text{ terms}\right\}$$

Two-phase — b odd.

$$A=\sqrt{2}\left\{[2\,b-1]+[2\,b-3]+[2\,b-5]+1\right\}$$

$$B=2\,b+2\left\{[2\,b-2]+[2\,b-4]+[2\,b-6]\text{ to }\frac{b-1}{2}\text{ terms}\right\}$$

Reference to Table II shows that in three-phase machines with an odd number of slots per phase per pole, K is constantly decreasing and approaches a constant value of 0.9569 when b is infinity. When b is even, K = 0.9569, regardless of the magnitude of b. Similar characteristics will be found in two-phase machines, except that K approaches 0.9.

TABLE II.

THREE PHASE.

	A		B		A+B	K″
1	1+1	4	1.73 (2)	3.46	7.46	1.022
2	2 + 1 (1+3)	14	1.73 (5+6)	13.84	27.84	0.9567
3	3+2 (1+3+5)+2 (7)	32	1.73 (8+6+4)	31.1	63.1	0.9624
4	2 (11+9)+1+3+5+7	56	1.73 (11+9+7+5)	55.4	111.4	0.9569
5	15+(1+3+5+7+9)+2 (1+11)	88	1.73 (14+12+10+8+6)	86.5	174.5	0.9587
6	2 (17+15+13)+11+3+5+7+9+11	126	1.73 (17+15+13+11+9+7)	124.5	250.5	0.9569
Infinity	$2b^2+b+0.5b\times b+b\ b/3=$	$3\frac{1}{2}\ b^2$	$0.866\times2b\times2b$	$3.464\,b^2$	$6.964\,b^2$	0.9566

TWO PHASE.

	A		B		A+B	K″
1	$\sqrt{2}$ (1)	1.414	2	2	3.414	1.052
2	$\sqrt{2}$ (3+1)	5.66	2 (2)	6	11.66	0.09
3	$\sqrt{2}$ (5+3+1)	12.7	2 (3)+2 (4)	14	26.7	0.9174
4	$\sqrt{2}$ (7+5+3+1)	22.6	2 (7+5)	24	46.6	0.9
5	$\sqrt{2}$ (9+7+5+3+1)	35.4	2 (5)+2 (8+5)	38	73.4	0.999
6	$\sqrt{2}$ (11+9+7+5+3+1)	50.9	2 (11+9+7)	54	104.9	0.9
Infinity	$0.5\ b\sqrt{2}b\times2b$	$\sqrt{2}\ b^2$	b^2+1^2b	$0.5\ b\ 2$	$2.9b^2$	0.9

The maximum value of induction corresponding to the maximum in the equivalent sine curve of magnetomotive force is

$$B=\frac{3.19\times0.9\ a\ n\ I\ K'}{2\ \Delta}=B=\frac{1.435\ a\ n\ I_0\ K'}{\Delta}$$

$$\Phi=B\ \tau\ L\frac{2}{\pi}=\frac{2}{\pi}\tau\ L\times\frac{1.435\ a\ n\ I_0\ K'}{\Delta}$$

$$I_0=\frac{\pi\ \Phi}{2\ \tau\ L}\cdot\frac{\Delta}{1.435\times n\ a\times K'}$$

Where I_0 = magnetizing current,

τ = pole pitch,

Δ = single air gap in inches (effective),

L = axial length of machine,

B = maximum flux density in gap in lines per square inch.

For a three-phase machine with four slots per phase per pole,

$$I_0=\frac{\pi\ \Phi}{2\ \tau\ L}\cdot\frac{\Delta}{1.435\times3\ a\times.9569}=\frac{\Phi\ \Delta}{2.62\ a\ \tau\ L}$$

For a two-phase machine with six slots per phase per pole,

$$I_0=\frac{\pi\ \Phi}{2\ \tau\ L}\cdot\frac{\Delta}{1.435\times2\times2\times0.9}=\frac{\Phi\ \Delta}{1.65\ a\ \tau\ L}$$

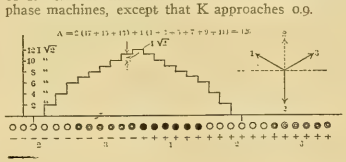
In the three-phase machine a = s × 4, and in the two-phase a = s × 1.225 × 6,

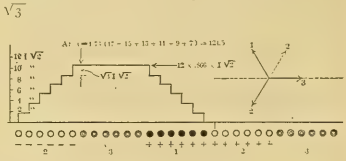
$$I_0\text{ three-phase}=\frac{\Phi\ \Delta}{2.62\times4\times s\ \tau\ L}=\frac{\Phi\ \Delta}{10.48\ \tau\ L\ s}$$

$$I_0\text{ two-phase}=\frac{\Phi\ \Delta}{1.65\ 1.225\times6\ s\ \tau\ L}=\frac{\Phi\ \Delta}{12.1\ \tau\ L\ s}$$

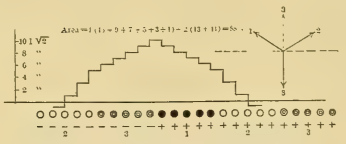
The magnetizing current in a three-phase machine is approximately 15 per cent. more than in the two-phase.

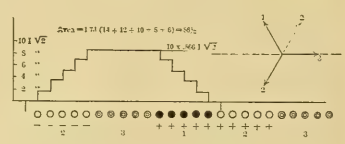
The load current of the three-phase machine is $\frac{2}{\sqrt{3}}$ times that of the three-phase machine, i.e., 15



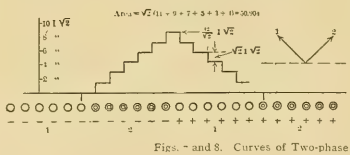


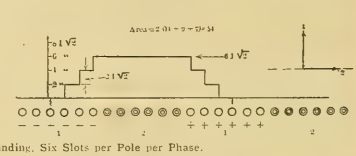
Figs. 3 and 4. Curves of Three-phase Winding, Six Slots per Pole per Phase



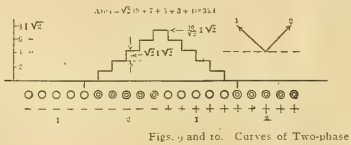


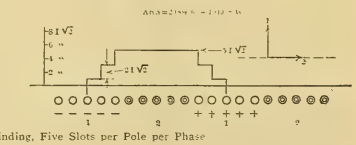
Figs. 5 and 6. Curves of Three-phase Winding, Five Slots per Pole per Phase.





Figs. 7 and 8. Curves of Two-phase Winding, Six Slots per Pole per Phase.





Figs. 9 and 10. Curves of Two-phase Winding, Five Slots per Pole per Phase

per cent. more; that is, the magnetizing current is the same when expressed in per cent of full load current both in the two-phase and three-phase machines. This, of course, assumes the same apparent efficiency in each case.

Copper Losses.

It has been shown that for the same value of flux we need 1.22 times as many conductors in the two-phase machine as are required for the three-phase Y connected motor of the same voltage. Considering the insulation space factor the same in each case, the two phase machine will have $\frac{1}{1}$ time the $\frac{1}{1.22}$ copper area.

As the current in the two-phase machine is $\frac{\sqrt{3}}{2}$ $=0.866$ times that of the three-phase machine, it follows that the current density of the two-phase machine is $\frac{0.866}{1.225} : 1$ $= 1.06$ times the current density in the three-phase machine and the copper loss is $(1.06)^2 = 1.123$ times as great, or, roughly, the copper loss is 12 per cent. greater in the two-phase machine.

Leakage Factor.

The leakage in a squirrel-cage induction motor may be said to consist of four components, stator-slot leakage, stator free-end leakage, rotor-slot leakage and rotor free-end leakage. Since the leakage factor is so complicated in its make up, it is impracticable to compare the leakage factors of two and three-phase machines by means of mathematical formulas.

Tests of a number of machines show that the leakage factor of a two-phase machine is from 20 to 30 per cent. higher than on the same machine wound for three-phase service, the variations depending upon the relative magnitude of the four components which go to make up the total leakage. As a fair average, the leakage factor of a two-phase motor may be taken at about 25 per cent. larger than that of the same machine wound for three phases.

Summary.

The following are the principal points brought out in this article relative to two and three-phase machines, and will aid the designer in deciding upon the proper ratings for machines when wound for two-phase service.

1. A two-phase machine should have 22 per cent. more conductors per slot than the corresponding three-phase Y-connected machine designed for the same voltage and flux per pole.

2. The magnetizing current is the same in both two and three-phase machines, when expressed in per cent. of the current which corresponds to the full-load output.

3. The copper loss of the two-phase machine is 12 per cent. higher than that of the three-phase.

4. The leakage factor of the two-phase machine averages 25 per cent. greater than that of the three-phase machine.

Even machines of the same phase and rating, which are made as nearly alike in every respect as is commercially possible, vary widely among themselves in their characteristics when put in test. This fact makes it very difficult to determine by test the relative behavior of two and three-phase machines, especially with regard to those characteristics which differ but slightly. There can be no doubt as to the higher temperature rise of the copper in the two-phase motor, occasioned by the higher copper loss. For the same reason the efficiency of the two-phase motor is slightly lower, the difference depending upon the relative magnitude of the iron and copper losses. Since the slip is equal to the ratio of the secondary copper loss to the total power input to the secondary, it is evident that the slip is greater on the two-phase motor. Calculations and tests indicate that the slip on two-phase motors is about 20 per cent. greater than in three-phase motors. Due to the increased leakage, the power factor on the two-phase machine is from one to three per cent. lower than on the three-phase motor.

"Reasons Why" for the Merchant.

In many a case where other advantages have appeared to be equal, actual count has shown that in stores electrically lighted, customers vastly outnumber those in places using open-flame illuminants. The reasons why, says Edison Light of Boston, are obvious. Merchandise, of no matter what character, looks better when displayed under the electric light; there are no dark corners or dark ends of counters; the air is not heated by the lights, nor is its oxygen destroyed, in any measure, by the glowing lights.

A new use has been discovered for the electromagnet. Recently a well driller in Greensburg, Pa., was drilling a well at a mine and at a depth of 250 feet the tools stuck. After fishing a long time for the tools, all of which were drawn out but the heavy point, an electromagnet, made to operate under water, was let down, and at the second trial the point brought up.

Grounding Secondary Alternating-current Services.[1]

By [illegible]

In the spring of [illegible] Electric Illuminating Company, [illegible] ing [illegible] the last [illegible] ter [illegible] all alternating [illegible] being [illegible] one dedication [illegible] the best and cheapest [illegible] connecting each [illegible] in the building.

The arrangement made [illegible] obtaining of permission from [illegible] bottom plate and [illegible] thought best to require [illegible] of building, it did not [illegible] the house. Before [illegible] effort was made to ground in the street as the [illegible] former. A large number of tests [illegible] over our entire territory demonstrated that it would be impossible to get [illegible] reasonable expense. These tests were made by digging and by driving, going as far down as to [illegible] It was then decided that all services where [illegible] than 20 were supplied from one transformer or main should be grounded individually on water pipes, and larger groups should be left for further investigation and trial of street ground. Our requirements for street grounds were that each should be tested and should be able to blow a six-ampere fuse on 115 volts. Up to the present time we have found that it was impossible to obtain these grounds except in a few places, and I believe it will be necessary to abandon this method entirely.

Having arrived at the conclusion that we would ground individual services, various conferences were held with the insurance interests and with the municipal authorities having jurisdiction, and certain detail rules were formulated by some of them as to the treatment of the ground wire in buildings.

In general, these rules required the following:

(1) All installations to be tested, and if below insulation requirements of the underwriters' general rules they could not be grounded, nor could any installation fed from same transformer or main. (This requirement was afterward modified to call for a minimum insulation of 10,000 ohms.)

(2) Wire to be treated as an electric-light wire, not less than No. 4, and to be run on outside of building as much as possible.

(3) A special clamp for water pipe was prescribed.

Several contractors were then sent out with instructions to install 12 grounds under these rules and submit a flat price per ground for covering all our territory, and two were afterward awarded the contract. Next, the tenant or owner of each building in which a ground was required was visited and permission obtained for doing the work. A certain amount of difficulty was encountered in this stage of the work, but a comparatively small percentage of refusals was received. Where the customer did refuse, he was required to sign a release, accepting the responsibility himself. On new business coming onto our lines, the installation of the ground wire by the building owner is made one of our requirements for service, unless he is willing to sign a release.

In some of the towns the water departments, and in one case a private water company, offered objection. The water departments were in all cases reasonable and ready to investigate and be convinced that it brought no risk to them, and they all have been satisfied. The water company refused to discuss, investigate, or argue the matter at all, ordered all grounds removed, and notified its consumers that after January 1, 1906, water service would be discontinued to any house where a ground wire was attached. This town was very nearly all grounded before the water company took that position. About 25 per cent. of the consumers have removed their grounds, signing a release to the Edison company, but no action has been taken against the others by the water company.

The insulation test requirement has been the one thing that has caused us the most trouble, as not only is there the labor of making the test, but one bad installation will, of course, prevent grounding all installations fed from the same source.

Practically all our services are grounded now except those held up by low insulation, and these are in the hands of the insurance underwriters to compel correction.

Discussion (in Abstract).

P. H. Bartlett: I am very much interested in Mr. Hosmer's paper, particularly as we have done a considerable amount of preliminary work in the same direction in Philadelphia. We are at the present time taking the matter up with the insurance interests. What I wanted to ask Mr. Hosmer about particularly is that the greatest trouble that we anticipate in connection with the grounding of these installations is that they will not come up to the installation requirements. I should like to ask —

[1] Paper read before the National Electric Light Association, Atlantic City, N. J., [illegible]. The author is superintendent of the installation bureau of the Edison Electric Illuminating Company of Boston.

[illegible]

where you have a good many secondary mains, you will find it advisable to carry out the idea of extending the neutral line and going to the expense of grounding each individual transformer on the water pipe.

The National Independent Telephone Convention Next Week.

Elaborate preparations have been made for the national Independent telephone convention to be held in Chicago next week. This is the second annual meeting under the present consolidated organization—the National-Interstate Telephone Association. The meeting will be held in the Auditorium Hotel, beginning on Tuesday, June 26th, and continue through Wednesday and Thursday. On Monday three important committees and the advisory board will meet to complete their reports and make final arrangements for the convention.

From all quarters there come reports of prosperity and advancement in the Independent telephone field, and an exceptionally large attendance at this meeting is expected. An excellent programme has been prepared, and something concrete, of value to the investor and the operator, is promised. The work of the association has been in the hands of competent officers and strong committees, with the result of an effective organization. Of the more important committees to report are the following: "Standard Forms of Accounting," Charles F. Bender of Pittsburg, chairman; "Standardization of Equipment," Samuel G. McMeen of Chicago, chairman; "Standard Operating Rules and Regulations," John F. Caspy of St. Louis, chairman.

Ample arrangements have been made for the entertainment of the delegates by the entertainment committee. The annual banquet will be held at White City on Wednesday evening at 6:45. Col. J. D. Powers of Louisville, Ky., will be toastmaster, and among the speakers are J. H. Shoemaker of Waterloo, Iowa; Jesse W. Weik, Greencastle, Ind.; C. E. Sumner, Portland, Ore.; N. F. Wing, Grass Lake, Mich.; J. Walter Barnes, Fairmont, W. Va.; H. M. Daugherty, Columbus, Ohio, and Elmer B. Jones of Salt Lake City.

Nearly all the state organizations have selected their delegates, which alone assure a large attendance at the convention. There will be the usual exhibits by manufacturers and supply men.

Following is the programme to be presented:

TUESDAY, JUNE 26TH, 2 P. M.

Address of Welcome—Mayor Dunne of Chicago.
Response—E. H. Moulton of Minnneapolis.
Annual Address—President James B. Hoge of Cleveland.
Officers' reports; appointment of committees.
Question Box.

WEDNESDAY, JUNE 27TH, 10 A. M.

Report of Entertainment Committee.
Roll Call of States.
Paper—"Official Organs—National and State," Charles S. Norton of Indianapolis.
Paper—"Look for the Shield," R. A. Walker of Des Moines.
Paper—"Telephone Publicity—Appealing to Public Opinion," Ivy L. Lee of New York city.

WEDNESDAY, JUNE 27TH, 2 P. M.

Standard Forms of Accounting—Committee report.
Paper—"Independent Advertising—Getting Results," W. B. Woodbury of Detroit.
Standardization of Equipment—Committee report.
Address—"Southern Toll Line and Exchange Development," L. G. Parker of Louisville.
Paper—"Telephone Revenues," W. P. Hemphill of Topeka.
Question Box.

WEDNESDAY, JUNE 27TH, 6:45 P. M.

Informal Banquet at White City—Col. J. D. Powers of Louisville, toastmaster.

THURSDAY, JUNE 28TH, 10 A. M.

Standard Operating Rules and Regulations—Committee report.
Paper—"Suggestions—How to Finance Small Telephone Properties," Theodore Gary of Macon, Mo.
Paper—"Texas," J. B. Earle, Waco, Texas.
Reports of Outstanding Committees.
Presentation of New Business.
Question Box.

THURSDAY, JUNE 28TH, 1:30 P. M.

Transaction of unfinished business.
Report of Nomination Committee.
Election and installation of officers.
Farewell Address—Dwight E. Sapp of Mt. Vernon, Ohio.

For the convenience of persons with impaired hearing 12 telephones have been installed in the First Methodist Episcopal Church, Washington and Clark streets, Chicago. Dr. J. P. Brushingham is the pastor. The telephones consist of an earpiece only and are connected with a large transmitting disk on the pulpit.

Automatic Telephone Exchange for Skibo Castle.

Andrew Carnegie has purchased of the Automatic Electric Company, Chicago, a complete private automatic telephone exchange of 20 lines, for his Scottish estate, Skibo Castle, Bonar Bridge, Sutherland, Scotland.

Mr. Carnegie's sister-in-law, Mrs. Lucy Carnegie, has an automatic exchange of 22 lines on her estate, Dungeness, on Cumberland Island, just off the coast of Georgia. The Dungeness exchange has been in operation over two years, and Mr. Carnegie was so pleased with its working that he decided to use the same system at Skibo Catle.

K. B. Weatherbee, Mr. Carnegie's mechanical engineer, was in Chicago during the latter part of May to familiarize himself with the automatic system, and expects to install the exchange at Skibo Castle in August.

The initial installation will be for 13 telephones,

FRONT VIEW OF SKIBO CASTLE.

five of which will be in the castle, one in the estate office, two in the stable and garage, one in the gamekeeper's lodge, one in the gardener's lodge, one in the golf house, one at the dock on Dornoch Firth, where Mr. Carnegie's yacht is kept, and one at the natatorium. The estate is about 10 miles square, and the automatic telephones will probably be scattered all over it eventually. The automatic system will replace an old magneto manual system that has been in use there for some time.

Telephone News from the Northwest.

The Wisconsin Telephone Company will soon start work on the construction of a local exchange for Durand, Wis.

The Northwestern Telephone Exchange Company will build 18 blocks of conduits in Fargo, N. D.

The Tri-state Telephone Company, operating local exchanges in Minneapolis and St. Paul, has issued a new form of bill which adds a charge of 25 cents per month for collection if the bill is not paid before the 10th of the month. Some think that this amounts to an attempt to raise the rates, which are now $2.50 for residences and $4 for business service. The Northwestern Telephone Exchange Company makes a discount of 50 cents per month if paid before the 10th, but the Tri-state is already charging the limit allowed by its charter and does not feel inclined to discount from these figures. The company declares that the charge is simply to expedite collections.

J. W. Ward has sold his Sauk Center (Minn.) and rural telephone lines to the Northwestern Telephone Exchange Company.

The Haven Telephone Company of Bordulac, N. D., will build 37 miles of telephone line.

The Northwestern Telephone Exchange Company has moved into its new building in Albert Lea, Minn.

A telephone company has been organized at Mazeppa, Minn., with Charles Marx as president and J. T. Hoffman, secretary. R.

Canadian Telephone Items

The Grand Trunk Pacific Railway Company has under consideration the establishment of a telephone service. While nothing definite has been decided upon as to this enterprise, it is believed that the scheme will be carried out and that within the next few years Canada will have a competing telephone service.

The Town Council of Ingersoll, Ont., has granted the Ingersoll Telephone Company a 25-year franchise. The company agrees to have its system in operation by January 1, 1908, with at least 3,000 subscribers. The company agrees not to sell or lease to the Bell Telephone Company. Rates must not be raised for five years from $15 for business and $12 for residence telephones.

At the annual meeting of the shareholders of the New Brunswick Telephone Company, held at Fredericton, N. B., on June 12th, the directors reported that the last year had been the most prosperous in the company's history. A dividend for the half year of four per cent. was declared. The new lines now being constructed between Fredericton, St. John, Newcastle and Bathurst will be in operation in a short time. Hon. A. G. Blair was re-elected president and Senator Thompson managing director.

The council of Fort William, Ont., has voted $10,000 with which to improve and enlarge the municipal telephone system. A multiple switchboard of 4,500 lines capacity will be installed in the main station and other improvements will be made. The switchboard now in use will be removed to West Fort and reinstalled in a sub-station to be built at once in that suburb.

The Town Council at Port Arthur has awarded a contract for the new telephone exchange, to cost $15,615.

The latest offer made to the city of Ottawa by the Bell Telephone Company for a five-year renewal of its franchise is $5,000 annually, the price of business telephones to be $45 and house telephones $25 for exclusive service and $20 for two-party lines. The city now gets $2,500 a year, while the rates are $45 and $25, respectively.

A branch of the Lorimer automatic telephone system of Chicago is being established at Peterboro, Ont.

Indiana Telephone Items.

The Advance Telephone Company has been incorporated to build in Vanderburg County. The capital stock is $6,500, and the principal exchange will be in Howell. The directors are headed by Henry Denzer and Henry Hartig.

The Central Union Telephone Company has completed its third copper metallic toll line between Indianapolis and Columbus, the preliminary work to the new exchange and exchange building which is now being built in Columbus. Along with these improvements the company has made a reduction of its toll rates. The company's lines run through Franklin, where a franchise is being sought. The council committee proposed to fix the maximum rate to be charged, but the company wants to work on an agreement not to charge more for the service than is charged in towns of similar size. The council would not agree to this proposition.

Local telephone companies have become so numerous in Hancock County that the public highways will scarcely afford sufficient space for the poles and wires. The Carrollton Telephone Company recently appealed to the county commissioners for relief against the Central Union Telephone Company, claiming that the latter was erecting its poles and stringing its wires along a highway already burdened with poles and wires to the injury of the service of existing lines. The commissioners ordered the latter company to place its poles and wires so as not to injure existing service, as is required by law.

The Indiana Horse Thief Detective Association gives much credit to the telephones in Indiana as an agency for ridding the state of many crimes and much thieving.

The plans agreed upon a year ago by the Independent telephone interests for a closer organization and to enter all the large cities and establish long-distance trunk lines are being worked out, notwithstanding the refusal of the Indianapolis Board of Works to increase the local rates in Indianapolis, which is one of the important links in the chain. The syndicate is nominally headed by James S. Brailey, Jr., of Toledo and H. S. Stifel of St. Louis. Mr. Brailey says that in bringing the Independents of each state into separate groups of close organization, the syndicate controlling the long-distance lines and dominating the large exchanges is laying the groundwork for greater plans. Mr. Brailey says the future of the Independents demands that all large cities be entered. S.

GENERAL TELEPHONE NEWS

C. B. Stark is asking the city of New Orleans for a telephone franchise.

The Missouri and Kansas Telephone Company will erect a new building in Coffeyville, Kan.

The Alpha Mutual Telephone Company of Newkirk, Okla., has been incorporated by E. Lindsay and others.

The Star Rural Telephone Company has been incorporated at Parkland, Okla., with a capital stock of $10,000.

H. F. Cannon has sold his telephone business in Cook, Neb., to the Johnson County Home Telephone Company.

The Strasburg Mutual Telephone Company of Strasburg, Ill., has been incorporated by J. F. Kull, Martin Hamm and L. J. Kircher. The capital is $10,000.

It is announced in Denver, Colo., that the Colorado and Eastern Telephone and Telegraph Company, recently incorporated in Colorado, will build telephone lines to Kansas City and Omaha, thus effecting telephone communication between Denver and Chicago, St. Louis, Kansas City and Omaha. The new lines will consist of three copper metallic circuits between Denver and Omaha and Denver and Kansas City. The Denver-Kansas City line will be constructed first, connecting with the Pueblo, Colorado Springs and Denver exchanges.

A proposition was received at the Chicago City Council meeting this week from Arnold Kalman, 315 Postal Telegraph Building, Chicago, for the installation of a telephone system in Chicago similar to the Kansas City Home Telephone Company's

system. Mr. Kalman said he was backed by the men who installed the Kansas City system, and that he desired a hearing before a council committee. The matter was referred to the gas, oil and electric light committee.

The annual report of Manager F. E. Eberle of the Lincoln Telephone Company of Lincoln, Neb., contains the following figures: Earnings for 12 months, based on earnings for December, 1905, $84,000; gross annual income for 1905, $77,060.44; net annual revenue, $30,006.39; surplus for dividends, $14,581.72; telephones in operation December 31, 1905, 3,583. Several hundred miles of toll lines were constructed during the year, so that now the company's system is connected with all the important towns of the state. The equipment is of the Automatic Electric Company's make. The cost of operation per telephone per year based upon the month of January, 1905, was about $1.12 greater than the cost of operation per telephone based upon December, 1905. This latter fact apparently goes to show that the maintenance cost of the automatic telephone decreases with the increase of the number of instruments connected.

MANUFACTURERS AND DEALERS.

A recently established company is the National American Telephone Company of 141 South Clinton Street, Chicago, manufacturer of telephone supplies. Its specialty is an intercommunicating type of telephone embodying several new and improved features.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards in the following places: Lansford, N. D.; Willow City, N. D.; Beaumont, Tex.; Page, N. D.; Colton, S. D.; Osawatomie, Kan.; Carter, Wis.; Chicago, Ill.; Galias, Me.; Sutton West, Ont., Can.; Bedford, Ind.; Grimes, Iowa; Ames, Iowa; Larrabee, Iowa; Ludlow, Ill.; Dieterick, Ill.; Streator, Ill.; Hoople, N. D.; Ashland, Mo.

Single-phase Equipment for Richmond and Chesapeake Bay Railroad.

In the early days of electric railroading, Richmond, Va., was among the first to install a street railway, and in the year 1888 the Sprague system was installed and successfully operated in the city on a commercial basis. This glimpse of early railroad history is called to mind by the fact that Richmond is taking the same initiative by adopting the latest development in railway traction, the single-phase alternating-current system.

To this end, the Richmond and Chesapeake Bay Railway Company has been incorporated, and, in accordance with its plans, about 15 miles of track will be equipped immediately with single-phase apparatus. Eventually this single-phase road will extend from Richmond to Chesapeake, but the portion about to be electrified comprises that part lying between Richmond and Ashland. The contracts for the equipment of this section have been let to the General Electric Company.

The line in general will follow the plans which several roads in the Middle West have adopted, but the trolley voltage will be higher. The catenary method of suspension will be used, adapted for a trolley potential of 6,600 volts. Each of the cars will be shipped with four GEA-603 (125) alternating-current single-phase motors. Multiple-unit control will be furnished, using the Sprague-General Electric system, and in this connection it is interesting to note that the road first to employ the Sprague direct-current system commemorates this bit of railway history in adopting the Sprague-General Electric system of multiple-unit car control. The air-brake system will be of the combined straight and automatic type, with CPA-52 motor compressors.

Power for the operation of the new road will be furnished by the Virginia Passenger and Power Company, and the arrangements for furnishing the single-phase current are of especial interest. Two generating sets will be furnished, both to be operated ordinarily by waterpower, but arranged for electrical drive when that is necessary. The first unit will consist of a 750-kilowatt 6,600-volt three-phase 25-cycle generator, mounted on the same shaft with a 750-kilowatt 2,300-volt 60-cycle three-phase generator, the shaft being extended at one end for connection with a waterwheel of sufficient power to drive both generators at their rated output.

The second set will be made up of a 25-cycle 6,600-volt generator, a duplicate of the first, but instead of being mounted with a 60-cycle machine, this generator will be mounted on the same shaft with a 750-kilowatt 550-volt direct-current machine. When there is sufficient water to operate all of the waterwheel generators in the station, these sets will be driven by the waterwheels. If at any time, however, there is sufficient water to drive the generators or flood conditions render it advisable to close the gate valves, the sets will be disconnected from the wheels and operated as straight motor-generator units. In their respective cases, the 60-cycle generator will run as a 60-cycle synchronous motor and the 550-volt machine will operate as a direct-current motor. Power for driving the motor end of the 25-cycle sets in this way will be obtained from the engine-driven units of the Virginia Passenger and Power Company already installed. When the motor-generator sets are operated as waterwheel driven [illegible] the 60-cycle generator will be operated in parallel with the present 60-cycle machines, and the [illegible] set will be run in multiple with the present [illegible] machines. The 750-kilowatt 25-cycle generator in each set will, for the present, be operated as single-phase machines, and will supply current direct to the trolley of the Richmond and Chesapeake road at 6,600 volts.

In addition to the main apparatus outlined for the road, there will be a lighting station at Ashland. This will consist of a 100-kilowatt 2,300-volt 60-cycle three-phase generator, mounted upon a common base with a 150-horsepower [illegible] 25-cycle single-phase induction motor. This set will be operated from the 6,600-volt trolley through a 150-kilowatt single-phase oil-cooled transformer. The motor-generator set will be provided with a direct-connected exciter, mounted on an extension of the shaft. The voltage will be controlled by a Tirrill automatic regulator, made by the General Electric Company, which will insure a uniform voltage at the generator end of the lighting service, regardless of the fluctuating trolley voltage.

The Richmond and Chesapeake Bay road to be so equipped will practically parallel the Richmond, Fredericksburg and Potomac steam road from Richmond to Ashland, and it is the intention of the trolley company to maintain a fast schedule between these two points, operating cars at very frequent intervals.

Experience of Central Stations with Lightning Trouble.

Some interesting information was gathered upon the subject of lightning trouble by the committee of the National Electric Light Association, composed of Alex Dow (chairman), C. A. Honnold and Robert S. Stewart, who reported to the Atlantic City convention on the subject of protection from lightning during 1905. Statistics were obtained by them through the agency of a circular letter sent out to each of the companies belonging to the association. Following are the results of the investigation, given in condensed form.

Two-thirds of the companies have been practically free from trouble. This proportion holds in the high-tension as well as the low-tension plants. In the plants of large kilowatt capacity this is apparently reversed, but, when it is considered that one transformer was lost for every 1,850 kilowatts station capacity under 10,000 volts and one for every 5,400 kilowatts capacity over 10,000 volts, it is surprising that more of the large plants are not in the troubled class.

The money value of property destroyed by lightning is extremely small compared with the value of the plants, for, even when transformers are burned out, they can be repaired at a moderate expense. The principal loss is due to interruption of service.

The freedom from trouble is due largely to the increased use of lightning arresters and largely to the high grade of insulation in modern transformers and generators. Every year, as old transformers are replaced by newer types and as defective lightning arresters are replaced by more efficient types, properly located in the system, the troubles should diminish.

The standard station at the present time runs at 2,300 volts, 60 cycles, three-phase. There are a large number of two-phase stations operating below 10,000 volts, but above 10,000 volts practically all plants are three phase. The average size of stations below 10,000 volts is 1,540 kilowatts and of stations of 10,000 volts and over is 4,840 kilowatts.

There has been quite a little trouble with burned-out graphite resistances in lightning arresters. This resistance is a very variable quantity, being greatly affected by electric discharges. Carborundum and other mixtures are used in the latest types, and resistances of these materials seem to be constant and do not fly to pieces as the graphite rods do. The wire resistances in the Westinghouse low-equivalent arresters have also burned out in several cases. Objection is made to the wire resistance that the path to earth is very far from straight, and that the choking effect of this circuitous path must be great.

Transformers burned out have been usually the small, old, air-cooled type or switchboard series or shunt transformers. Very often transformer fuses are blown or lightning jumps from the transformer lead to the case, without injuring the transformer.

Wattmeters are frequently burned out. The damages are slight, and there is usually no interruption to the service, but the company loses quite a little while the meter is not registering.

There has been little trouble with the main generators. In one high-tension plant the two generators, which are well protected by arresters, have burned out repeatedly during mild storms. All burnouts have been short-circuited coils, and none have been due to discharges to earth. These generators are 200-kilowatt 6,600-volt three-phase Y-wound machines, and both the inductance and the length of wire in the armature are consequently very great. It is very possible that the length of the static wave in the armature is reduced so much by the inductance that it is sometimes comparable in length with [illegible]

[illegible] would be effective.

Very few [illegible] their high-voltage [illegible] of wire in the armature [illegible] is smaller. The [illegible] longer compared with the length [illegible] armature [illegible] trouble in high-voltage [illegible] due to this [illegible] protected by [illegible] the leads punctured on the transformer side of the choke coil. The question [illegible] of the choke coils if they did not [illegible] Possibly the choke coils added [illegible] inductance and length to the transformer [illegible] reduce the potential difference across the arrester for that particular discharge. [illegible] guarded against, when choke coils were [illegible] by connecting arresters to both the transformer side and line side of the coils.

Choke coils are usually installed in high-tension plants, but in plants under 10,000 volts choke coils are not very common. No arguments, for or against their use, can be deduced from the replies received, for the main generating stations have had few burnouts. Many series transformers on station switchboards have been burned out, both in stations protected by choke coils and in those unprotected. A considerable part of the discharge must have passed the choke coils to burn out this apparatus. Experiments have shown that choke coils reduce the strain on the ends of the windings of generators or transformers, and they should therefore prevent this apparatus from receiving as high a potential strain as that required to brake down the arresters.

Overhead ground wires are rarely used. On distribution lines they are a menace to the linemen and have been taken down, after trial, by several companies. Barbed wire is especially troublesome. The benefit derived from overhead ground wires on distribution lines is doubtful. On transmission lines they are of undoubted service. The few companies that use them report that they are well satisfied, and some are even enthusiastic. It is still a disputed question as to whether they are worth the cost. There is danger of trouble from breaking of these ground wires unless they are very heavily galvanized iron or heavy copper wires, and either of these would add considerable to the cost of a line.

Most companies have learned from "before and after" experience that lightning arresters are absolutely necessary. As to the location of these, many feel that they have not enough on the lines. One very good way of telling where new arresters are required is to keep a special map of the distribution system, and mark on this the location of any burnouts. Lightning may never strike twice in the same place, but it often makes itself manifest in the same part of a distribution system. A system of different marks can easily be arranged to show what kind of apparatus was injured, how it was protected by arresters, how severe the storm, etc. Much more can be learned from such a map than from the records usually kept.

It should be remembered that, except on railway lines, arresters should be located near apparatus to be protected or on junction poles. It is very good to have a general rule as to the proper number of arresters per mile, but the rule should be flexible enough to permit of locating arresters near transformers. If there is a long distance between transformers, the capacity of this line helps very materially in keeping down excessive potential strains, and therefore needs no arresters.

On transmission lines arresters should not be scattered along the line, for an arrester is a weak spot on the line, and should be placed where it can be inspected from time to time. Apparatus connected to the line is what needs protection rather than the line itself.

The chief cause of trouble in the arresters seems to be due to failure of arresters to discharge, though there was nearly as much trouble due to too violent discharges through arresters. Apparently there is little trouble in the average station from discharges between line wires. Many such discharges, however, may not have been recognized as such. Static discharges are assumed as going

to earth unless there is positive proof to the contrary.

Short-circuits and sudden changes of load do not seem to have set up high-frequency currents that damaged insulation very much. In one plant high-tension cables were sometimes punctured from this cause. In another case a 20-kilowatt transformer was burned out, and probably this was the cause rather than the result of the short-circuit. No other short-circuits reported were followed by damages that could have been brought about by high-frequency currents. Experimental tests and several actual examples show how destructive high-frequency currents set up by short-circuits and sudden changes of load may occasionally be, but in the average plant the conditions do not seem to be just right for setting up these dangerous oscillations.

One argument for overhead ground wires is that the poles and insulators are protected thereby. Only 25 per cent. of the companies replying to this question have had poles struck, and on the poles struck few insulators were broken. One pole was struck for every 2,860 kilowatts capacity of station. One pole was struck for every 19 miles of high-tension transmission line and one insulator was broken for every 62 miles. Interruptions to service, due to broken insulators, are very rare and are confined to special localities. Every company should be able to tell from its past history whether or not special precautions should be taken to guard against broken insulators and poles.

Are the damages to apparatus caused most frequently by severe storms, by mild storms or by static charges on the wires? Practically all who replied to this question have most trouble from severe storms. Four have had the same trouble from static as from severe storms. Arresters which discharge freely, or, in other words, which do not have too much resistance throttling the discharge, should therefore be most useful. The long air gap generally required for such an arrester prevents it from handling the occasional trouble from static charges and mild storms. An arrester with a long air gap, part of which is shunted by a high resistance, is equally effective in both severe and mild storms.

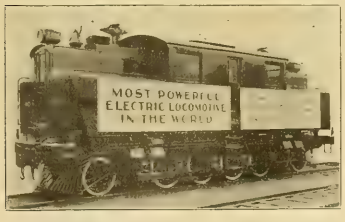
The South Atlantic, Central and Northwestern states appear to have had the most trouble. The Rocky Mountain district reported no trouble except in two large plants in Utah and Colorado. The New England, North Atlantic, Pacific and Southwestern states had about the same amount of trouble as the average of the entire United States.

As over one-third of all the reports come from New England, New York and Pennsylvania, the conclusions concerning the trouble in most of the United States are based on meager testimony. Except in New Mexico, Arizona, South Dakota and Nevada, the reports are very well scattered over the United States.

The portions of the United States in which lightning was most destructive were as follows: Southeastern Minnesota, Iowa, Missouri, Illinois, Eastern Ohio, North Carolina and Northern Georgia. It may be that the companies reporting from these sections were more unlucky than the others.

New York Central Electric Locomotive at Atlantic City.

One of the 100-ton electric locomotives which the General Electric Company and the American Locomotive Works are furnishing for the electrification of the New York Central lines in New York city arrived in Atlantic City, N. J., June 8th, from Schenectady, N. Y. During the attendance



NEW YORK CENTRAL LOCOMOTIVE AT ATLANTIC CITY.

this month at various electrical and railroad conventions prominent officials from all parts of the country will have an opportunity to inspect the locomotive. Its capacity under ordinary working conditions is 2,200 horsepower, and it is said to be able to develop a speed of 80 miles an hour when in regular operation. The locomotive is the same type as the famous "6,000" which has so many times distanced its steam competitor while working out on the test track on the New York Central road near Schenectady, but bears on its side the number 3404 and the inscription "New York Central Lines."

The locomotive is attracting much attention at the Pennsylvania side track, where it is in charge of representatives of the two companies which have been co-operating in its manufacture. The electric locomotive is primarily on the ground to serve as an actual example of what the railway master mechanics will encounter in their daily work within a very few years. It was for the convention of the Master Car Builders and Railroad Master Mechanics that the electric locomotive was shipped from Schenectady, and its early arrival was very timely and of considerable interest to the electrical men who visited Atlantic City during the National Electric Light convention week.

An Amateur's First Dynamo.

By T. H. Reardon.

About 15 years ago, at a time when dynamo design was rather an indefinite proposition, the writer was invited by a friend to drop in and see a small machine shop. The shop in several ways was unique and up to date, especially in the matter of economical operation, being equipped with a good-sized lathe, a drill and steam engine and boiler for supplying power.

A glance about the place, for the purpose of ascertaining what particular agent went on duty when "Old Sol" took off his overalls, revealed three kerosene lamps that looked as if they had seen better days—that particular fact, however, being even more uncertain than dynamo design.

Upon asking the proprietor how he managed to find himself in case he got lost in the shop after sundown, he answered that he never did much work by artificial light, and if a tool dropped on the floor he never looked for it till next day, as he had a very complete line of tools.

The idea of a small dynamo, inexpensive, and one that could be built right in the shop, was suggested, it being further suggested that such things as pulleys, shafting, etc., required were in evidence already, laying about the place as useless material.

The idea "took" all right. The capacity was next discussed. The shop owner was positive he would never want more than six or eight 16-candlepower lamps, and that number would only be used on grand occasions. Using a liberal factor of safety, the design was worked out for a maximum load of 20 16-candlepower lamps.

Economy in first cost was the prime consideration. The disks for the armature core were ordinary wrought-iron washers one-eighth-inch thick, 3½ inches in diameter, with central hole two inches in diameter. A 1¼-inch shaft was driven through a suitable hole in a block of seasoned hardwood, placed in the lathe and turned up for the reception of the washers—the embryo armature core. Then followed the winding—24 coils, drum armature, 10 turns per coil, voltage 52, speed whatever happened to be required; field, bipolar, gray cast-iron; weight 450 pounds.

The machine was completed in a relatively short time. The owner was so intensely pleased that he could hardly be restrained from running it night and day. Lamps were frequently added, and in three months there were 22 lamps on the machine. Further, a friend of the shop owner approached him, and wanted to know if he could run a pair of leads to his house nearby and give him 10 lamps for special occasions, without depriving himself of the effulgence that reigned in place of the smoky kerosene flame.

At this particular time expert advice was needed very much. The designer was sought and asked to make a suggestion that would make it possible to extend a favor that was very much desired. The suggestion made was as follows: Discard your 52-volt lamps, use 75 volts on your system, and hustle the machine until you generate the desired voltage; then put on 10 additional lamps, and your amperage will still be within the limits of safety. The speed, which was 2,300 revolutions per minute, went up to 3,300 revolutions per minute. The scheme was entirely successful, was in operation for two or three years, when a new slow-speed dynamo (800 revolutions per minute) was built by the same people to take its place, the first machine being sold to a clever individual, under whose management it showed the highest commercial efficiency of any dynamo ever constructed, giving 20 16-candlepower lamps for a year, the cost of same, in a certain sense, being nothing. The particulars were as follows:

The buyer had a 10-horsepower electric motor for running machinery in his shop at a fixed rate per year. He wanted 20 16-candlepower lamps, which, if served directly from the electric company's wires (the cheapest for the lighting company) would cost at that time 20 cents an hour, but by using the electric motor to run the amateur dynamo the 20 lamps were obtained all right and the current for lighting did not pass through any meter to extort coin from a man well up in clever methods, even though he was lacking in the "fundamentals" of electrical science.

The dynamo saw its last days in a paper-mill fire, but it was too highly prized by its owner to be relegated to the scrap heap; the armature was sent to a standard electric firm for rewinding; then it was discovered by the wizards that it was a terribly cheap armature; the shaft was made in three pieces for economy of material, and the wrought-iron washers from the hardware store did not correspond with the latest ideas in the theory of perfect lamination; it was therefore pronounced dead by Dr. Expert.

Large Isolated Electric Plant in the Heart of Pittsburg.

The electrical equipment of modern office and mercantile buildings has attained far greater proportions than is generally known, as, aside from illumination, there is a broad field for electric motors, their practically noiseless operation, cleanliness and compactness rendering them especially applicable to general power work such as operating ventilating systems, refrigerating appliances, elevators, water and sewerage pumps and the many classes of apparatus that make up the equipment of large buildings. Further, the high efficiency, ease of control and minimum amount of attention required give the electric motor, from the standpoint of economy, precedence over other methods of operation.

To illustrate practically the many applications enumerated, a description of the central power plant of the estate of Henry W. Oliver, Pittsburg, Pa., will be both interesting and instructive. It is located in the heart of the city's business center

FIG. 1. THREE 200 KILOWATT UNITS IN PITTSBURG ISOLATED PLANT.

and furnishes light, heat and power to several large office buildings and churches, the McCreery department store, Duquesne Club and a number of smaller consumers.

This very interesting and completely isolated plant has a total capacity of 1,459 kilowatts, wired in load, which, with contemplated extensions in the near future, will ultimately increase to approximately 3,000 kilowatts.

The Westinghouse three-wire direct-current system of distribution is used, with an electromotive force of 220 volts between outside mains and 110 volts between each main wire and neutral.

The Westinghouse three-wire system was designed for the purpose of obtaining all the advantages of distribution without the necessity of using two separate machines or a balancing set, and to gain the additional efficiency of one large machine over two smaller ones.

The main features of the three-wire generator are the same as those of an ordinary direct-current machine, with the addition of four slip rings, which are connected to the armature winding by taps at four electrically equidistant points for each pair of poles. From these rings, wires are carried to balancing coils, with their middle points connected together to form the neutral of the system. By this method the unbalanced current in the armature is practically evenly distributed, and the machine will operate satisfactorily with a 25 per cent. unbalanced load.

Babcock & Wilcox boilers, with a total capacity of 2,000 horsepower are used. These are divided into four batteries of 500 horsepower each, operating at a pressure of 150 pounds. Each boiler is provided with chain grates, manufactured by the Green Engineering Company of Chicago, Ill.

The coal is elevated from the storage bins to a traveling hopper by means of a coal conveyor. Scales in the cage beside the hopper provide a means for weighing all coal used. Both the conveying apparatus and traveling hopper are operated by electric motors, and are easily and quickly handled. The hopper travels on an elevated track the length of the boiler room and is controlled from the floor by the fireman.

The generating units consist of three 200-kilowatt Westinghouse 220-volt direct-current three-wire generators, direct connected to three Ball vertical twin-compound engines of 325 horsepower each, operat-

ing at an approximate speed of 300 revolutions per minute. These machines are shown in Fig. 1. There is also one Westinghouse 375 kilowatt generator of the same type connected to a Ball & Wood type vertical cross-compound engine of 600 horsepower operating at 130 revolutions per minute (Fig. 2).

Current is transmitted by lead-covered cables to the switchboard, which is of the standard West-

FIG. 2. A 375 KILOWATT UNIT IN PITTSBURG, ISOLATED PLANT.

inghouse three-wire type, with panels of white marble.

As the series field coils of the generators are divided in halves, one half being on each side of the circuit, the protective devices and measuring instruments receive special consideration. Circuit-breakers are provided with special equalizer contacts, to insure the opening of all circuits in case of excessive loads or short-circuits. Two ammeters are used with each generator, so that the load on both sides of the system may be observed. They are connected to the machines by special shunts mounted directly on the contact blocks and interposed between the series coils and armature—one on the positive and one on the negative side.

A double-reading ammeter is connected in the neutral of each machine, to show the amount of unbalanced load. A voltmeter connected across the main bus-bars indicates the potential at all times, and a second voltmeter, arranged to be connected

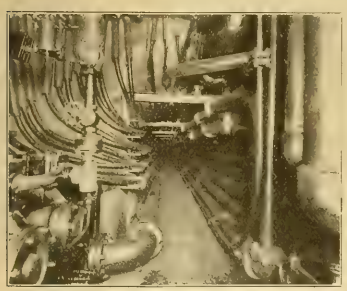


FIG. 3. TUNNELS FOR WIRES AND PIPES IN PITTSBURG ISOLATED PLANT.

to each motor by four-point voltmeter receptacles, enables the operator to adjust the voltage for paralleling. Two double-pole generator switches, two double-pole balance-coil switches and a shunt-field rheostat complete the equipment of each generator panel.

The balance coils are located conveniently upon a shelf, near the ends of the switchboard.

Feeder panels are provided, with instruments similar to the generator panels, with the exception of the field rheostat and balance-coil switches. A load panel is provided for measuring the total output of the station, upon which is mounted a Bristol recording voltmeter, two recording ammeters of the same make, and a switchboard-type integrating wattmeter.

A daily record is kept of the readings of the various instruments on specially prepared blanks with spaces for hourly readings of the voltage and current. At the bottom of each sheet spaces are provided for the total of the hourly readings, average amperes per hour, readings of wattmeters and total watt-hours, furnishing valuable records which enable the efficiency of the employes to be checked, and an estimate to be made of the fuel and supplies necessary at any season of the year.

The distribution system is extensive, owing to the large area supplied with power. A tunnel (Fig. 3) extends from the power plant to the McCreery

FIG. 4. ROW OF MOTOR-DRIVEN REFRIGERATING PUMPS IN PITTSBURG, ISOLATED PLANT.

plying 27 electric motors, ranging from one-half to 50 horsepower, 486 arc lamps, 928 16-candlepower and 600 eight-candlepower incandescent lamps. The feeders for supplying current for this load are composed of 2,370 feet of lead-covered cable, 1,600,000 circular mils in area; 2,340 feet of lead-covered cable, 1,400,000 circular mils in area, and 7,941 feet of paper-insulated cable, 1,000,000 circular mils in area, all manufactured by the Standard Underground Cable Company.

The Smithfield and Wood Street properties are supplied by 4,620 feet of lead-covered cable, 1,000,000 circular mils in area, each leg being approximately 250 feet long, for supplying the balance of the consumers. The cables are all supported by the latest improved methods, and present a very neat appearance.

The refrigerating apparatus for furnishing refrigeration to the McCreery store kitchen and drinking water for the building is located in the rear of the switchboard in the power plant. Fig. 4 is a view of the line of motor-driven refrigerator pumps driven by Westinghouse motors, ranging from 3½ to 15 horsepower.

There are several interesting motor applications in the McCreery Building, among which may be mentioned the 30-horsepower constant-speed Westinghouse motor, operating a cold-air fan for ventilating purposes; two eight-horsepower Westinghouse type S, 220-volt motors operating elevator safety devices, and a 25-horsepower Westinghouse constant-speed motor driving a sewage-pumping outfit to raise the building sewage to the level of the street mains.

A New Insulator Pin.

In the description of the transmission line and third-rail system of the Long Island Railroad, published in the Western Electrician of June 9th, attention was called to the new type of iron insulator pin employed. This pin, which is a radical departure from previous practice in pin design, is the invention of W. N. Smith of Westinghouse, Church, Kerr & Co., who has applied for a patent on the device. The design has been further improved and arrangements are now being made for manufacturing and placing it on the market under the name of the Smith-grip insulator pin.

It combines several important advantages as follows: It does away with the necessity of boring holes in the cross-arms, thereby conserving the whole strength of the arm and lengthening its life; the metal composing it is distributed in the most effective manner possible, as its cross-section is greatest next to the arm where the greatest resistance to bending is required; and, finally, the shrinkage of the arm can effectively be taken care of by the U bolt and strap, as there is no tendency to distort the bolt, and consequently there is no possibility of the pin standing crooked upon the arm after the shrinkage has been taken up. Furthermore, it is practically indestructible, and instead of being one of the weakest factors in line construction this pin is expected to be the strongest.

More than 8,000 of the pins as originally designed and shown in the accompanying illustration were used in the transmission line construction of the Long Island Railroad, carrying 250,000-circular-mil cables in spans averaging 150 feet in length, and no failures have yet been reported after over a year of service. A dozen or more standard sizes of the improved design are being worked up to fit several sizes of cross-arms and pole-tops and

Electrical Works of the Allis-Chalmers Company in Cincinnati.

construction, well lighted and ventilated. As a group, the buildings of this plant present an appearance which is far above the average being faced with buff-colored pressed brick, and designed extremely well to make a pleasing architectural effect. As shown in Fig. 1, all buildings, with the exception of the foundry, face on Forest Avenue, and are provided with wide and well-kept grass plots between the pavement and the building proper.

The foundry building is 202 feet long by 103 feet wide. The structure is so arranged that it may be readily extended in the rear toward the pattern-storage building if a larger capacity is at any time required. The foundry is equipped with two cupolas, with a capacity each of 12 tons an hour. The main bay of the foundry is served by two electric traveling cranes of 25 and 15 tons capacity, respectively. Each of the side bays is served by a

A NEW INSULATOR PIN.

smaller five-ton crane. Coke-heat, core ovens are employed for the treatment of cores and molds.

The second building, opposite the main buildings and facing them, is the pattern shop and pattern-storage building. This building is new and of modern construction throughout. It is 53 by 216 feet and four stories in height. The slow-burning mill type of construction has been followed, the floors being of heavy timber, with no openings of any description. A tower in the rear of the building contains the elevator, staircase and electrical wiring. There are no openings from this tower directly into the various floors of the building, but at each landing a fireproof sliding door leads into the main building. The heating system is carried out by means of the hot blast, all the air ducts being built

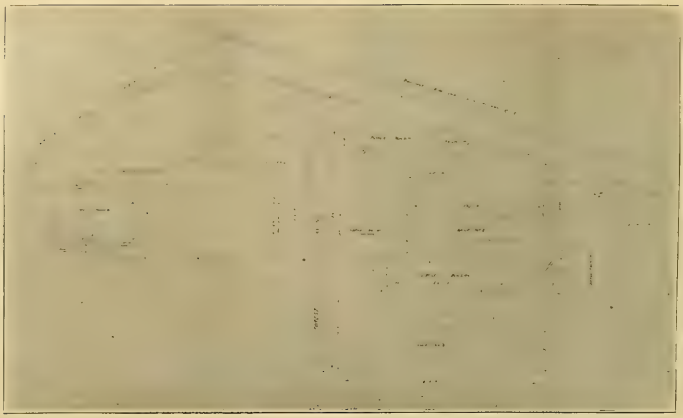


FIG. 1. GROUND PLAN OF ALLIS-CHALMERS COMPANY'S CINCINNATI WORKS.

in the walls, thus avoiding the use of galvanized-iron pipes. Each floor consists of a single large room, the two upper ones being provided with suitably numbered racks for storing patterns. The storage capacity is approximately 30,000.

Machine shop No. 1 (Fig. 2) of the main group opposite the pattern building just described, is one of the original Bullock buildings, 102 by 462 feet. The equipment throughout is composed of motor-driven machine tools of all kinds used in the manufacture of electrical apparatus. The building is identical in general appearance and construction

FIG. 2. SHOP NO. 1 AND POWER HOUSE OF ALLIS-CHALMERS WORKS, CINCINNATI.

with the others of the group. The central bay is served by two cranes of 20 and 30 tons capacity, respectively, and the side bays each by a five-ton crane. In addition to the machine-tool work performed in shop No. 1, a portion of the armature winding for large machines is carried on here, and a testing department for the smaller machines has been provided in the front portion of the building. The Allis-Chalmers motors, used to drive the machine tools, are operated on the multiple-voltage system of variable-speed control.

In each machine shop there is a separate balancer

FIG. 3. SHOP NO. 2, SERVICE BUILDING AND ADMINISTRATION BUILDING OF ALLIS-CHALMERS COMPANY.

installed for splitting the voltages, and which may be used independently in case of the failure of those installed in either of the other shops. The connections of these balancers are such that one set may be made to carry the load of the others.

Machine shop No. 2 (Fig. 3) is identical in general appearance with the other buildings of the group. It is 100 by 303 feet, and two stories in height. The roof has a wide skylight area, which secures a flood of diffused light to the interior of the building. This unit, with the others of the group, is also heated by means of the overload blower system, which draws in fresh air, and, having passed it around steam-heated pipes, blows it out through the tubes. This same system keeps the shop at an even and agreeable temperature in summer by the circulation of cooled air.

A five-ton electric traveling crane serves the entire length of the shop. An industrial railway connects the punch department with the annealing. At both ends of the shop, freight elevators, driven by electric motors, connect the upper and lower floors. The drying ovens are also connected directly with the insulating department by means of a smaller elevator.

On the first floor is located the punching department, where the sheet-steel punchings for armatures and field poles are made. This shop is provided with a complete equipment of motor-driven punch presses. On this floor the armature cores for direct-current dynamos and motors, and the stator cores for small alternating-current machines, are assembled. The commutator department is located at the rear, and in a room separated from the remainder of the building by fireproof walls, the punchings for armature and stator cores are annealed and japanned.

The annealing equipment consists of two ovens arranged for oil fuel, each oven with a capacity of about 30,000 pounds of steel at each charging. These ovens are of latest design, provided with recording pyrometers and arranged so that the heat is under complete control at all times. The upper floor of shop No. 2 contains the coil-winding department, where armature, field and transformer coils are wound and insulated.

In this shop every machine tool, from the ponderous drill presses, making laminations for turbo-generators, to the small taping machines for insulating armature coils, is driven by an individual electric motor. The initial cost of many of the smaller tools is somewhat increased by driving each separately; but by this arrangement the machines are rendered independent of each other, so that an accident to one does not interfere with the operation of the others. The system becomes also extremely flexible. Not only can the tools be moved to the work, when it is desirable to do so, but they can be shifted easily from one portion of the shop to another without disarrangement of the power connections. Other advantages are clear headroom, better light, freedom from dirt, economy of operation (as power is only used when the machines are working) and reduction of the liability of accidents to employes. The greatest advantage to be derived from this individual drive, however, is the increased output, due to the fact that the machines can be run at the proper speeds to suit the work. As labor is the greatest single item of expense in a machine shop, a very small percentage of saving in its cost per year will more than balance a comparatively large initial increase in the expense incurred for tools.

Shop No. 3, a general interior view of which is shown in Fig. 4, is 462 feet long, the front portion being one story high and 176 feet wide, while the rear portion is 107 feet wide and two stories high. The two-story extension in the rear is a recent addition; it is of ferro-concrete construction and is faced with brick on the outside to match the other buildings. Both upper and lower floors are divided into bays by rows of columns, and on the lower floor two 10-ton cranes are provided; the work on the upper floor being of a lighter character, two five-ton cranes are installed. An elevator is located at about the middle of the extension. On the second floor are the tool room and brass department for the manufacture of small brass parts entering into the construction of machines. The front portion of this unit is used for the construction of large machines and is divided into three bays. The central bay is 68 feet wide and 60 feet high under the roof trusses and is equipped

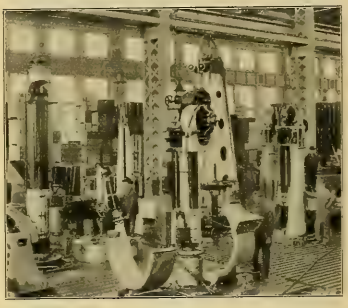


FIG. 5. PORTABLE TOOLS IN ALLIS CHALMERS CINCINNATI WORKS.

with a 60-ton traveling crane, having a 50-foot lift. Each side bay is 48 feet wide, one served by a 20-ton crane and the other by one of 30 tons capacity. Part of the central bay is provided with iron floor platens for the use of portable drills, slotters, etc. Fig. 5 shows a few of the portable tools installed here, equipped with motor drive.

The works power house and boiler plant are located alongside of shop No. 1. The power-house

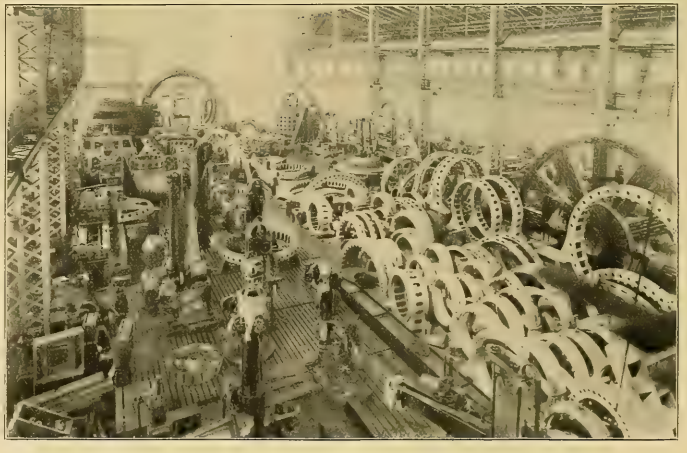


FIG. 4. INTERIOR OF SHOP NO. 3 OF ALLIS-CHALMERS COMPANY'S CINCINNATI WORKS.

equipment consists of two Allis-Chalmers 800-kilowatt 240-volt direct-connected engine-type generators, one of which is driven by a Lane & Bodley engine, and the other by an Allis-Chalmers-Reynolds cross-compound Corliss engine. There is further equipment, consisting of a small 100-kilowatt unit and an air-compressor outfit used for operating pneumatic tools used in various operations throughout the shops. Two artesian wells furnish the entire water supply for engines and fire service. A

water storage reservoir is provided for use in fire, with a fire pump in connection with a complete sprinkler system for all buildings. The engines are run non-condensing. The boiler house equipment is comprised of six 250-horsepower Cahall vertical water tube boilers, fitted with Mansfield chain grate stokers.

The service building, 53 by 261 feet, is located between shops Nos. 2 and 3. A wire storage room and locker and wash room for employes occupy its lower floor. The upper floor is fitted up as a dining room for factory and office employes.

The administration building (shown in the foreground in Fig. 3) is 100 by 100 feet and two stories in height. It provides accommodation for the various administrative offices and departments, drafting room, engineering department, purchasing department, superintendent's office, etc.

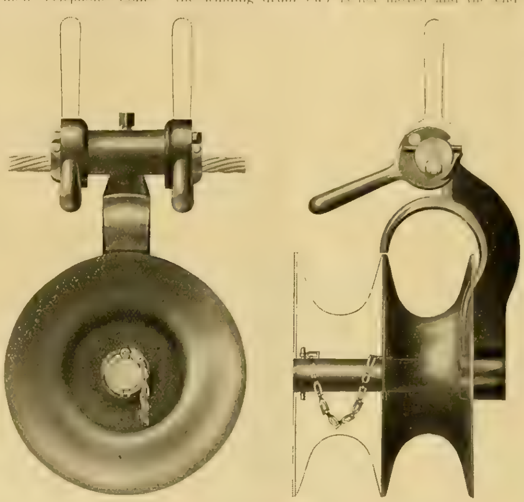
The general plan of buildings and grounds shown in Fig. 1 gives the layout of standard gauge railroad tracks in yards and buildings. In addition, there is a complete equipment of narrow gauge industrial railway interconnecting the various shop units. All the yard track is equipped with overhead trolley, and motor driven cars, equipped with electrically operated jib cranes, are used for loading and unloading material and conveying it between the shop buildings.

New Style of Cable Roller.

William Callahan, for a long time cable superintendent for the Central Union Telephone Company in Ohio, Indiana and Illinois, and now with a new Independent company on the Pacific Coast, has designed a new style of cable roller or trolley, illustrated herewith, which is manufactured by W. N. Matthews & Bro. of St. Louis.

In designing this roller Mr. Callahan had in mind simplicity, quick action, safety, strength, convenience, weight and the saving of labor. Keeping these points in view, he has perfected a roller that is instantaneous in action; that will fit all sizes of messenger wire; that has no bolts or nuts to operate; that is made entirely of malleable iron and only has four parts, not including the pins, and that weighs only 11 pounds.

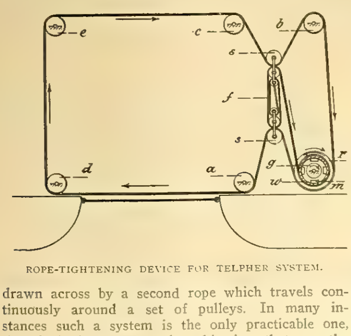
To use the Callahan roller, simply raise the handles, as shown by the dotted lines, and drop it over the messenger; then turn them down as shown. This action clamps it securely to the wire. If a small messenger is used, tighten the set screw at the top. To insert the cable in the roller, remove the inside cotter pin and slide the roller out. Drop in the cable and slide it back. Replace the pin and proceed.



NEW STYLE OF CABLE ROLLER.

Electrical Rope-tightening Device for Telpher System.

In the unloading of boats, or the transference of cargo from one boat to another, recourse is frequently necessary, where docking facilities are not to be had, to a telpherage system in which the loads are conveyed on a rope or cable by carriers



ROPE-TIGHTENING DEVICE FOR TELPHER SYSTEM.

drawn across by a second rope which travels continuously around a set of pulleys. In many instances such a system is the only practicable one, though it is open to the objection that, as the boats rise and fall with the waves, the drawing cable cannot be kept taut. To overcome this objection, Otto Adam of Dresden, Germany, has devised an apparatus, which has been patented in the United States, by which the drawing rope is kept taut by the [illegible] tinuously over the [illegible] The arrangement is shown diagrammatically in the accompanying illustration.

The motor, [illegible] drives a pulley (r) upon which travels the drawing rope, which passes over pulleys [illegible] and (a). Connected to the rope drive at two points is a system of compound pulleys (s) (f) over which passes a rope (g) [illegible] drum (w) of the motor.

The pulley (r), which is driven by the armature, is rotated in one direction, while the drum (w), which is actuated by a system of magnets (m), travels in the opposite direction, the consequent action of the compound pulleys being to draw them together and keep the cable taut. The magnets are mounted rotatably and are not positively connected to each other.

By suitably arranging the winding of the motor and by suitably proportioning the tension in the endless rope circuit and in the winding-up cord an approximately constant number of revolutions may be obtained for the rope pulley (r), even at the maximum number of retrograde revolutions of the systems of magnets and of the winding drum. Hence in the normal position of the parts the winding drum (w) is not moved and the endless-rope circuit has the correct tension, while the cord of the system of compound pulleys (f) is wound up at the same moment when the tension is released in the endless-rope circuit.

If the distance is again increased between the guide rollers (a) and (d) or (e) and (c) the endless-rope circuit pulls the tension rollers (s) (s) away from each other, the winding-up rope or cord of the system of compound pulleys (f) being drawn off from the drum (w), which at the same time performs a retrograde movement. The winding drum is capable of performing this kind of movement, in view of the oppositely directed rotating capacity of the system of magnets corresponding only to the definite tensional resistance of the rope. Thus, the winding-up rope or cord is pulled in the direction of rotation of the armature (g), and consequently also of the pulley (r), until the tension of the rope in the endless circuit has again arrived at the value which is fixed by the power working at the periphery of the armature of the motor.

Books Received.

"Practical Telephone Handbook and Guide to the Telephonic Exchange." By Joseph Poole. Published by Whittaker & Co., London and New York. Price, $2.

"Continuous-current Armatures, their Winding and Construction." By C. Kinzbrunner. Published by the D. Van Nostrand Company, New York. Price, $1.50.

"Steam Turbine Engineering." By T. Stevens and H. M. Hobart. Published by the Macmillan Company, New York (Whittaker & Co., London). Price, $6.50.

"Electricity Meters and Their Construction and Management." By C. H. W. Gerhardi. Published by the Electrician Printing and Publishing Company, London. (The D. Van Nostrand Company, New York.) Price in the United States, $4.

CORRESPONDENCE.

Great Britain.

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The deputation of 15 gentlemen which has been appointed by the National Civic Federation of the United States to inquire into municipal ownership of electricity, tramway and gas undertakings in the United Kingdom visited Glasgow last week. So far as the electricity and tramway undertakings in Glasgow are concerned, the position is somewhat peculiar. The supply of energy for the two services is given from separate stations, but the tramway department supplies some energy in bulk to the lighting department, which is paid for as a customer. The deputation is said to have expressed its satisfaction with the Willans steam turbines which are installed, these machines being some of the first made by a licensee of Messrs. Parsons, and they contain several improvements, especially in the governing gear, which have been patented by Willans & Robinson. Municipal government was inaugurated in Glasgow in 1690, up to which time it was subordinate to the church. With its municipal gas, water, hydraulic power, electric light and power, tramways and telephones, Glasgow is regarded as having a distinct tendency toward municipal socialism, but, unlike so many other places, its assets exceed its liabilities by some $2,250,000.

A proposal is now before Parliament to build a railway around the outskirts of Northern London, running in a semicircle and having a total length of some 30 miles. It is intended to adopt the single-phase system of traction, and although very meager technical details—of necessity—have been placed before the committee, some idea may be gathered from the fact that the New York Central Railroad has been quoted as the pattern. Mr. Philip Dawson, who is consulting engineer for the conversion of a portion of the suburban lines of the London, Brighton and South Coast Railway to the same system, is also engaged on the new line, and has estimated $1,500,000 for the overhead equipment, with a further $2,000,000 for the electrical equipment of 34 trains. These are rough figures, for committees do not very much concern themselves with technical matters of this sort, having in view the wide powers given to the railway department of the Board of Trade before any new railway is sanctioned.

The Dolter surface-contact system of electric traction is being laid down along the sea-front parade at Hastings.

The Poplar (London) Borough Council has erected a plant for the manufacture of electrolyzed sea water for disinfecting purposes, under the superintendence of its medical officer. The Hermite process is employed and the disinfectant is distributed in bottles, in addition to being utilized for street watering. As a matter of fact, real sea water is not made use of, but a mixture of magnesium chloride and sodium chloride in the form of a saturated solution.

The Glasgow Corporation recently appointed a committee to inquire into the various systems of public time service adopted in some of the principal cities of the Continent. The report just issued is a very useful epitome of the systems in vogue, mostly electrical, in Berlin, Antwerp, Brussels, Paris and other places. The committee recommends that

Glasgow should establish a public time service, combined with the lending of clocks, etc., as practiced in Berlin and Antwerp. G.

New York.

New York city, June 16.—The delicate task of placing a large new drawbridge in place on the Harlem River was accomplished without mishap this evening. The bridge will be electrically operated and provides for extension of the subway and for foot and trolley traffic. At Two-hundred-and-fifteenth Street and the Harlem River the bridge was constructed, the girders having been assembled in a framework built on piles. Two pontoons were sunk at each end when the tide was low, and when the tide rose the bridge was lifted from the supports by pumping the water from the pontoons. Four tugs then pulled the scows to Two-hundred-and-twenty-first Street, where water was again let into the scows and the bridge slowly dropped into position on the pivot pier in the center of the river. There was a large crowd present and a hearty demonstration followed. The electrical connections were soon made and the lights turned on. The bridge is double decked. It weighs 1,600 tons and is 265 feet long and 39 feet wide. Terry & Tench were the contractors for the work.

The department of water supply, gas and electricity has granted to the Brooklyn Rapid Transit Company a permit for the installation of transmission wires on its new elevated and surface extension to Canarsie. The company some time ago acquired the old steam road running between East New York and Canarsie Landing, and has since rebuilt it, making of it an extension of the Fulton Street elevated line, connecting with the Williamsburg and Brooklyn bridges. Permission is given for the use of a voltage of 5,600 on the line. The road is to be a high-speed line on which motor trains will be operated. It has been connected with the Fulton Street line at Pitkin and Vesta avenues, having been elevated from that point along Vesta Avenue to New Lots Road, whence it runs on the surface to the shore of Jamaica Bay.

The commission appointed by the Appellate Division of the Supreme Court, Brooklyn, to consider the plans for the subway extension in Brooklyn, made its report on Wednesday. The report approves of the expenditure of $11,000,000 for extensions of the subway system in about five miles of territory in Manhattan and $25,000,000 for 14 miles in Brooklyn. One route proposed is across the Williamsburg Bridge and over Delancey Street to a point near Norfolk Street, and thence under the Bowery, Walker and Center streets to the Brooklyn Bridge. Spur connections are to made in Manhattan. Aonther route provides for a river tunnel from Old Slip to the foot of Montague Street, Brooklyn. It is proposed to reach Central Brooklyn and the eastern district from this point by means of a route through Lafayette Avenue. The report will come up for confirmation on Monday.

Commander Fajolle of the French liner La Touraine says that when nearing Sandy Hook on Saturday night the ship encountered the most wonderful electrical storm he had ever seen on the Atlantic. "So surcharged was the atmosphere," said the commandant, "that every wire in the Marconi apparatus as well as every piece of nickel work on the above deck, including the skeleton railings on the bridge, was outlined in a beautiful gold and blue flame. The metal tops of the masts were great glowing balls of fire, while the rims around the tops of the ventilators and the brasses about the decks glowed in flames only slightly less gorgeous."

Borough President Coler of Brooklyn has expressed faith in the Behr mono-rail system of rapid transit and promises to use his good offices toward furthering the proposed line from Flatbush and Atlantic avenues to Coney Island. A meeting of delegates from leading civic organizations of Brooklyn will soon be held to discuss the plan.

A gasoline touring-car department has just been established by the New York Transportation Company, which operates the electric motor-cab service in New York. Fifteen Columbia cars were lately purchased from the Electric Vehicle Company as a nucleus for the new department. The cars have met with such popular favor that five high-power touring cars capable of accommodating seven persons each will soon be added to the automobile service of the transportation company.

Judge Lacombe in the United States Circuit Court handed down today the final restraining order in the Consolidated Gas Company case, the previous existing orders having been merely temporary. The order restrains the attorney-general, district attorney and state gas commission from enforcing the provisions of the 80-cent gas law, and states that the provisions of the temporary restraining order shall continue in full force and effect until final hearing and disposition of the case. The order provides that in case the company loses its suit, it shall refund to consumers the difference between the 80-cent and the dollar rate. It also suggests that consumers shall notify the clerk of the court of any change in address.

Resolutions adopted by the board of estimate yesterday are to the effect that the application of the Atlantic Telephone Company for a franchise will not be considered by that body until after the New York Telephone Company and the New York and New Jersey Telephone Company have decided whether or not to make an offer to the city for a like franchise.

A circular signed by the New York and Queens Electric Light and Power Company was enclosed in the May bills of customers in Queens. It notifies customers of a 20 per cent. raise in the rates after this month. The law cited says that the rate shall not be over 19 cents a kilowatt-hour in New York city, except in the boroughs of Brooklyn and Richmond and Queens (outside the Fifth Ward), and that portion of the Bronx lying east of the Bronx River, where 12 cents per kilowatt-hour may be charged. C. I. C.

Dominion of Canada.

Ottawa, Ont., June 16.—The Northern Aluminum Company is shortly to double its present output by installing a new power house of 16,000 horsepower over and above what is now being used.

The Grand Trunk Railway management has its electric plant about ready to install at the St. Clair tunnel. The electric plant will cost about $700,000. The electric locomotives to be used will employ alternating current, and will be capable of hauling a passenger train on the grade at a speed of 20 and 25 miles an hour, and a 10,000-ton freight train at 10 miles an hour.

The Hudson Bay Company has issued legal process, joining with the Keewatin Power Company in a move to prevent the town of Kenora using the east branch of the Winnipeg River for municipal power purposes. The power is said to be worth $200,000. The companies each claim to own half of the river bed, and they seek a declaration to this effect, and that a crown lease of the property to Kenora be declared invalid.

Acting upon the advice of Ross & Holgate, consulting engineers, of Montreal, the West Kootenay Power and Light Company is adding to its already splendid equipment, six Westinghouse transformers of 1,875 kilowatts to step up 2,200 volts to 60,000 volts, and fifteen transformers of 1,250 kilowatts to lower 60,000 to 2,200 and 440 volts. Throughout the entire Canadian West there is a marked increase in the use of electricity, including the employment of electric locomotives in place of steam for mine haulage, fast traction work, factory yards, etc.

What is said to be the largest generator ever made in Canada has just been prepared for shipment to British Columbia from the works of the Canadian Westinghouse Company of Hamilton, Ont. It is for the Electric Railway Company of Vancouver. The generator is 2,000 horsepower, three phases, 7,200 alternations, 200 revolutions a minute, with engine pipe for direct connection with the waterwheel. The order also includes a rotary converter of 1,350 horsepower, 550 volts, three phases, 7,200 alternations, 400 revolutions per minute, and eight air-blast transformers. The necessary switchboards for regulating and controlling the devices were also manufactured in this plant. This is the fourth generator of the size ordered by the Vancouver company, but the other three were supplied by the Westinghouse company from its Pittsburg works.

The Great Northwestern Telegraph Company has acquired control of the Canada Atlantic Telegraph system, extending the whole length of the line from Swanton, Vt., to Depot Harbor, Ont. In many stations extra wires will be put in so that commercial and general business will not be delayed by the use of the wires for railway purposes.

The announcement has been made that the Grand Trunk Pacific Railway Company will establish and operate a new telegraph system in connection with the transcontinental railway now in progress of construction. The new telegraph company has been incorporated by Dominion parliament with a capital of $5,000,000. The company will enter into competition with the present telegraph services in this country. It is said that before many years pass the Grand Trunk Pacific will absorb the Great Northwestern Telegraph, and there will then be practically only two telegraph companies in Canada, the Canadian Pacific Telegraph and the Grand Trunk Telegraph.

Winnipeg, Man., June 16.—The City Council of Winnipeg has passed a by-law to issue debentures to the amount of $3,250,000 for the purpose of acquiring right-of-way and other necessary property for building and maintaining an electric street railway to be owned by the city, independent of the Winnipeg electric street railway, and also for constructing a power plant for supplying electricity for heat and power purposes of every description, to be used by the city and also for commercial purposes. The site will be at the Point Du Bois or at some other point on the Winnipeg River that the council may select. The amount of money to be raised annually will amount to $168,438, which covers interest and sinking fund for a term of 39 years. The remainder of the debt will be offset by the assets of the electric plant.

The Camaguay Electric Company has been incorporated in Canada with a capital stock of $350,000 to carry on an electric railway, light, heat and power business in Cuba. The following Canadians are the provisional directors: R. V. Sinclair, A. F. May, A. McFarlane, W. H. Middleton and C. F. Moffatt, all of Ottawa. The head office will be in Halifax, N. S.

The Ontario government has appointed the Hon. Adam Beck of London, Hon. J. S. Hendrie of Hamilton and Cecil B. Smith of Toronto, expert electrical engineers, as the hydro-electric power commission to provide for transmission of power to municipalities, under the act passed last session, for the operation of electric street railways and the supply of power, heat and electric light.

The Ontario Power Company has had extended to August 17th the temporary period during which it can erect and maintain wires for transmission of electrical power for use on the different electric roads and other electrical purposes over the tracks of the Grand Trunk, the Wabash, the Michigan Central, the Canada Southern, the Niagara, St. Catharines electric railway, and the Niagara Falls Park and Electric Railway.

The City Council of Berlin, Ont., has decided to expend $55,000 in enlarging the municipal electric-light and power plant.

The citizens of Madoc, Ont., propose to generate electric power from the Moira River for the installation of an electric plant.

A by-law has been introduced in the Town Council of Port Hope, Ont., providing for the operation of an electric-light plant under municipal control.

The Temiskaming and Northern Railway is being built and is owned by the Ontario government. It is already finished and running from North Bay to New Liskard, about 130 miles, and is building another 100 miles onward so as to tap the Grand Trunk Pacific when it reaches the junction point this fall. On account of the valuable forests through which it runs and the danger of fire from the sparks from the locomotives, which are now run by steam, the government has decided to do away with steam altogether and substitute electricity as the motive power at an estimated cost of $1,000,000. Tenders will be called for as soon as the plans and specifications are prepared, and in the meantime information may be obtained of D. E. Ryan, Toronto, secretary of the government commission which has been appointed to build the road. H.

New England.

Boston, June 16.—The Massachusetts Legislature has passed, to be engrossed, the bill by which street and elevated railway companies are compelled to carry pupils of private schools at half fare when going to or from school. This is an amendment of the existing law under which pupils of public schools have enjoyed that privilege for some years.

A short-circuit caused a fire in the Boston Elevated Railway Company's yard in Roxbury, early Monday morning. One car was destroyed and two others were badly damaged, the loss amounting to $5,000.

In the Suffolk County Superior Court, John F. Dempsey brought a bill to enjoin the building of the Boston Elevated Railway Company's elevated structure in front of his estate in Roxbury. This is a portion of the company's extension to Forest Hills, which is now being built.

The Ward-Corby Compan of Cambridge, Mass., has opened a new bakery, in which all the mixing is done by electric motors.

Among the securities sold at auction in Boston on June 13th were the New England Telephone and Telegraph Company's five per cent. bonds, maturing in 1919, and amounting to $5,000, at 105¼.

The Hudson River and Eastern Traction Company has secured a franchise to build an electric railway between Ossining and Sherman Park, N. Y. This company is a competitor of the Danbury and Harlem Traction Company, which is building an electric railway between Danbury, Conn., and Golden's Bridge, N. Y.

The short-circuiting of the electric current in the Boston subway, near the Boylston Street station, on the evening of June 6th, started a fire which destroyed the insulation on the feed wires and stalled the Boston Elevated Railway Company's cars for 2½ hours. The damage was slight. B.

Indiana.

Indianapolis, June 16.—At a recent meeting of the board of directors of the Indianapolis, Huntington, Columbia City and Northwestern Railroad Company, in this city, final preparation for the construction of one of the longest interurban lines running out of Indianapolis was completed. The original capitalization of $50,000 was increased to $1,500,000, officers were elected and a contract let for the construction of the first 60 miles of the road. The line is to run from Goshen to Huntington, thence to Indianapolis by way of Columbia City. The company was organized a year ago. A loan of $1,500,000 has been negotiated, and a mortgage will be executed to the Central Trust Company as trustee. Construction of the road is to begin at Goshen, July 2d. The contract for this work has been awarded to M. V. Ryan & Co. of Silver Creek, N. Y. Charles E. Merrifield of Indianapolis is president of the company.

The Evansville and Mt. Vernon electric railway was opened for service today. The cars enter Evansville over the West Heights line of the local

company. This line promises well, once it opens a territory void of transportation facilities. Four passenger and one freight car will take care of the service.

The Electrical Installation Company of Chicago and the Allis-Chalmers Company of Milwaukee, which have the entire contract for building and equipping the Indianapolis, Newcastle and Toledo Electric Railway, have sublet the contract for grading, ballasting and track-laying to J. I. Adams of Columbus, Ohio. Work is to begin at once.

The last stake of the surveys for an electric railway to connect South Bend and Chicago, via Michigan City and Gary, and a connecting link in the big system which is to be operated between Cleveland and Chicago, was driven on June 13th. Part of the construction work is under way and the early completion of the line will be attempted. The enterprise has been amply financed.

It is said the Dayton and Western Traction Company's line between Richmond, Ind., and Dayton, Ohio, has been purchased by the Widener-Elkins-McGowan-Shoepf syndicate. This will obviate the necessity of constructing the proposed line paralleling the Dayton and Western to give the syndicate a connecting line between its Indiana and Ohio properties. The purchase price is said to be $3,000,000.

The voters of Union Township, which includes the city of Crawfordsville, defeated a subsidy proposition in aid of the Crawfordsville and Northwestern Traction Company, which is being promoted by Detroit capitalists. It is now thought the enterprise will be abandoned.

The Indiana Union Traction Company has approved the revised plans for a new and modern terminal station in Kokomo. The contract will be let July 2d.

The Light, Heat and Power Company of Connersville has decided to install sufficient new machinery and equipment to duplicate the present plant. The board of commissioners has given the company the right to string its wires along the highways of the county, and the company will soon supply light and power to farmers. S. S.

Southeastern States.

Charlotte, N. C., June 16.—The Southern Power Company expects to be able to furnish power from the Great Falls waterpower by the first of the coming year. There is said to be sufficient power available to run several scores of cotton mills. Two dams are being built, one 40 feet in height and the second about 90 feet high, giving an immense water pressure at the lower dam. The company has recently promised to carry power as far as Greenville, nearly 90 miles away, if conditions warrant such a step. Transmission lines are already under construction from the falls to Spartanburg, 65 miles away. The amount of money required for the Great Falls development is placed at $5,000,000, while a great amount has been spent on the development near Yorkville and Fort Mill, 20 miles from Charlotte. The annual meeting of the company takes place this month. Gil Wylie of New York city is president.

The Georgia Railway and Electric Company is turning out from its shops 30 cars. The shops are located near Piedmont Park, Atlanta, Ga.

S. Westray Battle was recently elected president at a meeting of the Asheville (N. C.) Automobile and Transit Company. It is proposed to operate automobiles for sightseers. It is also announced that an automobile line will soon be in operation between Asheville and Rutherfordton, a round trip of 100 miles through the mountains.

The council of Lumpkin, Ga., has called an election for July 2d to vote on bonds for a lighting plant.

The United States Senate has passed a bill permitting the Charleston (S. C.) Light and Water Company to build a dam across Goose Creek.

H. G. Merry of Baltimore, Md., Paul T. Brady and O. T. Smith of New York are the officers of the recently organized Eagle Falls Light and Power Corporation, with a capital stock of $5,000,000, that proposes to make a large power development in taking advantage of a fine waterpower at Clarksville, Va., the home of the new company.

The City Council of Lynchburg, Va., has decided to advertise for sale a 30-year franchise for electric lighting and power in that city.

In reference to the proposed plan of the United Railways and Electric Company of Baltimore to provide funds for the extensive improvements contemplated, it is said that provision is made for funding the past-due coupons, amounting to $1,400,000. This will be perfected, it is said, through the issuance of certificates of indebtedness to be exchanged for unpaid coupons, ample funds also being provided for carrying out the extensive improvements. The Maryland Electric Railway Company, recently granted valuable franchises by the city, will be used to supply the needed funds. The Income Bondholders' Association will present an underwritten plan and assume all responsibility for the raising of $6,000,000, a sufficient amount to meet the demands of the company and to pay back interest and to pay the coupons as they mature. The Income Protective Bondholders' committee has had deposited with it about $5,000,000 of the $14,000,000 income bonds outstanding. There is a decided fight on the question of the length of the franchise to be granted the Maryland Electric Railway Company. L.

Northwestern States.

Minneapolis, June 16.—The Interurban Railway Company at La Crosse, Wis., has filed an application for a new ordinance providing for extension of three of its lines.

The business men of Fond du Lac, Wis., are reviving the talk of building an interurban electric railway along the east shore of Lake Winnebago, to connect with Menasha. John Heath, president of the Business Men's Association, is head of the committee in charge.

The Interurban Railway Company, of Des Moines, Iowa, is planning the construction of an interurban line from Des Moines to Carlisle, Iowa.

The Northern Electric Railroad Company has been granted a franchise at Sheboygan, Wis.

The Milwaukee Electric Railway and Lighting Company is planning the construction of three interurban lines out of Watertown, Wis., one to Jefferson and Fort Atkinson, another to Juneau and Waupun and the third to Madison.

Citizens of Brookings, S. D., have contributed $12,000 to aid in the construction of an electric railway from that city to Sioux Falls, and the work will be started at once. L. A. Smith of St. Louis is promoting the project.

The council of Grand Forks, N. D., has voted a franchise to Edward L. Healy for 30 years. He will transmit electricity for lighting and power purposes from Red Lake Falls, Minn.

The council of Menasha, Wis., has voted to establish a commercial lighting system.

J. J. Clarke has made application at Bedford, Iowa, for an electric-light franchise.

The Minnesota Light and Power Company of Winona, Minn., has amended its articles of incorporation to provide for an increase in capital from $75,000 to $200,000.

The Minnesota Electrical Contractors' Association held its convention at Duluth, Minn., June 11th. The next meeting will be held at Minneapolis in January. R.

Pacific Slope

San Francisco, June 14.—The electric-lighting situation in San Francisco has improved somewhat, a string of arc lamps on temporary 30-foot poles at intervals of one block having been placed in commission at the curb line on the north side of Market Street. These make the thoroughfare safer for travel at night, but, in the absence of stores, with their window lights, the dreariness is only made more apparent in contrast with the former appearance of the street. However, within two or three weeks there will be a great deal more business life along Market Street at night, as a number of stores are in process of completion between the intersection of Powell Street and the Bay, and several large office buildings that were burned out will be partly rehabilitated and will contain many tenants. The United Railroads will light Market and Sutter streets later on, in return for trolley permits.

The electric power-supply situation has improved a little, but is still wanting in many respects. Electric elevator service in some of the few downtown buildings that have resumed the use of elevators has been subject to occasional interruptions, sometimes lasting nearly all day.

John A. Britton, president and general manager of the Pacific Gas and Electric Corporation, left for an extended tour of the Orient shortly before the great disaster, and has not yet reached home. He has always proved a good manager in emergencies, since he became connected with the Martin-DeSabla interests. On his return he can be depended upon to make the most of every resource available to supply the needs of the city for electric light and power. The three-phase transmission line connecting the city with the company's standard electric transmission system, supplied from the electric power station, was doubled not long ago, but 6,000 kilowatts is said to be the maximum which can be delivered in San Francisco by the present line.

When the three new gas engines that have long been in course of erection at the Martin station of the Pacific Gas and Electric system, six miles south of the city, are completed and connected to their three Crocker-Wheeler three-phase generators, about 15,000 kilowatts additional will be available, and it will be possible to proceed with the fulfillment of the company's contract to supply the United Railroads with all the power needed for the operation of its lines. The two power stations of the United Railroads are being operated as well as their condition will permit, and are doing as well as could be expected. There is a fair supply of current on most of the lines, although during the busy part of the day very slow progress is made by cars on the hills of Fillmore Street. The United Railroads power station at North Beach was badly wrecked by the earthquake, losing most of the roof and all but a stump of the brick chimney. Repairs to the steam plant were made as rapidly as possible, and the generating sets were started up, and have kept going ever since, although not in the best condition. A temporary roof has been constructed over the electrical machinery. The steel

[redacted]

Rocky Mountain States.

Boise, Idaho, June 16.—Arrangements have been completed under which the General Power Company of Boise, Idaho, will secure possession of all the great power sites along the Snake River, excepting that at Swan Falls. It is the company with which J. H. Hollister, I. B. Perrine and associates have been negotiating for some months relative to the proposed power plant at Shoshone Falls.

E. W. Tatlock and L. R. Derby have made application at the state engineer's office at Salt Lake City, for an appropriation of a large supply of water to be diverted from Farmington Canyon for the purpose of generating electric power for Davis County. The plant will be erected in Farmington Canyon, with a capacity of 500 horsepower. The electric power will be used for lighting and power purposes.

It is stated that the Madison River Power Company at Twin Bridge, Mont., is contemplating the building of another large power plant on the Madison River to furnish more electric power for Butte mines and smelters, the plant now in operation on the Madison Canyon being inadequate to the demands for electric power. A party of surveyors, under the direction of George H. Potter, was sent out from Butte a few weeks ago, and is now in the upper Madison Valley for the purpose of making surveys.

It is reported that the Gold Road Mining and Exploration Company is to install an electric plant in Kingman, Ariz., for the purpose of generating power for transportation to Gold Road, to cost about $150,000.

President Bowen of the American Fuel Company has visited the mining camps of Golbe and Clifton for the purpose of making arrangements for building a power plant near Gallup, N. M., from which electric power is to be conveyed to Arizona mining camps.

Through their representative, A. J. Muzzy, eastern capitalists will shortly ask the City Council of Carlsbad, N. M., for a franchise for an electric street railway and the right to lay mains and manufacture gas in the city of Carlsbad. It is proposed to equip the line with the best electrical machinery, generating power from the Pecos River. A.

PERSONAL

The Technical University of Berlin, Germany, has conferred on George Westinghouse the degree of doctor of engineering.

Frederick W. Kelley of Davenport, Iowa, has resigned as secretary and manager of the People's Light Company of Davenport. He was with the company since it was organized, six years ago, nearly all the time as manager under President Van der Veer. A good part of the success of the company is due to Mr. Kelley. He will remain in the lighting business, it is said, having secured options on several plants.

General Superintendent J. W. Bramlette of the Michigan United Railways Company has made the following appointments to cover the entire system: Thomas W. Keeley to be assistant to the general superintendent with offices at Kalamazoo; Dr. H. A. Haze to be chief surgeon, office at Lansing; P. A. Courtright, engineer maintenance of way, office at

Kalamazoo; Michael Hobin, general claim agent, office at Lansing; E. A. Clare, general purchasing agent, office at Lansing.

V. W. Eaton has been succeeded as manager of the Northwestern Telephone Exchange Company in Mankato, Minn., by E. E. Michael, formerly of San Bernardino, Cal. Mr. Eaton has been transferred to the construction department in Minneapolis.

Among the passengers leaving New York for Liverpool on June 10th, on the Cunard steamer Caronia, was President W. H. Whiteside of the Allis-Chalmers Company, who, accompanied by his wife and daughter, will devote several weeks to a recreation trip abroad. Mr. Whiteside and his family will visit various points of interest in England, Germany, Switzerland and France, spending most of their time on the Continent.

ELECTRIC LIGHTING.

Rush City, Minn., contemplates putting in a municipal electric-light plant.

V. G. Shimple has applied for an electric-light franchise in Humboldt, Kan.

Bonds have been voted for the installing of an electric-light plant at Arapahoe, Neb.

The Ozona Improvement Company will install an electric-light and power plant in Ozone, Texas.

The Carmen (Okla.) Electric Light and Power Company has been incorporated with a capital stock of $12,000.

W. D. Rusk of St. Joseph, Mo., and others are asking for an electric-light franchise in Maryville, Mo.

The Kings River Electric Light and Power Company of Eureka Springs, Ark., has been incorporated with a capital stock of $75,000.

The Business Men's Association of Sedalia, Mo., will apply for a franchise for a street-railway and an electric-light plant. J. W. Mellor may be addressed.

A business men's association has been formed at Oregon, Ill., to co-operate with Rochelle (Ill.) people for the purpose of carrying out a water-power electric scheme.

About $75,000 will be expended by the Fremont (Ohio) Yaryan Electric Company for extensions and improvements to be made to the plant. W. B. Jessop is superintendent.

A report from Peoria, Ill., says that the holdings of John R. Walsh of Chicago, constituting the majority stock of the Peoria Gas and Electric Light Company, have been sold to the Hodenpyle-Walbridge syndicate of New York city. Emil G. Schmidt of Springfield, Ill., manager of the Hodenpyle-Walbridge interests at that place, will, on July 1st, become manager of the new interests in Peoria, it is said.

The York Haven (Pa.) Water and Power Company is said to have closed a deal with the Harrisburg Light, Heat and Power Company to supply the latter with current for general power purposes, lighting, heating and operating motors. The deal is very important, as it means much to the city of Harrisburg in having cheaper light and power. The York Haven Water and Power Company will erect a sub-station at the eastern limits of the city of Harrisburg for the purpose of supplying the current.

Steps have been taken by the council of Milwaukee, Wis., which, it is said, will bring the proposed municipal light plant closer to a realization. Bonds amounting to $150,000 were voted and decision was reached to purchase a site for the plant for $60,000. The city attorney was instructed to draw a bill to be presented to the next Legislature for passage which will authorize the creation of a commission to operate the lighting plant when it is finally erected.

Colorado Springs men have purchased the light and power plant at Cherryvale, Kan., and are preparing to put over $50,000 into the proposition. Articles of incorporation of the Cherryvale Electric Light and Power Company have been filed. Charles T. Fertig and E. A. Sunderlin of Colorado Springs, Hugh E. Vest of Peru, Kan., and Seth H. Piper and W. R. Murrow of Cherryvale, Kan., are the incorporators of the company, which is capitalized at $25,000. The principal office of the company will be maintained in Colorado Springs.

The Electric Company of America, a Philadelphia central-station syndicate, owning and operating a number of plants in various parts of the country, has just concluded the purchase of an Allis-Chalmers steam turbo-generating unit of 500 kilowatts, for the Muncie Electric Light Company of Muncie, Ind., one of its constituent companies. The turbine is the Parsons horizontal, multiple-expansion type, and is identical in general design and construction with the larger 5,500-kilowatt unit recently started in the Williamsburg power house of the Brooklyn Rapid Transit Company.

ELECTRIC RAILWAYS.

The annual report of the Glasgow (Scotland) Corporation Tramways states that additions to the lines during the last year aggregate about seven miles.

Judge Rohnert of Detroit, Mich., has handed down a decision denying the right of the city of Detroit to build street-car tracks. Mayor Codd had planned to experiment with municipal ownership by spending $10,000 to build tracks under the new subway on Greenwood Avenue. The decision perpetually enjoins the municipality from building the tracks or spending any part of the $10,000 appropriation for that purpose.

Social apartments for the use of the employes of the Huntington street railways on the Pacific Slope have been opened on the second floor of the large Huntington Building in Los Angeles, Cal. All conveniences for the comfort of the men are provided. There is also a well-stocked library and an assembly room. It is proposed to hold debates, concerts and meetings to discuss social and technical subjects.

The McKinley system has gained control of the property of the Granite City-Venice Electric Company in Illinois. The consideration, it is said, is about $250,000. This deal gives to the McKinley system all of the lighting power in the Tri-cities. It has already gained control in Edwardsville, and these, together with their interurban lines, which run from Madison to Springfield, will give them a wide hold on the east side of the Mississippi.

The Alabama City, Gadsden and Attala Railway Company and the Gadsden Light Company will let the contract June 23d for the buildings and machinery for a new power plant to be built in Gadsden, Ala. G. D. Gaboury is general superintendent. The power will be generated by steam turbines capable of generating 1,500 electrical horsepower. The new plant will furnish power for the street-railway system, lighting for Gadsden and power for manufacturing plants.

Work will be commenced at an early date on an electric railway that is to parallel the Yazoo and Mississippi Valley Railroad between New Orleans and Baton Rouge. The line is to be built by the New Orleans and Baton Rouge Railroad Company. Edward Godchaux is president of the company and Walter Godchaux is the vice-president. President Godchaux says that the new line will be operated by electricity and will be of standard gauge. The right-of-way has already been secured and building operations will be started as soon as possible. It will be a single-track railway and will be built between the line of the Yazoo and Mississippi Valley and the Mississippi River.

The Corn Belt Limited is to be the name of the new electric train on the Illinois Traction Company's lines in Central Illinois. The new cars—Illinois, Indiana and Missouri—were ordered for this service. The company is seeking a 50-year franchise in St. Louis and this will show just what service it proposes to give. The cars are now running between Springfield and St. Louis. The ultimate plan of the McKinley syndicate will be a through service from St. Louis to Chicago, and the lines now operated and being built will make a great feeder system to the main line. It is expected to have cars running from Bloomington to East St. Louis by August and the Bloomington line into Peoria by the last of October.

PUBLICATIONS.

A folder which is being mailed by the Wagner Electric Manufacturing Company calls attention to the company's extensive line of instruments, both portable and for switchboard use. The folder is attractive, each type of instrument mentioned being illustrated.

Flush push-button switches are described in a recent bulletin from the Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass. These switches are compact and easy to wire because of the protected corners of the porcelain and the convenient location of the terminal screws. The switch is designed with an unusually long break distance, so that it may be used safely on 250 volts.

Iron and steel works equipment is made the subject of a particularly attractive catalogue from the Wellman-Seaver-Morgan Company of Cleveland, Ohio. The catalogue is devoted to various types of furnaces, including open-hearth and reheating furnaces. A notable feature is the excellent character of the illustrations, some covering a page, which show actual operating installations of these furnaces.

The Westinghouse Electric and Manufacturing Company's new bulletin upon "Westinghouse Protective Devices" is quite an exhaustive treatise on this type of apparatus as manufactured by the Westinghouse company. Some general directions are first given as to the laying out of a proposed system and the selection of the apparatus to be used, followed by a detailed description of the various devices, including those for low-tension distribution systems and for high-tension alternating-current power transmission. Numerous half-tone illustrations show the general form of the devices, while excellent diagrams illustrate the methods of connection.

One of the latest bulletins from the Allis-Chalmers Company takes up Reliance-Corliss engines of the direct-connected type. Two types are described, those with a single-plate gear, which is the usual type, and those with double-plate gear, which are for use on extremely varying loads.

Crocker-Wheeler form I motors and generators are described in a bulletin just issued by that company. The machine combines the advantage of the open construction of the earlier types of Crocker-Wheeler machines, having a separate base and bearings, and those of the more recent types designed for floor, wall or ceiling suspension. At the same time, the use of enclosing covers provides as much protection as the conditions of operation require.

Alternating-current generators are made the subject of bulletin No. 3075, just issued by the Western Electric Company of Chicago. The company is prepared to offer to its customers alternators of any of the standard sizes, speeds and frequencies in the engine, waterwheel and belted types, and is confident that in the machines described in the bulletin the design will be found thoroughly modern and efficient in all respects.

"The three-fold means"—advertising, solicitation and service—by which the central-station management may hope to increase the sale of current, are made the subject for some very valuable hints in a unique and "catchy" pamphlet which is being distributed by the Curtis Advertising Company of Detroit, Mich. Advertising with electricity in its various forms is dealt with directly, illustrating, for example, what may be done in the way of store lighting, barber-shop equipments, cafes and restaurants, etc., based on the principle that plenty of light and electrical conveniences are business getters for those who have them installed. The pamphlet is well worth a careful reading, and it is prepared in an attractive style.

Three new pieces of advertising literature are now ready for distribution by the Fort Wayne Electric Works of Fort Wayne, Ind. They consist of a catalogue on fan motors, entitled "Summer Comforts," a bulletin on "Direct-connected Type MPL Direct-current Generators for Power and Lighting," and a small "flyer," also descriptive of fan-motor products. The catalogue is a very attractive little booklet and explains how "Wood" fan motors are really "summer comforts" during the hot months. The apparatus is described in detail and the catalogue is finely illustrated with views of the various types of fans and a few of their applications. The bulletin describes a line of machines which have been developed to meet extremely varied operating conditions. The improvements and modifications suggested by experience and incorporated in the present line of machines is a guarantee of their future satisfactory operation.

The Gould Storage Battery Company has just issued two new additions to its catalogue J in the form of booklets ready for filing. "Part II" deals with the "stationary types" of batteries in glass and lead-lined tanks. It shows an alteration the company has made in the conducting lug heretofore used, the new type being split, one part leading to the edge of the plate, while the other reaches toward the center. This is a step forward in battery construction in that it does away with all local action and secures a more even distribution of the current. "Part IV." refers to "train-lighting types" and shows various new styles of batteries for train-lighting purposes. The new types have many commendable points, among which are: The case is absolutely acidproof, having special attachments to prevent leakage; an insulating air-gap is left between the cells, insuring insulation internally; porcelain rollers and spacing pieces are used on the case, insuring insulation from the carbox and each other; all corrodible parts have been reduced to a minimum and the workmanship throughout is of the highest order. Both booklets contain matter and tables of great interest to those who have need of a constant and economical source of power and may be obtained at the company's New York (or branch) offices, No. 1 West Thirty-fourth Street.

SOCIETIES AND SCHOOLS.

Columbia University, New York city, is to add to the equipment for lighting and power a new Crocker-Wheeler 250-volt direct-current generator of 450-kilowatt capacity.

The president of the American Street and Interurban Railway Association has appointed a committee on the promotion of traffic to investigate the problem of how to increase the receipts of railway properties. This committee consists of W. E. Harrington (chairman), H. F. Grant and H. E. Reynolds. This committee is sending out an eight-page information blank to the various companies, which is to be carefully filled out and returned to the secretary of the association, B. V. Swenson, 60 Wall Street, New York city. This information will form the basis of a report for the 1906 convention. A similar committee on municipal ownership was also appointed, consisting of

C. D. Wyman (chairman), J. J. Stanley, H. M. Sloan, John A. Beeler and George [illegible] Chapman. This committee is also sending out a short list of questions that are to be answered and the replies sent to Secretary Swenson.

The annual meeting of the Illinois Electrical Contractors' Association was held recently in Rock Island, Ill. The officers elected are: President, John T. Marron, Rock Island; vice-president, F. B. Bolte, East St. Louis; secretary, C. R. Kreider, Chicago; treasurer, E. E. Gibson, Decatur. Directors: Henry Newgard, Chicago; Charles Stapp, Peoria; J. W. Tanner, Danville. Delegate to national convention, John T. Marron, Rock Island.

The coming convention of the American Street and Interurban Railway Association, which is to be held in Columbus, Ohio, October 15th to 19th, will make use of the State Fair grounds, where suitable halls are available. The outlook at the present time indicates one of the most successful meetings in the history of the association, especially in the matter of exhibits of railway appliances. Each of the four affiliated associations will have a programme by itself which will well repay those in attendance. Hotel accommodations are ample, despite the fears of some that a city the size of Columbus could take care of so large a convention in this respect. Moreover, Columbus is a great electric-railway center. It possesses a fine system of its own, and there are, besides, eight interurban lines, radiating in all directions, so that the delegates will be given an opportunity to inspect some of the best electric lines in the country.

TELEGRAPH.

The report of the Western Union Telegraph Company for the quarter ending June 30, 1906, shows that the net revenues of the quarter, based on nearly completed returns for April, partial returns for May and estimated business for June, will be about $1,750,000, which, added to the $16,659,191.73 surplus left on March 31st, will make $18,409,191.73. After appropriating for interest on bonded debt, which will amount to $331,300, and a 1¼ per cent. dividend, amounting to $1,217,022.50, there will be left a surplus of $16,860,869.23.

J. P. Bray, consul-general at Melbourne, Australia, reports the termination of the agreement between the government of Australia and the Eastern Extension Telegraph Company. The latter declines the proffered extension of privileges to 1915, falling back on the separate agreements made with the states of New South Wales, South Australia, Western Australia and Tasmania prior to the establishment of the commonwealth. These allowed the company for all time to carry on a cable business in the states named. The company has therefore closed its Melbourne and Brisbane offices and will in future transact its Australian business under the agreement with the states named.

SPACE TELEGRAPHY.

A San Francisco dispatch says that a 216-foot mast has been erected on Russian Hill, San Francisco, by a space-telegraph company. It will be used as a station to connect with a branch of the system in Colorado, connecting the Pacific Coast with the East by space telegraphy.

John I. Waterbury, president of the Manhattan Trust Company of New York city, has been designated by Secretary Metcalf of the Department of Commerce and Labor, Washington, D. C., to represent the department before the international space-telegraph conference to be held in Berlin, beginning June 28th.

MISCELLANEOUS

[illegible] alarm system [illegible] The apparatus [illegible] one, an automatic [illegible] operated by [illegible] and [illegible] push button. [illegible] system [illegible] contact is formed [illegible] fire department and at the same time registers the location of the blaze [illegible] The push [illegible] of a building an opportunity to send in an alarm as soon as the blaze is discovered, where formerly they were required to go down or up flights of stairs or out upon the street to do so.

It is stated in a prominent British medical journal that there is a possibility of electrolysis dissolving lead from a water pipe to such an extent as to endanger the users of the water. In one case analysis showed 0.14 grain of lead to a gallon of water. The water supply was from a [illegible] and in other situations when conducted through lead pipes was not contaminated. The lead water main was within a few inches of a cable of an electric-light service, the return being an uncovered strip of copper. A leakage of 1.8 volts was discovered, and on testing the water pipe it was found to carry a current at one-tenth volt. Attention is called to the common practice of grounding telephone wires and electric-bell installations by attaching them to the water pipes of houses.

A news item furnished by the New York Herald Company says that in the Simplon Tunnel it has so far been found impossible to employ electric locomotives for hauling trains. The engineers have discovered that the metal surfaces of the locomotives, chilled to ordinary outdoor temperature, immediately upon entering the warm, moist atmosphere of the tunnel, received so great a volume of condensation that the insulation of the entire organism was affected and short circuits occurred. The motors are now undergoing hurried alterations, it is said, to obviate this difficulty. In the meantime satisfactory service is afforded by steam locomotives, provided with a new type of smoke consumers. The Furka Pass was opened on June 8th, much later than usual, owing to the enormous masses of snow.

The Lackawanna Steel Company of West Seneca, N. Y., which recently decided to operate the greater part of its mills by electricity, and contracted for electric power with the Ontario power-transmission plant at Niagara Falls, is now installing the electrical machinery in its power house at West Seneca. This machinery will include seven 1,500-horsepower transformers and a number of motor-generator sets, which will transmit the power and make it available in the mills. These electrical improvements to the steel plant will involve the expenditure of several hundred thousand dollars, and when completed will add considerably to the operative efficiency and the producing capacity of the works. All of the electrical machinery will be furnished by the Westinghouse Electric and Manufacturing Company of Pittsburg.

TRADE NEWS

At the office of the supervising architect, Treasury Department, Washington, D. C., sealed proposals will be received until July 17th for the installation of a conduit and wiring system for the postoffice, courthouse and custom house at Laredo, Texas, in accordance with drawings and specification, copies of [illegible]

[illegible]

[illegible] McLean [illegible] Ohio, and [illegible] V. [illegible] the [illegible] supplies [illegible]

The Department of the Interior, Washington, D. C., will receive [illegible] the United States [illegible] N. D., until July 9th, for the [illegible] and electric pumping plants and [illegible] generating and transmission apparatus [illegible] ing stations containing centrifugal pumps [illegible] by steam engines and electric [illegible] aggregating 1,200 horsepower, also two [illegible] lane generating units, a [illegible] plant and accessories, the necessary buildings and three-mile transmission line, located in the vicinity of Williston, N. D. Particulars may be obtained from the chief engineer, United States Reclamation Service, Washington, D. C., or from H. A. [illegible] electrical engineer, Williston, N. D. E. A. Hitchcock, secretary.

BUSINESS.

Alfred F. Moore of Philadelphia says that he had his own booth at the Atlantic City electric-light convention and did not exhibit in the Gould storage-battery space, as stated in the Western Electrician last week.

For the equipment of its new rolling stock, made necessary by the recent fire, the United Railroads of San Francisco has placed large orders with the General Electric Company for various types of railway motors. These include 25 four-motor, GE-80 (40-horsepower) equipments, 15 four-motor, GE-[illegible] (50-horsepower) equipments, and 10 four-motor GE-73 (75-horsepower) equipments. All these equipments will be supplied with the flexible Sprague-General Electric system of multiple-unit control. The GE-80 (40-horsepower) motor is being widely adopted in railway work, many other companies having adopted this motor. It is particularly suitable size for city work, and the special M. C. B. oil-bearing design has proven extremely popular. The United Traction Company of Albany, N. Y., has recently ordered 25 four-motor equipments of this type, and the Philadelphia Rapid Transit Company, 100 four-motor equipments. In several instances the GE-80 is being substituted on cars already using a less efficient motor. Thirty-six equipments of four-motors each were recently ordered by the St. Louis Railway Company, supplanting motors of another type.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 12, 1906.

822,936. Wireless-telegraph System. Lee de Forest, New York, N. Y. Application filed February 2, 1906.

A monoperiodic space-telegraph system comprises an antenna system and a closed oscillating circuit connected thereto and so constructed and arranged that the two paths from the top of the antenna to earth are equal in natural period.

822,961. Trolley Placer and Guide. Edgar A. Leake, Lawrence, Mass. Application filed October 18, 1905.

Mechanical features of a trolley wheel include supplemental grooves in the face for guiding the wire into the main groove.

822,965. Calling Device for Telephone Exchanges. Frank A. Lundquist, Chicago, Ill. Application filed July 11, 1904.

A contact maker is provided with means for operating it so as to make any desired number of contacts therewith. An indicator determines the desired number of contacts, and an automatically operating register registers the number of contacts made.

822,966. Calling Device for Telephone Exchanges. Frank A. Lundquist, Chicago, Ill. Application filed February 6, 1905.

In a calling device are an indicator, a hand-operated device for moving the indicator to any desired point, means by which the indicator is locked in its advanced position during the return movement of the device and means by which the device, upon reaching its normal position, will release the indicator so that it may also return to its normal position.

822,968. Relay. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed May 25, 1904.

A relay comprises an electromagnet, an armature pivoted thereto, contact members secured thereto, one of which is provided with a depending portion forming an open foot extending in the path of the armature, and contact points visible through the opening in the foot.

822,973. Automatic Telephone System. August A. Monson, Gray Eagle, Minn. Application filed January 24, 1905.

The system embodies an automatic switchboard, including circuit-closing strips, electromagnets for operating the strips, a locking slide for engaging all of the strips after the movement of one of them, and preventing movement of the remaining strips, an electromagnet for operating the slide, a circuit in which the electromagnet is arranged, an automatic circuit-closer and a switch also arranged in the circuit whereby the system may be rendered strictly private or optionally public.

822,987. Electrical Measuring Instrument. Frank W. Roller, Plainfield, N. J. Application filed July 18, 1904.

Combined with the current-carrying part of the instrument are a relay device for short-circuiting the part and means in the path of a movable part of the instrument for operating the relay upon the occurrence of excessive current through the instrument.

823,019. Liquid Filter and Purifier. Milton F. Adams, New York, N. Y., assignor to the Electric Water Purifier Company. Application filed June 10, 1905.

Associated with cup-shaped perforated electrodes, one adapted to fit within the other, are filtering means within and between the electrodes, an electric circuit normally open and means for simultaneously opening the supply pipe to the filter and closing the electric circuit.

823,040. Automatic Safety Trolley Pole. John R. French, Los Angeles, Cal. Application filed March 3, 1905.

Essential features are a base, a trolley pole pivoted thereto, a trolley carrier comprising a lever pivoted to the trolley pole, a spring connected with the base, a rod connected with the trolley carrier and an intermediate device connected loosely with the pole and connected with the spring and rod.

823,055. Transmission and Distribution of Electric Power. Jacob Kruyswijk, Ryswijk, near The Hague, Netherlands. Application filed August 3, 1904.

In a system for transmitting electric power are combined a continuous-current dynamo having an armature, a commutator with brushes for deriving current from said commutator and collecting rings and means for leading current from certain points of the armature winding to the collecting rings. Means connect the points of the armature winding with the brushes by the intermediacy of separate circuits, so that the currents of these circuits complement each other to the total current generated in the armature. (See cut on next page.)

823,061. Telephone Receiver. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Application filed March 17, 1905.

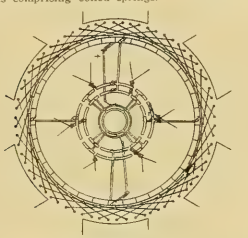
In a telephone receiver are a magnet structure, a threaded block molded around the front end of the magnet and the rear ends of the pole pieces, and a ring a shoulder around its front end. A cup section incurs the middle part of the casing and in which the block is screwed, leaving a space between the shoulder and the bottom of the cup, in which space cement is placed to permanently fix the block in the cup.

823,067. Electric-railway System. John L. Moore, New York, N. Y. Application filed November 16, 1904.

A working conductor is divided into insulated sections, a switch for each section controlling the flow of power current thereto. A magnet closes the switch and another magnet opens the switch. Spring-pressed contact plates are severally connected to the magnets and mounted directly above the sections of the working conductor.

823,086. Alternating-current Translating Device. Louis H. Thullen, Edgewood, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed October 13, 1903.

In an alternating-current relay are a movable member operated in one direction by electromagnetic means when affected by an alternating current, and contacts made and broken by the movement of the member, the contacts comprising coiled springs.



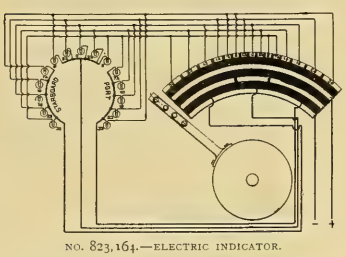
NO. 823,055.—TRANSMISSION AND DISTRIBUTION OF ELECTRIC POWER.

823,118. Electrically Driven Pump. Howard F. Gurney, Jersey City, N. J. Application filed June 20, 1904.

The combination consists of an electric motor, a pump having a variable working capacity, a power-applying device for regulating the working capacity of the pump and a centrifugal regulator whose shifting movement is a function of the motor speed and which regulator causes the movement of the power-applying device, thereby increasing the capacity of the pump with increase of motor speed.

823,164. Electric Indicator. Grover S. Eble, New York, N. Y. Application filed August 7, 1905.

An electric signaling apparatus comprising a receiver including a number of signals arranged in groups, the number of the groups being determined by the square root of the number of signals, and a separate return wire for each group, each of said wires having a break in it. Section wires are connected with the signals, and a transmitter has means for controlling the flow of current through the individual section wires and also through the return wires by closing the break. (See cut.)



NO. 823,164.—ELECTRIC INDICATOR.

823,182. Insulator. Otto W. Lutz, Petaluma, Cal. Application filed January 2, 1906.

Combined with a switch block is a socket-receiving perforation and a member bolted thereto having a rearwardly extending socket extending into the perforation and provided with a bore for receiving a conductor.

823,196. System of Train Control. August Sundh, Yonkers, N. Y. Application filed March 16, 1905. Renewed December 4, 1905.

Separate electric motors and controllers are provided for each car, with electromagnetic actuators for the controllers. A master switch, an independent reversing switch and magnets for reversing the motors, means for locking the reversing switch except when the controllers are in their off position, suitable electrical circuits and relays for operatively associating the circuits on the several cars complete the apparatus.

823,206. Telegraph Transmitter. Albert C. Crehore, Tarrytown, N. Y., and George O. Squier, Washington, D. C., assignors to the Crehore-Squier Intelligence Transmission Company, Cleveland, Ohio. Application filed April 8, 1901.

A pole-changing transmitter device having two independent operable circuit-closing levers has associated with it a generator of pulsations of alternating electromotive force, electromagnets controlling the position of the lever and a double make-and-break ring adapted to be run in synchronism with the generator.

823,215. Telephone System. Calvin R. Green and David R. Green, Rising Sun, Ind. Application filed August 24, 1905.

Main and party lines are supplied with a multiple electromagnet included in one line, a separate electromagnet adapted to be included in either of the lines, a circuit-controlling mechanism for throwing the circuits into and out of action, and a permanent magnet arranged between the members of the multiple electromagnet for polarizing it to admit of selection being made when it is required to cut one of a series of circuits into the main circuit.

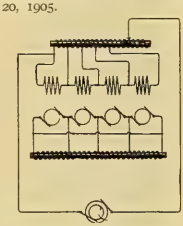
823,220. Circuit Connection for and Method of Operating Alternating Motors. Dugald C. Jackson, Madison, Wis. Application filed May 16, 1904.

Several alternating-current motors are connected serially in a circuit bridging between the limbs of an alternating-current circuit. Means are supplied for maintaining, at the several motors, fixed proportions of the pressure impressed on the series. (See cut.)

823,234. Magnetic Ore Separator. Henry H. Wait, Chicago, Ill., assignor to the International Separator Company, Chicago, Ill. Application filed March 20, 1905.

Combined with a shaking-table concentrator having riffles thereon are a magnet having means for producing flux divergencies and means arranged to move the divergencies close to the surface of the table at an angle to the riffles, whereby the more permeable particles of material are shifted across the riffles by the moving flux divergencies.

823,235. Magnetic Separator. Henry H. Wait, Chicago, Ill., assignor to the International Separator Company, Chicago, Ill. Application filed March 20, 1905.



NO. 823,220.—CONNECTIONS FOR ALTERNATING-CURRENT MOTORS.

Magnetic separation is accomplished by the combination with magnet poles of opposite polarity facing each other to constitute a working passage, of means for establishing a magnetic riffle diagonally across the passage, and a divider plate in the path of material approaching the riffle.

823,237. Magnetic Tachometer. Arthur P. Warner and Charles H. Warner, Beloit, Wis., assignors to the Warner Instrument Company, Beloit, Wis. Application filed May 20, 1905.

In a tachometer are a magnet and a magnetic mass, one of these parts mounted to rotate, a freely rotative scale disk interposed between the magnet and mass, and means for automatically compensating for variations in electrical effect due to variations in atmospheric temperature at which the instrument is operated.

823,301. Magnetic Separator. Frederick T. Snyder, Kansas City, Mo., assignor to the International Separator Company, Chicago, Ill. Application filed December 2, 1902.

In a magnetic separator are a plane surface, means for feeding materials to be separated to the surface, means for causing magnetic riffles diagonally along the surface and means for vibrating the surface in a direction substantially parallel to the riffles.

823,302. Magnetic Separator. Frederick T. Snyder, Oak Park, Ill., assignor to the International Separator Company, Chicago, Ill. Application filed November 28, 1902.

A magnet, means for rotating the magnet, means for feeding material to be separated to the magnet, deflectors suspended in position to rotate about the axis of the magnet and means for adjusting the deflectors are the principal parts.

823,303. Magnetic Separator. Frederick T. Snyder, Oak Park, Ill., assignor to the International Separator Company, Chicago, Ill. Application filed December 1, 1902.

Details are described.

823,304. Magnetic Separator. Frederick T. Snyder, Oak Park, Ill., assignor to the International Separator Company, Chicago, Ill. Application filed December 6, 1902.

In a magnetic separator are a field magnet, a bare armature, a winding on the armature adapted to have a current induced therein by the field magnet to produce magnetic poles on the armature, and means for feeding materials to be separated into contact with the surface of the armature.

823,332. Trolley-finder. William J. Hinton, Danville, Ill. Application filed August 16, 1905.

An appliance for guiding the trolley wheel to the wire is described.

823,377. Telephone or Other Line-supporting Post. Gordon E. Van Every, Naper, Neb., assignor of one-fourth to Krauth Harms Cressman, Naper, Neb. Application filed November 28, 1905.

Mechanical parts are described.

823,402. Static Valve for Wireless Telegraph Systems. Lee de Forest, New York, N. Y. Application filed December 9, 1905.

In a space-telegraph receiving system are a receiving antenna, an oscillation detector associated therewith, and an electrolytic static valve connected between the earth and a point in the antenna above the point of association of the detector with the antenna.

823,438. Trolley Hanger. Thomas Price, Minneapolis, Minn. Application filed June 5, 1905.

Mechanical features of construction are set forth.

823,478. Safety System for Motor-propelled Cars. John A. Miller, Baltimore, Md., assignor to John M. Thurston, trustee, Washington, D. C. Application filed November 6, 1905.

Combined with a motor and its independent controlling means are a separate safety circuit, an armature short circuit, opening and closing means for the safety circuit independent of the motor-controlling means, and switch mechanism comprising means for opening and closing the motor-supply circuit, and for the reverse opening and closing of the short circuit. (See cut.)

823,484. Electric Conductor Union. Frederick W. Sorg, Englewood, N. J. Original applications filed August 1, 1903, and August 17, 1903. Divided and this application filed February 21, 1905.

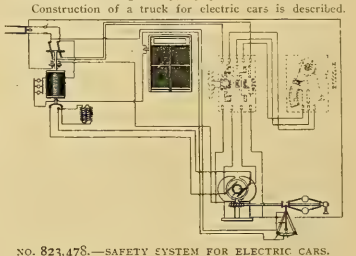
A torsional electric union is formed with wire pockets and with resilient wire-retaining projections adjacent the pockets to hold wires inserted, there being open lateral wire-inserting slots in the union.

823,489. Electric Warp Stop-motion for Looms. George E. Chandler, Taunton, Mass., assignor to the Mason Machine Works, Taunton, Mass. Application filed September 25, 1905.

Details are described.

823,490. Electric Motor Truck. William Dalton, Schenectady, N. Y., assignor to the American Locomotive Company, New York, N. Y. Application filed August 29, 1905.

Construction of a truck for electric cars is described.



NO. 823,478.—SAFETY SYSTEM FOR ELECTRIC CARS.

823,492. Magnetic Separator. Lewis A. Dunham, Kansas City, Mo., assignor to the International Separator Company, Chicago, Ill. Application filed December 8, 1902.

In a magnetic separator are combined with a hollow separating cylinder, a magnet pole piece outside and inside of the cylinder respectively, the pole pieces being offset with reference to each other.

823,495. Alternating-current Motor. John O. Heinze, Jr., Lowell, Mass. Original application filed July 22, 1903. Divided and this application filed May 29, 1905.

A synchronous alternating motor is made up of a stationary member, a movable member, a field circuit, an armature circuit, means whereby the field circuit may be connected in series with the armature circuit. The motor, while the circuits are connected in series, operates as a series motor.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on June 18, 1906:

405,246. Galvanic Battery. W. A. Childs, Englewood, N. J.
405,248. Electric Switch. O. Dahl, Brooklyn, N. Y.
405,249. Electric Meter. O. Dahl, Brooklyn, N. Y.
405,263. Compound-wound Alternating-current Dynamo. H. Lamp, Lynn, Mass.
405,284. Dynamo-electric Machine. F. Thone, Oskaloosa, Iowa.
405,365. Electric Railway. A. L. Lineff, Westminster, England.
405,382. Telephone Switch. A. Stromberg, Chicago, Ill.
405,399. Electric Meter. R. Diehl, New York, N. Y.
405,420. Attachment for Telephones. H. Konigslow, Cleveland, Ohio.
405,427. Sheath for Regulating Light from Electric Lamps. W. H. Melaney, Pittsburg, Pa.
405,440. Electric Arc Lamp. E. A. Sperry, Chicago, Ill.
405,441. Dynamo. E. A. Sperry, Chicago, Ill.
405,452. Apparatus for the Electrolysis of Lead. C. O. Yale, Rome, N. Y.
405,460. Metallic-telephone Circuit. H. L. Burbank, Jersey City, N. J.
405,471. Apparatus for Generating Electricity. T. Gleeson, Brooklyn, N. Y.
405,483. Diagram for Acoustic Telephones. H. P. Jones, New York, N. Y.
405,507. Dynamo-electric Machine. W. D. Sandwell, Herne Hill, County of Surrey, England.
405,518. Pilot or Head for Sectional Rods for Threading Underground Conduits. G. H. Warde, New York, N. Y.
405,519. Electric Appliance for Railway Switches. M. Wuerpel, St. Louis, Mo.
405,522. Electric Pull Bell. C. A. Braun, Chicago, Ill.
405,539. Autographic Telegraphy. M. W. Dewey, Syracuse, N. Y.
405,544. Contact Device for Electric Railways. F. E. Fisher, Detroit, Mich.
405,556. Electric Railway. R. M. Hunter, Philadelphia, Pa.
405,566. Telephone Attachment. O. Konigslow, Cleveland, Ohio.
405,577. Ground Detector for Electric Circuits. O. P. Loomis, Somerville, Mass.
405,576. Electric-wire Circuit. J. Lynch, Washington, D. C.
405,602. Dynamo-electric Machine for Motor. C. L. Rosenquist, Yonkers, N. Y.
405,604. Production of Copper by Electrolysis. A. Revelli, Turin, Italy.
405,609. Galvanic Battery. James Serson, Boston, Mass.
405,627. Switch for Suspended Electric Conductors. Chas. J. Van Depoele, Lynn, Mass.
405,628. Closed Slotted Conduit for Electric Railways. C. D. Van Depoele, Lynn, Mass.
405,646. Electrical Primer. Ed L. Zalinski, U. S. Army, and H. J. Smith, Pompton, N. J.
405,668. Electric Motor or Dynamo-electric Machines. R. M. Hunter, Philadelphia, Pa.
405,677. Telephone Combination Circuit. F. A. Pickernell, East Orange, N. J.
405,684. Electric Primer. H. J. Smith, Pompton, N. J.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVIII. CHICAGO JUNE 30, 1906 No. 26.

A 60,000-kilowatt Steam-turbine Plant at St. Denis, France.

By Frank C. Perkins.

A steam turbine plant of modern design having an ultimate capacity of 60,000 kilowatts is under construction at St. Denis, on the Seine, near Paris. Three boiler rooms are provided in the plans, each equipped with 20 boilers. The coal is conveyed from the boats to three storage plants, consisting of four coal bunkers of a capacity of 12,000 tons, by automatic transporting apparatus. The 5,000-kilowatt turbo-alternators used in this plant are arranged in groups of four and are guaranteed to have a coal consumption not exceeding 0.893 kilogram a kilowatt-hour.

The turbines each weigh about 50 tons, and the pumps, condensers and piping about 60 tons, while the total weight of the unit with electrical generator is about 200 tons. This is about 40 kilograms a kilowatt output, while the weight of a Corliss engine unit is about 220 kilograms a kilowatt capacity, or nearly six times as much.

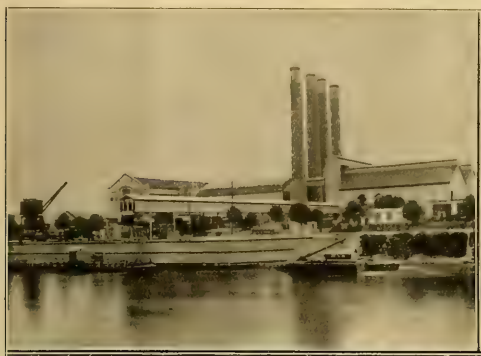
The accompanying illustrations show the details of construction, and the arrangement of this electric power plant, which is owned and operated by the Compagnie Generale de Railways et d'Electricite, formerly Compagnie Russe-Francaise. The steam turbines are of the Parsons type, constructed by Brown, Boveri & Co. of Baden, Switzerland, and are of 5,000 kilowatts capacity each, under normal load, and capable of a maximum output of 6,000 kilowatts.

The station is equipped with mechanical coal transporters, having a capacity of 80 tons of fuel an hour, and the boiler house is equipped with Green economizers, Babcock & Wilcox boilers, and superheaters of the latter type.

The plant complete will include 10 turbine units and 60 boilers, of which [illegible] three-phase current at 10,250 [illegible] and a frequency of 25 cycles a second. Two of the units will generate two-phase current having a frequency of 42 [illegible] and a pressure of 6,150 volts.

The boiler room will be equipped at first with 20 Babcock & Wilcox boilers, each having a heating surface of 420 square meters, with a pressure of 10 atmospheres, while 20 Green economizers will be used, having a total heating surface of 160 square meter. The 20 Babcock & Wilcox superheaters will each have a heating surface of 172 square meters, with a temperature of 350° C. The total capacity of these steam generators will be from 165,000 to 200,000 kilograms of steam an hour. The auxiliary apparatus includes two triplex plunger pumps of the piston type, and two electrically driven centrifugal pumps, each operated by an 80-horsepower motor, together with four [illegible] hour discharge.

The [illegible] switchboard [illegible] of the above mentioned [illegible] Kilowatt each will be [illegible]



Exterior of St. Denis Station.
First Three 5,000-kilowatt Units Installed.

Switchboard Controlling Gallery
View in the Boiler Room, Showing Coal Chutes.

A 60,000-KILOWATT STEAM-TURBINE PLANT AT ST. DENIS, FRANCE.

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The St. Denis electric station is at present equipped with four turbo-alternators, each operating at a speed of 750 revolutions a minute. These four units first installed supply a current of 25 cycles a second, and a pressure of 10,250 volts, the normal output, as stated, being 5,000 kilowatts for each unit, and the maximum capacity 6,000 kilowatts. Each unit is 14.5 meters long, 3.5 meters high and 4.15 meters wide. There are four condensers of the surface type, each supplied with water by a centrifugal pump of 120 horsepower and an air pump operated by a 70-horsepower electric motor.

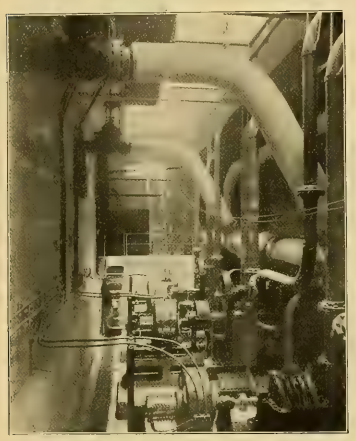
For supplying continuous current, a turbo-generator is provided, consisting of a 300-kilowatt direct-current machine, operating at a speed of 2,700 revolutions a minute and supplying a current of a frequency of 25 cycles a second and 10,250 volts, and the others with a two-phase current at 6,150 volts and a frequency of 42 periods a second. The two direct-current dynamos of 750 kilowatts, each driven by the 1,500-kilowatt motor in each set, supply direct current at 550 volts for use on the electric-railway lines.

As noted by the following diagram, the turbines and alternators are on the upper floor (A) of the plant, the turbines being eight meters apart and six meters from the sides of the building, which has a total width of 20 meters and a total inside height of 12.25 meters from the generator-room floor. The electric motors of the centrifugal pumps, as well as the other auxiliary apparatus, are located below on the floor (B). Cooling water for the condenser is supplied by a Sulzer centrifugal pump delivering 35 cubic meters of water a minute. The direct-current electric motor op-

erates at a speed of 310 revolutions a minute and is of the vertical type, directly coupled to the pump. It develops about 130 horsepower, taking 470 amperes at a pressure of 220 volts. The air pumps are of the three-piston type, directly coupled to 10-pole direct-current motors. Each motor has a normal capacity of 54 horsepower, operates at a speed of 225 revolutions a minute and takes 195 amperes at a pressure of 220 volts.

A small switchboard is located at (C), and a gallery is provided leading to the switchboard building, which has five floors, the cables entering the lower floor at (D) from the generators, and leaving the building from (M). The high-tension oil switches are located in compartments (E), (F), (J) and (K) for alternators and feeders, while the rheostats are installed in compartment (G) and the controlling apparatus on the top floor or gallery at (H).

Each of the two transformer groups of 375 kilowatts consists of a synchronous motor directly coupled to an eight-pole machine, supplying 1,700



ELECTRICALLY DRIVEN AUXILIARIES AT ST. DENIS PLANT.

amperes at 220 volts pressure, the motor developing 540 horsepower and taking 36 amperes from the three-phase 10,500-volt circuit.

Two auxiliary motor-generator sets are provided, of 110-horsepower capacity, consisting of a direct-current motor and a direct-current generator for use as booster sets, in connection with charging the 126 cells of storage battery. These dynamos are capable of supplying direct current at 660 amperes at a pressure varying from zero to 120 volts.

This is a very interesting steam-turbine station, representing, as it does, the latest design of power plant using this form of prime mover, as installed on the continent of Europe.

New York Electrical Society.

The annual meeting of the New York Electrical Society, for the election of officers, was held in the College Hall, Hotel Astor, New York, June 13th. The following-named gentlemen were elected: President, George Herbert Condit; vice-presidents, Robert T. Lozier, Walter F. Wells, P. G. Gossler; secretary, George H. Guy; treasurer H. A. Sinclair.

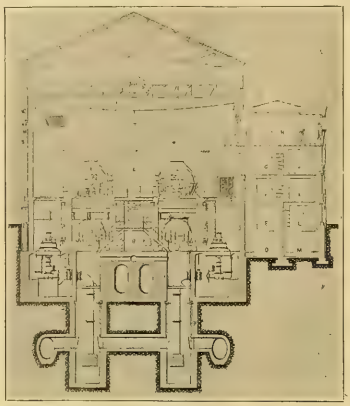
The report of the secretary showed that during the past season 59 members were elected; the society lost two of its members by death, and 32 resigned. The total membership is 662. Although the report of the treasurer showed a working deficit of $39.17 on February 1st—the end of the society's fiscal year—the present condition of the finances promises well for a marked improvement in the budget of the coming season.

Much interest was aroused by the announcement that the officers of the society are hopeful of securing quarters in the United Engineering Building, so that the many advantages of that edifice may be made available to the members of the society.

After the business meeting there was a smoker. Music was provided by the Eureka Trio. Among the speeches was a characteristic and witty recital by Mr. Charles L. Eidlitz of some of his personal experiences. An excellent collation was served, and the evening was voted a distinguished success.

Chicago Street-railway Situation.

The Chicago Union Traction Company expects to have electric cars running on its old West Side cable lines by September 1st, and on the North Side by October 1st. The idea is to lower the Washington and Van Buren street river tunnels first and then turn to the one at La Salle Street. Permits have been granted the company for the work under the ordinance passed a week ago. The Chicago City Company is not affected by the tunnel-lowering problem and therefore will take a little more time and work out a more complete



CROSS-SECTION OF ST. DENIS PLANT, INCLUDING SWITCH HOUSE.

system. It is expected, however, that all cables in the city will be out of the way by January 1st.

The Union Traction Company, it is said, intends to equip the best of its cable cars with new trucks for the trolley service. In all probability the companies will purchase the additional current needed for their operation.

The City Railway Company intends to put on a lot of new cars. The old cable power houses will be equipped with electric machinery. This company has a contract for 50 new cars of the latest type to be delivered before fall. It seems that last year when the company expected to get permission to run its Archer Avenue cars by electricity it ordered 50 new cars for delivery in April this year. The permit was not granted, however, and the company had no use for the cars. Then came the San Francisco disaster, following which the street-railway company of that city was greatly in need of new cars. Subsequently the new cars for Chicago were sent to San Francisco, and the company then transferred its contract for 50 similar cars to the Chicago company; these are the ones now nearly ready for delivery.

The traction companies have given the council committee on local transportation the figures at which they would agree to sell to the city their present tangible properties. They made no estimate of their intangible properties, saying they had not had time to prepare them. Neither did the Union Traction place any price on the Consolidated company. The figures are:

Chicago City Railway company	$20,103,925
Union Traction company	27,401,218
Total	$47,505,153

Mayor Dunne thinks the figures are excessive, and the committee referred them to Bion J. Arnold for analysis and a report. The amounts were arrived at by determining the cost at current prices of reproducing the property in question and deducting therefrom the amount of money that would be required to place the present property in a condition as good as new. Both statements contained the declaration that the cost of changing the present cable lines to trolleys and lowering the tunnels would have to be added if the city wanted to purchase after the transformation.

Boston Municipal Ownership Agitation Waning.

The Boston correspondent of the Western Electrician writes as follows: "The great lack of interest in the question of municipal lighting in Boston is shown by the fact that only six persons besides two representatives of illuminating companies attended the special aldermanic committee's hearing on the subject on Tuesday, a week ago. When the hearing began a majority of the committee was not present. This looks as though Boston would be free from the incubus of municipal ownership for some time to come. No new arguments were advanced at the hearing, the opponents presenting their side of the matter."

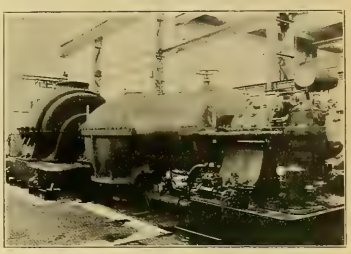
Railway Telegraphers Meet in Denver.

The Association of Railway Telegraph Superintendents held its twenty-fifth annual convention in Denver, Colo., on June 20th and 21st. About 100 superintendents were present, many of them accompanied by ladies. The meeting was beneficial to the members, and the entertainment features of the programme were greatly enjoyed. Probably the most interest centered in the discussion on improvements in the use of telegraph wires simultaneously for telephone communication. The members agreed that the perfecting of this system, which has been in experimental use for a number of years, will be one of the greatest aids to railway telegraphers. The sentiment seemed to prevail that in 10 years from now electricity will be the motive power for transcontinental railway traffic.

From the meeting hall in the Adams Hotel simultaneous communication was carried on with Limon, Colo., 100 miles distant, and with Akron, a much greater distance. W. W. Ryder, superintendent of telegraphs of the Chicago, Burlington and Quincy, conducted the experiments, and he proposes further to develop the art. Among the papers discussed were the following: "Wire-crossing Legislation," by G. H. Grace of the Illinois Central and U. J. Fry of the Chicago, Milwaukee and St. Paul; "Traffic," by F. F. Fowle of the American Telephone and Telegraph Company; "Increasing Railroad Telegraphic Facilities," by W. W. Ryder; "Telegraphones," by J. Sheldon; "Train Rules," by C. Selden of the Baltimore and Ohio.

J. G. Davis of the Chicago and Eastern Illinois led the agitation for a new set of rules and regulations to bring about thorough and absolute uniformity. Mr. Davis regretted the lack of uniformity in the rules of the railway telegraph departments throughout the United States. He asked for the appointment of a committee to draft a report on the duties of the various superintendents of telegraphs and of the telegraph departments and to formulate one uniform code applicable everywhere. At the executive session comparatively unimportant matters were considered. Informal discussion was had on the subject of unionism.

Fourteen new members were admitted, among them being "Old Farmer" Lawton of Denver, who was presented a gold telegraph key in miniature and was made an honorary member. The next



NEAR VIEW OF ONE OF THE 5,000-KILOWATT UNITS AT ST. DENIS PLANT.

convention will be in Atlantic City, N. J., on June 19, 1907.

The officers elected are as follows: President, E. A. Chenery of the Missouri Pacific Railway, St. Louis; vice-president, E. P. Griffith of the Erie, Jersey City, N. J.; secretary-treasurer, P. W. Drew (re-elected), of the Wisconsin Central, Milwaukee.

Electrification of the Rochester-Mount Morris Division of the Erie Railroad.

The management of the Erie Railroad, with a view toward constant betterment and improvement of its system, has for the last two years conducted a thorough investigation into the possibilities of electricity as a railway motive power. At a recent meeting of the board of directors it was decided to take the initial steps of operating electric trains, by contracting with Westinghouse, Church, Kerr & Co. for the installation of an electric system on the Rochester and Mount Morris division, a distance of 35 miles.

The company's electrical board, which consists of such eminent engineers as J. M. Graham, B. J. Arnold, L. B. Stillwell and A. M. Williams, has had the matter under advisement for a period of two years. Mr. Graham has been on a personal tour of inspection of electric-railway systems in this country, as well as in Europe, and there cannot be any doubt that the recommendation of the board in favor of electricity is as high an approval as the advocates of electric propulsion could ask for.

The system which the board of the Erie road has decided to adopt is the Westinghouse single-phase alternating-current railway system, the same which is now being installed by the New York, New Haven and Hartford Railroad Company.

The preliminary contract with Westinghouse, Church, Kerr & Co. calls for the electrification of

35 miles of the company's line from Rochester to Mount Morris, the equipment of a transforming station and the installation of seven electric cars. These cars will be operated by single-phase motors, probably four, at 150 horsepower capacity each, to one car. The line construction calls for the single-phase catenary trolley system. The motor cars will be used to haul passenger as well as freight cars. The power for the operation of the road is to be obtained from the Niagara Falls power plant.

Rotary-convertor Sub-stations of the Long Island Railroad.—II.

High-tension Bus-bars and Circuit-breakers.

The disposition of the high-tension switching apparatus varies slightly at the different sub-stations. The most complete development is at Woodhaven Junction sub-station. At this sub-station the high-tension cables enter through the lightning-arrester gallery in the third story. The cables are then carried down the wall into the basement, where they cross to septums built into the back of brick cubicles enclosing the oil circuit-breakers on the main floor of the high-tension gallery. This bank of oil switches is directly underneath the transfer bus and controls all the circuits that enter and leave the bus. The incoming cables of each circuit, therefore, run first to the proper oil switch, continuing thence up to the transfer bus in the gallery overhead, each cable being run in a separate brick septum. The outgoing branch circuits are tapped out of the transfer bus, each tap coming down a septum in the back wall of the bus structure to oil switch directly underneath. The oil switches both for the incoming and outgoing circuits are all in the same line underneath the transfer bus on the outer side of the gallery.

On the inner side of the gallery the station or "rotary" bus-bars and the switches connecting them to the transformers and rotary converters in this station are arranged in line in like manner on the two gallery floors. The brick structures enclosing the oil switches and bus-bars of these two distinct sets are practically identical in design.

Between every oil switch and the bus to which it is connected is a set of three disconnecting knife switches, one in each phase. These are mounted upon the wall which extends upward from the back wall of the circuit-breaker compartments, and are on the opposite side of the wall from the circuit-breakers. The switches are of the hook type and are mounted upon porcelain insulators and are opened and closed by hand by means of a hook on the end of an insulating wooden rod. The blade of the switch is hinged on the dead side of the connection when open. Their function is to completely isolate the circuit-breaker from the bus-bars, to facilitate inspection, cleaning and repairs. Their capacity is proportionate to that of the oil switches they protect.

At Woodhaven Junction sub-station two of the outgoing branch circuits emerge underground, while the third leaves by the overhead route. The underground feeder cables drop directly from their oil circuit-breakers into septums in the basement, where the three cables of one circuit are brought together into a single three-conductor high-tension cable, lead covered, which carries the current out into the underground portion of the transmission system.

The general arrangement of this part of the equipment is similar in the other sub-stations to that above described for Woodhaven Junction, differing only in details.

High-tension Switches.

Switches for manipulating the 12,000-volt current for the feeders and for the leads to the main transformers are type-C Westinghouse oil circuit-breakers. They are [illegible] stationary contacts per pole, one for the incoming and the other for the outgoing end of the same phase. The connection [illegible] terminal of these two [illegible] contact with them [illegible] bridging piece, and [illegible] mechanism operating against the force of gravity, which consequently tends to keep the switch open. The contacts are submerged [illegible] the bridging piece of each pole of the switch being at the lower end of a [illegible] rod. The three rods are secured to a [illegible] yoke so that all three contact pieces are raised and lowered simultaneously. The opening and closing gear is a simple parallel motion [illegible] drawn up into the closed position by an electrically operated mechanism consisting of two [illegible] solenoids acting on magnetic plungers. When raised into contact the mechanism is held in place by a toggle joint, which locks by dipping past the center against a stop where the mechanism is held by gravity. The opening of the switch is accomplished by energizing the circuit of a second solenoid used for this purpose only, which trips the toggle joint, with the result that the switch is instantly opened by gravity, tension springs being provided to take up the shock of the fall. The break occurs near the surface of the oil instead of at the bottom of the oil receptacle.

Each pole of the oil circuit-breaker is enclosed in a separate fireproof chamber of brick, capped with a slab of alberene stone, upon which the operating gear is mounted.

Both automatic and non-automatic circuit-breakers are employed. They are all automatic except those used for connecting the sections of the transfer bus and for connecting the two transfer buses to the rotary bus. The switches controlling feeders that pass through a station and also those which control apparatus supplied from the rotary bus are all automatic.

The non-automatic circuit-breakers are electrically controlled from the operating galleries, but are not provided with automatic tripping attachments.

Indication and Control Apparatus.

The high-tension feeder system comprises both the working or rotary buses and a set of transfer buses in the three principal stations, and the indicating and control apparatus governing the movement of these switches is somewhat intricate.

Being the central-distribution point and having the largest equipment of high-tension connections, Woodhaven Junction sub-station will be taken as a typical illustration. The apparatus in the other sub-stations is all identical with this as to type and general arrangement, the only difference being that due to less apparatus and resulting greater simplicity.

At Woodhaven Junction the switches may be divided into a group of three classes for each bus. The first group is as follows:

(1) Switches controlling incoming feeders from power station to transfer bus.

(2) Bus junction switches connecting the sections of the transfer bus.

(3) Outgoing high-tension feeders from transfer bus to sub-stations.

The second group is as follows:

(4) Switch controlling the feeder from the power station direct to rotary bus.

(5) Switches connecting the transfer bus with rotary bus.

(6) Switch connecting main transformer (for rotary converters) with the rotary bus.

The apparatus controlling the first group of switches, which deal entirely with the transfer bus, is mounted on a separate set of three marble panels, each 24 inches wide and eight feet one inch [illegible]

[illegible] the sub-station [illegible] arranged [illegible] paratus consists of a bench [illegible] upon the front [illegible] control instruments. The operator [illegible] in front of this and the [illegible] it is left vacant, permitting [illegible] an unobstructed view over the [illegible] level of the operator's head [illegible] system of instrument panels [illegible] as the control panels [illegible] sponding each to each [illegible] bench. The control panels and the [illegible] panels are each 12 inches wide.

The rotary-converter panels [illegible] control-operating handle, a red and a green signal lamp, a starting motor switch and a synchronizing receptacle.

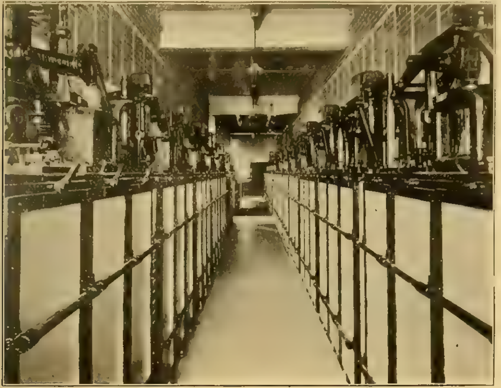
On the front of the operating control bench are panels 12 inches wide, extending across the entire front of the bench. Beginning at the left-hand end the first five of these panels are blank. Upon the last three, which correspond to the control panels of the rotary converters now installed, are mounted rheostat handles for the fields of the three rotaries.

The instruments which indicate the conditions of the circuits corresponding to each one of the control panels are mounted upon the corresponding panels directly over the operator's head.

The control apparatus, by means of which the electrically operated switches are worked from the control stand, consists of a circuit supplied by a storage battery whose current is conveyed to the two closing coils and the one tripping coil of each oil circuit-breaker, the control circuits being closed either by means of a handle on the control stand, or (if control is automatic) by the time-limit relay, which is actuated from a series transformer in each high-tension circuit. The contacts operated by the switch handle on the control stand, and this time-limit relay, are in multiple across the switch-opening circuit; while contacts operated by the control handle only are used to close the switch-closing circuit.

There are 16 relays in Woodhaven Junction sub-station, enabling the automatic control of that number of oil circuit-breakers. Of these 16 circuit-breakers automatically controlled, five are from the incoming power circuits from Long Island City, three are in the outgoing circuits to East New York and Grand Avenue, two are in the outgoing power circuits to Rockaway Junction, two are in the outgoing circuits to Hammel, and three control the rotary-converter circuits in the sub-stations. The remaining one controls the circuit supplying the auxiliary starting transformers. The bus junction and bus-connecting switches are non-automatic, and therefore no relays are provided for them. The relays are mounted on a black-finished marble panel on the main floor, directly under the operating gallery.

The source of supply for this electric system is separate from that for any of the other electrical circuits in the station, consisting of a small storage



High-tension Switch Gallery at Woodhaven Junction Sub-station.

Interior of Grand Avenue Sub-station

ROTARY-CONVERTER SUB-STATIONS OF THE LONG ISLAND RAILROAD.

battery of 53 cells of the Electric Storage Battery Company's type D-5.

Direct-current Switchboards.

Direct current for the third rail and track circuits is distributed from the rotaries to the outgoing circuits through panel switchboards of the standard direct-current type, the panels consisting of marble slabs of standard dimensions, upon which are mounted switches, circuit-breakers and instruments of standard design for the various functions required of them. These direct-current switchboards are situated in the operating gallery which contains the high-tension control apparatus mentioned above and is directly opposite the gallery containing the high-tension oil circuit-breakers and bus-bar connections. All the essential switching and control apparatus used in regular operation is, therefore, easily handled by a single operator. The only exceptions to this are the equalizer and negative rotary converter switches which are on pedestals adjacent to the rotary converter on the main floor.

It should be noted that the connections of the rotary converters are such that there is only one polarity on the direct-current switchboard. All the switches, circuit-breakers and instrument connections are on the postive side except for the negative connections that run to the voltmeter plug receptacles.

The negative and equalizer bus-bars are situated underneath the floor, being supported upon the walls of the hollow rotary foundations by means of insulated brackets. There are also mounted underneath the floor within these hollow foundations a shunt resistance for varying the compounding of the rotary series coils, an electrically operated switch for supplying current to the rotary converter starting motor, and a single-pole switch in the positive field lead of the rotary intended to enable the isolation of the field from the positive bus for testing purposes, but otherwise invariably kept closed, being fitted with a padlock so that it cannot possibly be opened by mistake.

There are two switches mounted upon a pedestal placed conveniently to the rotary on the main floor, one of these being the equalizer switch and the other the main negative switch of the rotary. The negative bus-bars are connected directly to the track-return circuit without the intervention of any other switches.

Coming now to the feeder end of the switchboard, the first of the feeder panels is a spare panel. The switch and circuit-breaker on the spare feeder panel are both 3,000 amperes capacity, the ammeter having a 5,000-ampere scale. The apparatus on each of the regular feeder panels consists of two 2,000-ampere switches, one 3,000-ampere circuit-breaker and one 5,000-ampere illuminated dial ammeter. The field rheostats for the rotaries consist of cast-iron grids which are mounted in an angle iron framework suspended underneath the gallery floor directly underneath the alternating-current control bench. The face plates and rheostat contacts are also carried on this framework, being operated by a sprocket chain from the hand wheels mounted on the front of the control bench.

Portable Sub-stations.

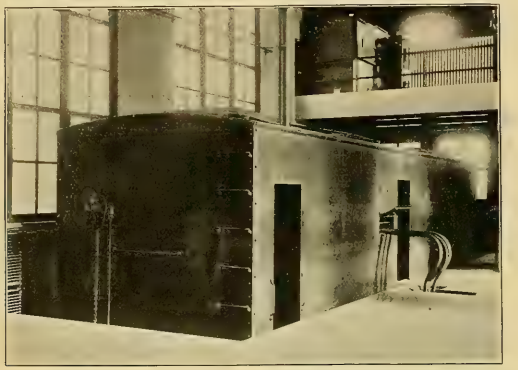
Frequent reference has been made in the foregoing to the portable sub-stations which were made necessary by the extremely heavy but very infrequent loads incidental to the service of race tracks during the racing season at Belmont Park and at the Metropolitan race track south of Jamaica.

Two portable sub-stations were provided, each consisting of a 1,000-kilowatt rotary converter with transformers, switchboard apparatus and the necessary auxiliaries, carried in a heavy steel car resembling a freight car in general appearance. The bottom of the car is of very heavy steel-beam construction, but the superstructure is as light as is consistent with the proper amount of strength. The end of the car containing the rotary converter is so built that it can be readily taken to pieces, and, in fact, entirely knocked down so that the rotary converter can be easily taken apart if necessary by being run under the crane in any of the sub-stations.

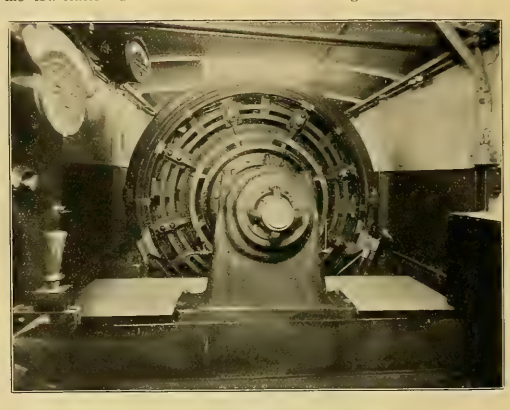
The car in which the portable sub-station is mounted weighs, without load, including trucks, draw bars, brakes and other fittings, 49,000 pounds. The weight of the equipment mounted in it, including rotary converter, transformer, high-tension switch, low-tension switchboard panels, transformer blowers, etc., is 142,400 pounds.

Besides the rotary converter, which is identical with the previously described standard rotary converters of 1,000-kilowatt capacity, are three 375-kilowatt transformers of the air-blast type, fitted with a blower and motor of a type similar to those described above for the sub-stations. The high-tension switching apparatus consists of a standard type C oil circuit-breaker in a standard brick setting which is arranged between the incoming connector lugs and the transformers.

It should be stated here that the portable sub-station rotaries are synchronized from the low-tension side by means of a synchroscope. That is, the rotary converter is started up by the starting motor after the transformers have been cut in, and by the aid of a synchroscope the low-tension alternating-current switches on the rotary panel are thrown in by hand at the instant of synchronism.



Portable Sub-station Car Connected Ready for Use.



Interior of Portable Sub-station Showing Rotary.

ROTARY-CONVERTER SUB STATIONS OF THE LONG ISLAND RAILROAD.

Cables and Wiring.

The incoming and outgoing high-tension feeder cables are all of 250,000 circular mils cross-section in each conductor. The overhead feeders entering a station by way of the high-tension gallery are of bare copper as far as the choke coils. The underground feeders entering from the conduits are of three-conductor cable, each conductor being insulated with seven-thirty-second inch of paper, and the group of three conductors is then covered with jute and another layer of seven-thirty-second inch of paper enclosing the entire group, all of which is enclosed in a lead sheath nine-sixty-fourths inch thick. One and one-half per cent. of tin is added to the lead to give it greater resisting power.

Brass end bells 7¾ inches in diameter are sweated to the ends of these three-conductor cables and filled with special insulating compound. The end of the cable is brought into an upright position and the three conductors are then laid in separate septums up the brick wall to the oil-switch structure, and through the switches to the transfer or the rotary bus-bars. These separate cables each have a cross-section of 241,610 circular mils and are inculated with varnished cambric ten-thirty-second inch thick, which is protected on the outside with double braid. The overhead feeders entering and leaving the lightning-arrester gallery are connected from the choke coils to the circuit breakers and bus-bars by cables of the same size and type as those connecting underground feeders.

Cables of similar type with a cross-section of 944,580 circular mils unite the several sections of the transfer bus and also couple the transfer bus to the rotary bus through the oil circuit-breakers. The high-tension side of each main transformer used for supplying alternating current to the rotary converter is connected to the rotary bus by varnished cambric insulated cables having a cross-section of 197,220 circular mils, where 1,500-kilowatt rotaries are installed, and 124,070 circular mils for 1,000-kilowatt rotaries.

The 50-kilowatt starting transformers are connected to the rotary bus-bars by cables having cross-section of 72,660 circular mils. The circuit-breaker protecting the signal-service panel is joined to the rotary bus-bars through varnished cambric insulated cables of 72,660 circular mils. The alternating-current leads from the rotary bus-bars to the portable sub-station connections are of the same type with a cross-section of 124,070 circular mils. With the exception of the incoming and outgoing feeders, all the high-tension cables in the sub-stations are insulated with varnished cambric ten-thirty-second inch thick, protected on the outside with double braiding.

The low-tension cables are of the following sizes: From stepdown transformers to rotary alternating-current brushes, 2,000,000 circular mils for 1,500-kilowatt rotaries, and 1,500,000 circular mils for the 1,000-kilowatt rotaries.

To rotary converter shunt fields, 28,600 circular mils. To the rotary starting motors, 134,000 circular mils for the 1,500-kilowatt size, and 106,000 circular mils for 1,000-kilowatt rotary. Between the rotary converters and the direct-current switchboard there are two 2,000,000-circular-mil cables in each lead for the 1,500-kilowatt rotary, and 1,500,000 for the 1,000-kilowatt rotary.

The direct-current third-rail feeders are of 2,000,000-circular-mil cables. They run from the switchboard in the operating gallery down the wall on heavy porcelain insulators which are fastened to cleats upon the building wall.

High-tension Lightning Arresters.

The arresters are of the Westinghouse low-equivalent type, mounted upon marble panels, which are carried on a steel angle-iron framework. The three arresters on the three legs of the high-tension circuit are separated by barriers of asbestos lumber. The arresters are all provided with knife switches so that they can be readily disconnected. There is a choke coil in series with each main circuit, mounted near the top of the steel framework. The arresters are mounted upon special porcelain insulators and the use of wood is entirely dispensed with in the lightning-arrester gallery, thus insuring fireproof construction.

Conclusion.

The sub-stations were first supplied with high-tension current from the overhead lines and tested out on April 27, 1905, and current was first furnished from Woodhaven Junction to the third rail for car tests May 13, 1905. The portable sub-stations were first placed in operation June 12, 1905. Regular operation of the permanent sub-stations began July 26, 1905.

The design and construction of the foregoing sub-station system was carried out by Westinghouse, Church, Kerr & Co., engineers for the Long Island Railroad Company, under the direction of Mr. George Gibbs, chief engineer of electric traction of the Long Island Railroad Company, subject to the approval of an electrical committee consisting of the chief operating officials of the road, with the president as chairman.

Practical Articles on Central-station Design and Operation.

Attention is again called to the series of practical articles which is to begin in the Western Electrician next week. The series, which is entitled "The Small Central Station: Practical Hints on Its Construction and Operation," deals with this subject in a thoroughly up-to-date manner, and will be of great value to the central-station man. Among the subjects which will be dealt with will be buildings and foundations, fuel and waterpower, boilers and setting, engines and steam turbines, belting and shafting, electrical equipment, switchboard and lamps, instruments, transformers and line constructions, distribution and cost of plants. The series of articles will be run weekly until completed and will be a prominent feature of the second volume of 1906.

Electric Power Supply for London.

[From the London correspondent of the Western Electrician.]

In view of the struggle now in progress between the London County Council and the administrative County of London and District Electric Power Company, in order to secure parliamentary power for supplying electrical energy to London, the two plans here given assume considerable interest as representing the proposals placed before the committee concerning the construction of the rival generating stations.

With reference to the plans of the generating stations just a few facts will help to elucidate what is proposed. The Greenwich power station, now being completed for tramway purposes, will have a total capacity of 34,000 kilowatts installed. The Battersea power house, to which one plan applies, will have, by 1915, 8,200 kilowatts installed, but when the tramway requirements are met it is only anticipated that there will then be available for other purposes, from Greenwich and Battersea combined, 60,000 kilowatts as the scheme stands at present.

The administrative company, on the other hand, has allowed for 90,000 kilowatts at two stations and 200,000 kilowatts at the third, its argument being that it has laid plans for dealing with definite loads under the following heads: (1) Supply to manufacturers direct; (2) bulk supply to existing authorities; (3) railway and tramway supply; the County Council scheme being admittedly a bulk-supply scheme pure and simple. Turbine sets have been adopted in both cases.

These are the broad outlines of the two proposals, the final issue of which is awaited with extreme interest in all quarters.

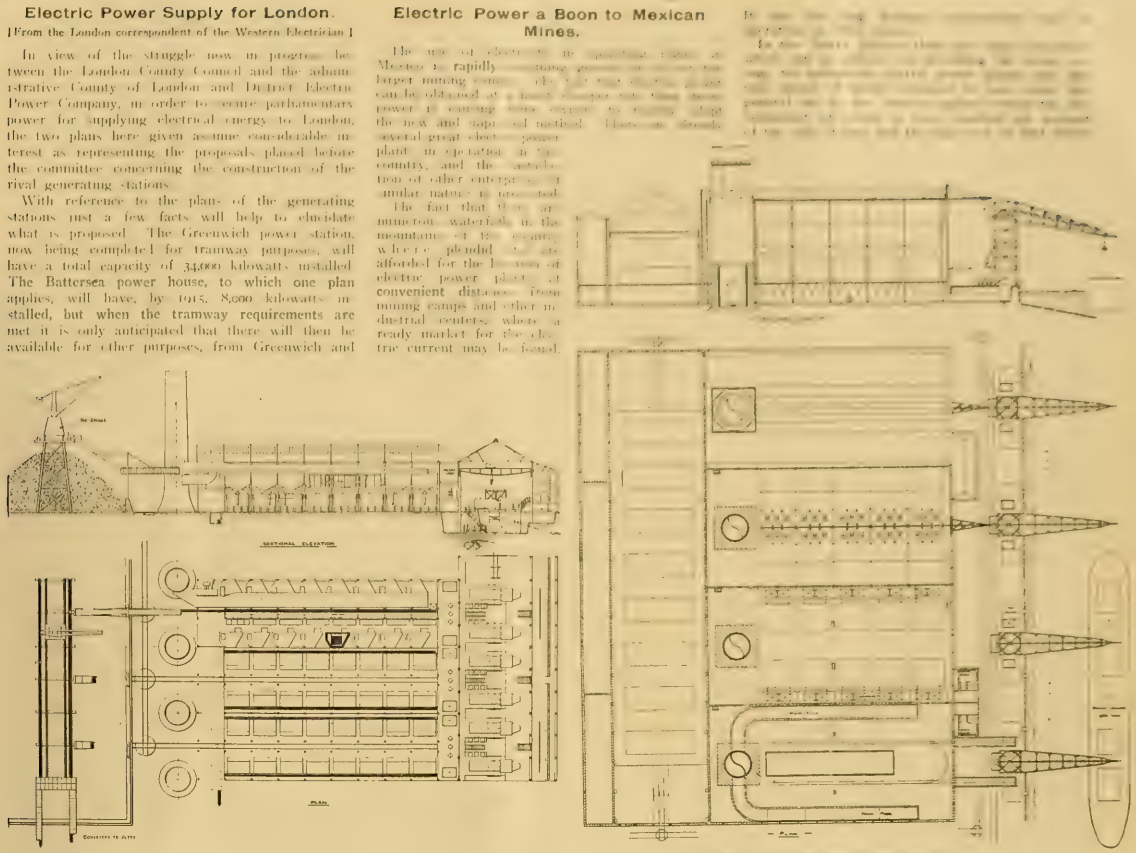
Electric Power a Boon to Mexican Mines.

The use of electric power in mining [illegible] Mexico is rapidly [illegible] larger mining [illegible] can be obtained at [illegible] power is coming [illegible] the new and superb national [illegible] several great electric power plants in operation in the country, and the installation of other enterprises of similar nature is projected.

The fact that there are numerous waterfalls in the mountains of the country, where plentiful [illegible] afforded for the location of electric power plants at convenient distances from mining camps and other industrial centers, where a ready market for the electric current may be found, makes the proposition an attractive one to investors. One of the first large enterprises of this kind to be installed in Mexico was the great power plant of the Guanajuato Light and Power Company at El Duro, state of Michoacan. This company is composed of a number of American capitalists. The electric transmission lines run from the central power station at El Duro to cities, towns and mining camps from 75 to 150 miles distant. Practically all of the leading mines in the Guanajuato district use the electric power supplied by the El Duro plant.

The most notable example of the cheapening of mining operations where electricity is used in place of steam power is to be found in the El Oro mining camp. Some of the largest and best producing mines in Mexico are located at El Oro. The Mexican Light and Power Company, the Canadian concern, which recently completed the installation of a mammoth electric power plant at Necaxa, 75 miles from Mexico City, has in operation an electric transmission line 200 miles long, leading from Necaxa to El Oro. Notwithstanding the fact that the electric current is transmitted that great distance the power is furnished the mines at El Oro at the low rate of $50, gold, a horsepower-year, whereas the cost of steam power was $150 to $200, gold, a horsepower-year. It has reduced the cost of working a ton of ore from $7 to $5.

The greatest importance of this cheap power lies in the fact that it enables the development of mines containing low-grade ore, which were idle on account of the high cost of steam power. It is stated that at El Oro thousands of tons of ore which were on the dump are now being "treated" with profit under the electric power system. Electricity also possesses another important advantage in that it enables the constant operation of the reduction mills and other machinery incident to the work of the mines. When steam power was used the engines and boilers were frequently out of repair and many shutdowns were necessary. The Mexican Light and Power Company is supplying this city with power for various kinds of industrial purposes. Among them is the operation of the extensive electric street-railway system in Mexico, which is now owned by the same interests. is used. There are scores of low-grade mines in the mountains which cannot be successfully operated by means of steam power. These will produce fortunes, it is said, when electricity is made available to them for power purposes. W. D. H.



Proposed Plant of Administrative County of London and District Electric Power Company.

Proposed Plant of the London County Council

PROPOSED PLANS FOR LONDON ELECTRIC POWER STATIONS.

Construction Preparations for the Buffalo, Lockport and Rochester Road.

Several of the officials who will be in charge of the construction work on the Buffalo, Lockport and Rochester Electric Railway between Rochester and Lockport, N. Y., have been appointed, as follows: C. G. Young, construction manager for J. G. White & Co. of New York, who has charge of all electric-railway contracts, including the Rochester, Syracuse and Eastern, between Rochester and Lyons, now approaching completion; W. H. Sawin, assistant general superintendent, located in New York; J. D. Evans, division superintendent of the first, or Albion-Rochester, division, of which he has charge; Paul Iglehart, division superintendent of the Albion-Lockport division; R. H. Whitcomb, assistant engineer; J. F. Tuthill, chief of surveys. The general contract is held by J. G. White & Co. The control of the railway company is held by the Niagara Falls Electrical Transmission Company and the Mackenzie-Mann syndicate of Canada. The office of the company will be established in Albion, where Mr. Evans has already taken his station. Edmund Wragge, chief engineer of the Niagara Falls Electrical Transmission Company and of the Buffalo, Lockport and Rochester Railway Company, will be the engineering representative of the Mackenzie-Mann syndicate.

Electric-light Rates In Chicago Again Reduced.

The Chicago Edison Company and the Commonwealth Electric Company announced on June 20th that a new schedule of rates will go into effect on July 1st. The official announcement of this voluntary reduction is as follows:

"All bills now rendered under the Wright demand system, computed from meter readings taken after June 30, 1906, will be rendered at the rate of 15 cents per kilowatt-hour for the first hour per day use of the maximum demand (known as the 'full-rate portion') and 10 cents per kilowatt-hour for additional hours daily use (known as the 'low-rate portion').

"These rates will be subject to a discount of one cent per kilowatt-hour for payment of bills within 10 days, so that the net charge per kilowatt-hour after June 30th on all bills paid within 10 days will be 14 cents for the full-rate portion and nine cents for the low-rate portion."

Electricity a Household Fuel.

A comprehensive talk on the utility, convenience, safety and economy of the electric fan, flatiron, heating pad, oven, coffee percolator, milk warmer, teakettle, cereal cooker and luminous radiator, when applied to everyday use, will give people a better appreciation of the possibilities of electricity as a household fuel. The small city kitchen assumes large proportions when an electric cooking outfit displaces the lumbering coal range and its more or less unsanitary appurtenances. Electric cookery, says the Public Service Monthly, will soon be as general as the electric car and electric light.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

A 60,000 Kilowatt Steam-turbine Plant at St. Denis, France. By Frank C. Perkins. Illustrated.....537, 538
New York Electrical Society.....538
Chicago Street-railway Situation.....538
Boston Municipal Ownership Agitation Waning.....538
Railway Telegraphers Meet in Denver.....538
Electrication of Rochester-Mount Morris Division of the Erie Railroad.....538, 539
Rotary-converter Sub-stations of the Long Island Railroad. Part II. Illustrated.....539, 540
Practical Articles on Central-station Design and Operation...540
Electric Power Supply for London. Illustrated.....541
Construction Preparations for the Buffalo, Lockport and Rochester Road.....541
Electric Power a Boon to Mexican Mines.....541
Electric Light Rates in Chicago Again Reduced.....541
Electricity a Household Fuel.....541
Editorial.....542
National-Interstate Telephone Association.....543, 544
Meeting of Illinois Independent Telephone Men.....544
Bell Telephone Output.....544
Independent Telephone Company Established in San Francisco.....544
Maine Telephone Companies Want Western Connections.....544
Ohio Telephone Notes.....544
Southeastern Telephone Developments.....544, 545
Indiana Telephone Items.....545
Telephone News from the Northwest.....545
General Telephone News.....545
Manufacturers and Dealers.....545
Chicago Edison and Commonwealth Electric Companies Reports.....545
New Light-rate Schedule for the Aurora, Elgin and Chicago..545
Practical Points on High-tension Line Maintenance. (Question Box of National Electric Light Association).....546
Book Table.....547
Modern Switchboard Practice with Particular Reference to Automatic Devices. By E. M. Hewlett. Illustrated. (National Electric Light Association).....546, 547
Selling Electricity. Illustrated.....548, 549, 550
Electric Power in Ice-cream Freezing.....548
Newspaper Versus "Follow up" Advertising.....548
Combining Burglar Protection and Advertising.....548
Electricity "Welcomes" Arch to Greet Elks at Denver. Illustrated.....548
Electricity in a Bakery.....548
Getting and Retaining New Business. (National Electric Light Association).....548, 549
Business-getting Methods. By Frank W. Frueauff. (National Electric Light Association).....549, 550
Canadian Electrical Association.....550
New Electrical Equipment for Cotton-mill Work.....550
A New Type of Polyphase Induction Motor. Illustrated...551
Stationary Engineers Visit Allis-Chalmers Shops at West Allis. Illustrated.....551, 552
Latest Types of the Duntley Air-cooled Portable Electric Drill. Illustrated.....552
Small Riveted-frame Induction Motor. Illustrated.....553
Alternating-current Overload and Reverse-current Relay. Illustrated.....553, 554
Test of a 5,000-Kilowatt Steam Turbine at Fisk Street Station. Illustrated.....554
The General Electric Tantalum Lamp. Illustrated.....554, 555
Aurora, Elgin and Chicago Railway to Extend Business.....555

DEPARTMENTS.

Correspondence.....555, 556, 557
Great Britain.....555
New York.....555
New England.....556
Southeastern States.....556
Ohio.....556
Illinois.....556
Indiana.....556, 557
Michigan.....557
Northwestern States.....557
Pacific Slope.....557
Personal.....557
Electric Lighting.....557, 558
Electric Railways.....558
Publications.....558
Societies and Schools.....558
Trade News.....558, 559
Business.....559
Illustrated Electrical Patent Record.....559, 560

DATES AHEAD.

National Electrical Contractors' Association (annual convention), Hollenden Hotel, Cleveland, Ohio, July 18th to 20th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

IN SPEAKING of the candlepower of a mercury-vapor lamp a relative term is used which should be modified by explaining the method used in making the determination. As pointed out by Mr. Percy H. Thomas in a paper which he read last month at the convention of the American Institute of Electrical Engineers in Milwaukee, relating to the fundamental characteristics of mercury-vapor apparatus, there can be no one proper method of measuring the candlepower of a Cooper Hewitt lamp. There are several reasons for this statement. One is that the color of the light is different from that of any other accepted standard. Another reason is that the light given off by the tube is not a point, and therefore the law of inverse squares does not hold except for very great distances. For commercial tests the candlepower should not be measured at very great distances because the lamp has the advantage over most lamps on account of its tubular form, which advantage would be lost if the tests were made over distances sufficient to make the tubular form to appear as a point.

THE FREQUENCY of street-railway accidents in Chicago, if the figures presented by one of Mayor Dunne's advisers be correct, is indeed deplorable. In a report to the mayor this authority says that within the last 50 days 21 persons were killed and 86 injured by street cars in the city. The report listed the causes of these accidents, and in seven cases particularly, and in the majority generally, the cause was primarily due to overcrowding of cars. Another frequent source of trouble was collisions between cars, or one car running into another from behind, which together caused 20 of the accidents. Stepping on or off moving cars, usually backward, caused its usual long list of accidents, and other fruitful sources of trouble were faulty brakes, high or no wheel guards, high fenders and passengers being knocked off by wagons. The mayor condemned the frequency of the accidents and said that something should be done, and done at once, to compel the street-railway companies to take more precautions. Traction officials say that nearly all the fatalities were due to carelessness on the part of the victims, but when all allowance is made it is evident that the companies have a grave responsibility to face.

IN THE LONG RUN the only true policy for a central station to adopt is the one which looks to the interests of the consumer. A dissatisfied customer can do an immense amount of harm, whereas a satisfied one is the company's best advertising agent. This point is well brought out in the paper of Mr. Francis W. Willcox, read at the Atlantic City convention of the National Electric Light Association, and relating to higher-efficiency incandescent lamps. From the central-station standpoint the logical method would seem to be to use a lamp of the lowest renewal cost, that is, a low-efficiency lamp. Instead of developing a high-efficiency 2.5 watt-per-candlepower lamp to replace the present one of 3.1 watts, why should central-station companies not adopt a four or five-watt-per-candlepower lamp? Simply, as Mr. Willcox points out, because the central-station standpoint is not the correct basis for the determination of lamp efficiency where current is sold by the kilowatt-hour. That lamp which for a certain rated output of light will consume the least amount of current is manifestly the one which it is to the advantage of the customer to have installed on his premises, and, being to his advantage, the central-station company will in the end gain by its installation.

AN AMERICAN who is traveling in England will observe many things in the line of electrical development which, judged by the standard set in this country, will seem to him to be making little or no advance. As is pointed out by an American writer in one of our English contemporaries, this lack of enthusiasm and progressiveness is shown most noticeably in the matter of procuring central-station business. As a rule the English central stations are abreast if not ahead of ours in the matter of equipment, but how to make this expensive equipment pay for itself by the extension of profitable business seems to be a greater problem to the average British central-station manager than plant design. To quote from this writer, the managements of the English central stations are content "to take such business as a kind providence sends them." As to going out after new business—it is a thing unthinkable. The corporation-owned properties are the worst of all, though the limited companies are bad enough in this respect. Of course there are certain notable instances where the rule does not hold good; but these are rare. If there is one thing undone, which seems to the transatlantic visitor to most need revolutionizing, it is in the matter of window lighting after business hours. The advantages not only to the central station, but to the customer, of such lighting, do not seem to be appreciated to any great extent in England. For window lighting no new mains are necessary, and at first no new service connections. After a few tradesmen could be induced to light up at night the benefits accruing to them by such an advertisement would be so manifest that their competitors would necessarily have to follow their lead.

FIVE MILLION telephones are in operation in the United States. Of this number, three million are owned and operated by the Independent interests. These are figures given out at the second annual convention of the National-Interstate Telephone Association in session at the Auditorium Hotel, Chicago, this week. The convention is still in session as the Western Electrician goes to press, but it is already evident that it is the most successful and profitable meeting ever held by the Independent interests. About all the states in the Union are represented, most of them by official delegations sent by the state associations which are affiliated with the national organization.

Almost as a unit the various states reported a large growth in the number and size of Independent telephone systems. Harmony exists among the thousands of operating companies as a result of the efficient work of the association's officers and members, and this is making toward the end of a united effort for long-distance connections throughout the country. Ohio, Indiana, Pennsylvania and Illinois probably are the leaders. The New England states have recently formed an association. Many western states have salaried representatives working among the companies. California is spreading out, San Francisco having granted a franchise, and Oakland will open an Independent exchange in six months. In Washington and Oregon four strong companies under one control have secured franchises, three for local service in as many large cities and the other for long-distance connections.

The association pledged its moral support of the efforts which are being made to get franchises in the large cities not yet served, and some of the leaders predicted that in the near future New York and Chicago would be entered. Independent lines already reach the outskirts of these cities. Considerable encouragement was given the association by the representative of Mayor Dunne, who, in his welcoming address, said that Chicago's gates were now open to telephone competition. It was reported at the convention that influential business men and strong financial institutions are awakening to the value of Independent securities and are investing their money.

The meetings are still somewhat lacking in the absence of a larger number of technical papers on the programme. Many of the new members seemed anxious for more information which would be of value to them in the economic operation of their systems. But this will no doubt come later when the present strenuous efforts to get the Independent movement fairly before the public are no longer necessary. There was a large number of the "Old Guard" present at the meeting, and their words of advice and counsel were an encouragement to the younger members. The exhibits by the manufacturers and supply men were exceptionally complete. President J. B. Hoge and his lieutenants are to be congratulated upon the success they have accomplished. A report of the first two days' proceedings of the convention appears in this issue. The remaining sessions will receive attention next week.

NATIONAL-INTERSTATE TELEPHONE ASSOCIATION.

Since the Independent telephone interests have been holding annual conventions there has never been so large a gathering present as at the opening session in the Auditorium Hotel, Chicago, on Tuesday of this week. It was the second annual convention of the National-Interstate Telephone Association. Prominent Independent telephone men were present from all parts of the United States and Canada, and all were enthusiastic in the support of the growing Independent movement. The large banquet hall was well filled when President J. B. Hoge called the meeting to order at 2 p. m.

President Hoge opened by introducing J. Hamilton Lewis as the personal representative of Mayor Dunne of Chicago, who delivered an excellent address of welcome. Mr. Lewis by his eloquent approval of the work of the Independents and by his well trained humor created a feeling of good cheer among the delegates. He said that Mayor Dunne was especially sorry that he could not be present because the matter of telephone competition was a question of much concern to him. Mr. Lewis warned against anything which savored of monopoly. He said Chicago was the home of competition, and its gates were now open to telephone competition. He paid a high compliment to the telephone men, not only for their principles but for their skill in developing telephone service to its present efficient state. The telephone itself was considerable of a mystery to him. Although familiar with the telephone situation, he was as unfamiliar with the instrument and its working as the farmer who received a telegram by messenger. The telegram was full of holes, caused by a heavy rain which overtook the messenger, and the farmer was made to believe that the company's lines had been blown down by a storm and the message had to be sent over a barb-wire fence—causing the holes.

Mr. E. H. Moulton of Minneapolis, president of the Tri-state Telephone Company, responded, heartily thanking the mayor for his welcome. "We come as friends and allies," he said, "bringing to your city's gates our telephone lines of communication, connecting with thousands of municipalities which are linked with you in common interests and social intercourse. It is a source of great regret that we cannot bring these lines beyond the confines of your city. Please allow me to express a little surprise that Chicago, so wonderfully energetic and enterprising, should so long have closed her ears to the cry for admission of the Independent telephone companies of this country."

"We await with considerable interest the decision of the momentous question, whether Chicago is to remain, telephonically, a city of one gate, or whether she will line up with Philadelphia, Cleveland, Pittsburg, Buffalo, Baltimore, St. Louis, Kansas City, San Francisco, Columbus, Indianapolis, Los Angeles, Portland, Rochester and the Twin Cities, for all the advantages obtained by opening up her avenues of communication in every possible way.

"A conception of the importance of these avenues of communication is obtained when the fact is cited that the number of Independent telephones in the country tributary to Chicago is conservatively placed at 1,250,000, fully double the number operated by the Bell company in the same territory. Our Chicago friends must also not lose sight of the fact that nearly all of the great Independent factories, employing 5,000 men, are located in your city. It would seem to one unprejudiced, that if the telephone is as claimed by the Bell people, a natural monopoly, and only one telephone system is to be used, it should be the Independent."

President James B. Hoge of Cleveland then delivered his annual address. It was attentively listened to. He told of the good work of the association and the excellent results which have followed the co-operative labors of the district, state and national officers. From the national headquarters in Cleveland, where a secretary is constantly employed, monthly bulletins have been issued keeping the members posted. "The last two years," said Mr. Hoge, "have been red-letter years in our history. During that time the plan which was outlined as the 'Ohio Plan' at the St. Louis convention in 1904 has been adopted by 22 states, eight being organized during the last year. Therefore, I feel safe in saying it has now become the "National Plan,' and justly so, as it is elastic enough to meet any special condition that arises. The importance of organization and the benefits that we derive from an organization has been apparent to each and every one who has given the subject any special thought during this period. During the two years it is estimated that our opponents have spent more money in misrepresenting our cause they they spent altogether in the five years previous. In addition to this, they have been giving away, or practically giving away, service in many sections of the country, yet with all of this to contend with, the Independent companies have forged ahead, extending their service, completing through connecting links, building a part of the few remaining cities, at the same time collecting for their service, and, where necessary, readjusting their rates, so as to meet the [illegible] tended [illegible].

"The [illegible] garded in [illegible] were two [illegible] the [illegible] finding them in [illegible] financed and [illegible] many of the [illegible] selling at much [illegible] This brings us [illegible] than we were [illegible] in harmony. The 'shield' the Independent [illegible] which was adopted [illegible] is being used by many of the [illegible] 41 states, and the public [illegible] as being the trademark of the telephone [illegible] which is responsible for [illegible] of telephones in the United States from [illegible] 300,000, 11½ years ago, to over [illegible] today, over 3,000,000 of which are connected with the Independent system. They give us the credit of popularizing prices and extending the service." Following are extracts from Mr. Hoge's address:

"A great majority of the companies today are using the best material and the latest type of equipment to be had; operating rules and regulations, system of accounting, and system of advertising have all become more uniform, and yet, gentlemen, when you stop to consider the possibilities ahead of you in this great work you will see that you have more victories yet to win, many problems yet to solve. It has been well said that no other public serving utility, except the water companies, fill so important a place in the daily life of the American people as the telephone.

"The report of the special committee from the merchants and manufacturers of New York city, made public a few months ago, on the telephone situation in the United States, is ridiculous to say the least, as it only shows, in the main, one-sided information. Why should the city officials in the few remaining cities where competition does not exist be so much afraid of granting franchises? In this age of prosperity, hustle and bustle, when the transportation companies, and, in fact, all the public-serving corporations are nearly swamped trying to take care of the business offered, the public officials should endeavor to give their citizens every opportunity possible to have their requirements met in the best possible manner. Would any thriving community try to keep out any one of the great telegraph systems? Would they try to keep out any one of the great trunk-line railway systems if an opportunity was offered to have their terminal property established?"

"We represent today an investment of over $300,000,000, with over 3,000,000 telephones installed. The next 10 years will see over 3,000,000 additional telephones connected with our system if we do our full duty. Strong interests are coming into the field each month. We are getting young men of wealth and influence interested, who are following their money into the business in a way that is a power for good. But a greater power for good is the fact that the masses are investing their money in these properties, and it is their property that is furnishing this service in their community, the same as it is their money that is furnishing the banking capital of their community, and they are going to lend their influence in seeing that the business is run on proper lines to give good service and fair returns upon the money invested.

"The public appreciates the fair treatment that our system has given them. A very striking illustration of this is the case in Seattle, Wash., where over 5,000 subscribers to the Bell telephone system in that city have ordered their telephones to be taken out on August 1st next, giving notice that on and after that date they expect to use the service of the Independent company in that city exclusively.

"I desire to extend my thanks to you who have so nobly assisted in making our organization what it is today. This is not a one-man organization, and I hope it never will be."

Following his address President Hoge appointed a committee to be in charge of the Question Box at future sessions. This committee is composed of Charles West of Pennsylvania, Theodore Gary of Missouri and J. B. Rhodes of Ohio.

A letter was read from A. L. Tetu of Indianapolis, secretary of the association, who was unable to be present at the opening sessions. The report of J. A. Harney, assistant secretary in charge of the national headquarters, showed that the association is in a prosperous condition. Bulletins, maps and all kinds of information are gathered by this official and given out to the members. A complete supply of official shields, emblems and signs, as well as Independent stationery and office material, is kept in stock.

The following committees were appointed by the president, after which adjournment was taken for the day: Ways and means—J. G. Splane of Pennsylvania, A. B. McPherson of Michigan, Henry A. Barnhart of Indiana, J. S. Brailey of Ohio, C. E. Sumner of Oregon; amendment to constitution—Cyrus Huling of Ohio, Senator Kline of Pennsylvania [illegible]

[illegible] manufacturers [illegible] $10,000.

The report [illegible] a report was made by J. B. Ware [illegible] suspended for [illegible] rules, J. C. [illegible] C. W. Kline [illegible] the [illegible] ganization of [illegible] was referred to the [illegible] the constitution for [illegible]

The [illegible] Mr. Jones of Alabama reported good [illegible] state. Mack Hammett of Ar[illegible] ton has made telephones cheaper [illegible] rates ranging from $1.50 to $2.50 [illegible] progress for the Independents [illegible] feature is that bankers are investing in Independent properties. There are about [illegible] Independent telephones in the state.

Louis Blankenhorn reported healthy development in California, especially Southern, which is being connected by long-distance lines with the northern part. Oakland will have an Independent system in six months and a franchise has been granted in San Francisco. Los Angeles has 23,000 subscribers. Rates in the state range from $1.50 for individual lines in the smaller cities to $5 a month for business connections in the big cities. San Francisco is still a considerable city and the destroyed telephone lines can easily be rebuilt.

Charles S. Norton reported 400 companies, 15,000 stockholders, 20,000 subscribers and $20,000,000 invested in Indiana.

Iowa has benefited by the services of a salaried state agent, who gets the companies together. P. C. Holdoegle reported 1,300 companies and 200,000 subscribers. P. E. Bellamy also talked for Iowa.

F. G. Miller reported conditions prosperous in Kansas and Mr. Cole reported similarly for Kentucky, where an association was formed this month.

E. E. Fischer and J. B. Ware gave interesting reports for Michigan. Grand Rapids has 27,000 subscribers, Alma 7,000, and Saginaw 5,000. A $3,000,000 company has begun laying conduits for a system in Detroit.

W. B. Scruggs said that Missouri is in good shape, a traveling representative doing good work organizing.

Nebraska has 265 exchanges, 75,000 telephones, and 45,000 telephones are represented in the association.

C. B. Cheadle spoke for Illinois. The state is well organized, the Independent lines are spreading, and, he thinks, entrance will be gained to Chicago before long. Mr. Cheadle explained for the Michigan delegates how a few Independent companies in Illinois still get long-distance service from the Central Union Company.

There was a large delegation from Canada. J. F. Demeres, Francis Dagger, Mr. Maybury and the president and secretary of the Canadian Independent Association were among those who spoke. Although there are no telephone manufacturers nor experts in Canada, the Independent systems are growing. Mr. Demeres is general manager of the Bellechasse Telephone Company of Levis, P. Q., a large system.

Charles E. Sumner of Portland, Ore., gave a very interesting talk on conditions in Oregon and Washington. Outside the big cities the Independent systems are yet undeveloped, but he is interested in four companies which are doing things in that country, one for Portland, one for the Puget Sound, one for Spokane and one company for long-distance connections. It was a difficult matter to get franchises in Portland and Spokane, and it was only by the shrewdest effort that his companies succeeded.

Senator C. W. Kline reported 150,000 telephones in the Pennsylvania state association. He thought

Pennsylvania would soon be the banner Independent state.

At the request of the Chicago Commercial Association the following committe was appointed by the telephone association to confer with the ways and means committee of the former organization. The object is to acquaint the Chicago Commercial Association with the scope and plans of the Independent companies. The committee is C. B. Cheadle, Francis Dagger of Toronto, Canada, E. R. Conklin and Manford Savage.

At the Wednesday afternoon session, Mr. Davis of West Virginia reported 26 companies in the state belonging to the association with 28,000 telephones, 561 toll stations and 86 exchanges. Five big companies control the state, these being at Wheeling, Fairmount, Parkersburg, Huntington and Charleston. The state is very well organized.

Secretary Buzzell of the Vermont association told of the growth in New England. Six years ago the Independents started in Vermont and New Hampshire; now the two states have 28,000 telephones with an investment of $1,600,000. There are 100 companies.

For the state of Texas, J. B. Earle of Waco gave a good account of the conditions. Although opposition is strong, the Indepdent systems are growing.

A report from the state of Wisconsin was presented by the secretary of the Wisconsin association. There are 42,000 Independent telephones in the state. Mr. Harper of Wisconsin reported that the Independents had succeeded in getting a bill through the Legislature which requires telephone companies to charge the same rate in all cities of the same size. The object of the law is to check unjust competition. He offered copies of the bill to any members who might profit by a similar law in their states.

President Folwell of the Keystone Telephone Company of Philadelphia reported the conditions in Pennsylvania, especially as concerning the Keystone company.

The reading of papers was begun with an interesting paper by Ivy L. Lee of New York city. The paper was entitled, "Telephone Publicity—Appealing to Public Opinion." Mr. Lee gave some good ideas as to how the Independents could best get their industry before the general public. They should give the newspapers the news in a truthful but newsy way. Comprehensive means should be devised to lay before the newspapers correct information concerning the Independent industry.

A resolution was adopted, presented by C. W. Kline of Pennsylvania, which expressed the sympathy of the association with the efforts which are being made to get Independent connection into New York, Chicago and other large cities.

Theodore Gary of Missouri presented a resolution which recited that the Kellogg Switchboard and Supply Company is controlled by Bell interests, and therefore members of the association should cease to purchase equipment and supplies from the company. There was a heated discussion both in support and in opposition to the resolution. After it had been amended so as to remove the restriction should the company again come into the control of Milo G. Kellogg, it was passed. Those who have installed Kellogg material may continue to buy these supplies in order to keep their equipment uniform. A resolution was passed expressing sympathy with Mr. Kellogg in his efforts to regain control of the company. The association also expressed appreciation of the work of Judge R. S. Taylor of Fort Wayne, Ind., and he was invited to address the convention. He spoke briefly, thanking the association.

R. A. Walker of DesMoines, Iowa, read a paper entitled "Look for the Shield." He urged the members to use the official emblem of the association wherever possible, and thus place the companies as a power and a unit before the people. He said, among other things:

"It remains for us to make this 'shield' the greatest advertising symbol that the country has ever known. We'll make ourselves into a lodge, with this 'shield' as a badge that will identify us and serve as an introduction between Independent telephone men from one end of the country to the other. Our interests are common, our action must be in unity. Remember then that if we are to show a common front the emblem must be the same everywhere. Our 'shield' has the orthodox form, with these additions: The interlined word, 'Independent,' surmounted by nine stars and underlined with 13, while across the two-color body appear the words 'Local and Long Distance,' and below in the blue stripe 'Telephone.' Let there be no changes, not the omission of a single star not the change of a word. Make this thing the same from coast to coast.

"In the Independent telephone industry we have banded together, through this organization, thousands of telephone men and operating companies whose aggregate yearly expenditure for printing and advertising of all kinds would astound the heaviest publicity agents and advertisers of this advertising age. What, then, should be the result if the more than 6,000 Independent telephone companies will use the 'shield' on everything they print, such as stationery, letter heads, bills, cards, forms of all kinds, posters, directories? Place a standard sign bearing the 'shield' at every toll station, office and booth; and upon every suit of clothes wear the badge in button or pin and see that every employe, every officer and director is so equipped.

"Chicago says, 'What benefit can a few such organizations be to the great commercial center of the West? What power is there in a few small telephone exchanges with no financial listing, under innumerable names and arrangements with as many different managements?' Have we in the past shown a unity of action and organization that would discredit opinions of this kind? If so, what has been the sign? We must show these doubters that we are of one mind, of one purpose. When the 5,000 and more Independent telephone companies in this country, following the 'shield' for a banner, shall march down on this commonwealth and show them that the Chicago of today is a 'puny' thing compared to what it would be if connection were established with the millions of Independent telephones throughout this land, brought together under one organization, the National-Interstate Telephone Association, bearing but one sign, and shouting but one cry, there will be no need of clamoring and beseeching, but this city, as well as New York, will meet us more than half way."

[The proceedings of Thursday, the concluding day of the convention, will be given in the Western Electrician next week.]

Meeting of Illinois Independent Telephone Men.

The first annual convention of the Illinois Independent Telephone Association was held in Peoria June 19th and 20th. It was well attended and a very interesting programme was carried through. The first day was taken up by an address of welcome by Mayor Tolson, followed by the annual address by President Conklin. The latter contained reference to the growth of the Independent movement and its strength in Illinois. Secretary Cheadle recalled the launching of the movement and called attention to the benefits to be derived by the district organizations, the state, and finally the national organization.

The reports of the vice-presidents of the state were given, and all told of like prosperity. G. H. Glass of Pekin made a motion to change the constitution of the state organization to make the district meetings semi-annual instead of quarterly, which was adopted. A committee of five, composed of Messrs. Bassett of East St. Louis, Dailey of Chillicothe, Ash of Kewanee, Hackett of Jacksonville and Aisthorpe of Cairo, was named to make certain changes in the boundary lines of the district association. The evening was spent in a smoker, at which several good talks were given.

The feature of the second day was the address by F. Dagger of Ottawa, Canada, an expert to the House of Commons select committee of telephone systems. Mr. Dagger's subject was "Telephone Competition vs. Monopoly." The speaker has for more than 25 years been an expert in the telephone world. The paper by Miss Barnes, chief operator at the Springfield exchange, on "Discipline at the Switchboard," was well received and thoroughly enjoyed. Hon. E. M. Moulton of Minneapolis, president of the Twin City Telephone Company, told of the system used in his exchange.

Officers of the association were elected as follows:

President—E. R. Conklin of Aurora.

Vice-president—Manford Savage of Champaign.

Secretary—C. B. Cheadle of Joliet.

Treasurer—C. B. Hankins of Decatur.

Members of the executive committee—E. R. Conklin, C. B. Cheadle, C. O. White of Princeton, J. W. Barrett of Pekin, Manford Savage, C. S. Haskins of Decatur and W. H. Bassett of East St. Louis.

Delegates to the national convention were elected as follows: E. R. Conklin, L. S. Bowen of Savanna, H. C. Barbour of Ottawa, B. F. Wasson of Clinton, G. H. Glass of Pekin, C. S. Haskins of Decatur, C. L. Chapman of Tuscola, A. F. Loehr of Carlinville, C. E. Hull of Salem, H. L. Liebig of East St. Louis, Manford Savage, W. H. Bassett, C. B. Cheadle, W. H. Ramsey of Auburn, J. S. Dalley of Chillicothe, J. H. Hackett of Jacksonville.

Bell Telephone Output.

The American Telephone and Telegraph Company reports that the gross and net outputs for May, 1906, break all previous high records, the best previous record having been made in April, 1906. The net output for the first five months of 1906 was more than three times greater than the combined net output of the years 1894, 1895 and 1896. The directors have declared the regular quarterly dividend of 1½ per cent. and an extra dividend of three-fourths per cent., payable July 15th to stock on record July 1st. Following are comparative figures:

May.	1906.	1905.	1904.
Gross output	211,573	168,764	103,897
Returned	59,343	53,212	51,721
Net output	152,230	115,552	52,176
January 1 to May 31:			
Gross output	944,614	777,065	508,372
Returned	304,362	231,115	203,046
Net output	640,252	545,050	305,326
Outstanding May 31	6,339,510	5,026,514	4,084,834

Independent Telephone Company Established in San Francisco.

The Independent telephone interests have at last got into San Francisco. The Home Telephone Company of that city, immediately upon the granting of the franchise (for which it paid the city $25,000, and in addition donated $75,000 to the relief fund) signed contracts with the Automatic Electric Company of Chicago for automatic telephone equipment, with immediate provision for 10,000 lines.

Work will be begun as soon as conditions in the stricken city will permit. It is impossible to say at this time how soon the exchanges will be in operation.

The time is auspicious for the entrance of the Independents into San Francisco. The almost complete destruction of the Bell equipment there and the delays of rebuilding will make the road of the Independents much easier to travel.

Maine Telephone Companies Want Western Connections.

The Maine Independent Telephone Association has been organized by representatives of some 70 Independent telephone companies in the state of Maine. W. H. Park of Portland was elected president and H. T. Davis of Portland secretary and treasurer. The association appointed delegates to the national convention in Chicago. The Maine association proposes to bring the Independent telephone companies into harmony, so that they can get long-distance connections in the state as well as with the western states. The association will hold its first annual meeting in August.

Ohio Telephone Notes.

The automatic switchboard at Columbus is being gradually enlarged to meet the demands made upon it. Since the new system has been in operation and people have learned how to use it, it has become quite popular. The fact that subscribers are able to call each other and hold conversation in a perfectly private manner has much to do with its growth. At the same time, if complaints are made regarding the conversation, the calls may be followed up in a few seconds and the telephone number ascertained

It is stated that the Federal Telephone Company has assets sufficient to liquidate all claims against it. A meeting of the stockholders has been called for July 2d to consider the plan now in the minds of the managers of settling its affairs. This consists of the stockholders taking the securities now held by the Federal at their market value and paying for them. The cash thus realized would pay the debts. Some of the stockholders cannot do this, and some others are unwilling, but it is thought that most of them will go as far as possible to untangle the matter. What cannot be taken, in proportion to the stock held, will probably be underwritten by the other large stockholders, and in this manner the debt will be cleared up. James B. Hoge will have charge of the settlement, and it is expected that he will give most of his time through the summer to the work.

The Beach City Home Telephone Company, Beach City, has been incorporated with a capital stock of $25,000 by J. F. Hoy, H. W. Briggs, Otto E. Oberlin, J. M. Rumsey, A. B. Wingate and James Muskopf.

At a special meeting of the stockholders of the United States Telephone Company at Cleveland a few days ago the capital stock was increased from $2,500,000 to $5,000,000. The board of directors was enlarged by the election of six new members to represent the interests that have recently been admitted, the following persons being chosen to fill these places: H. C. Stifle and A. H. Bower of St. Louis, Mr. Hopkins of Columbus, A. B. Taylor of Elyria, Ohio, Clarence Brown and Herbert Brown of Toledo. The increase in capital was made to enable the company to carry out its plans of extending the lines and taking in the properties of other companies as already arranged.

The Home Telephone Company of Ironton has been incorporated with a capital stock of $50,000 to build and operate a system in that city. A. J. Lathouse, formerly of Columbus, was instrumental in forming the organization. The officers are as follows: President, S. P. Humphrey; secretary, B. F. Forgey; treasurer, E. W. Bixby; manager, Robert Knapp; superintendent, A. J. Lathouse.

C.

Southeastern Telephone Developments.

The Southern Bell Telephone Company will erect a substantial exchange building at Brunswick, Ga., plans to be prepared by the company's architect in Atlanta.

The Southern Bell Telephone Company has filed its answer to the petition of Secretary of State J. Bryan Grimes of North Carolina for the establishment of long-distance rates of five cents a minute for the first five minutes and half that amount for each minute over five minutes, and a rate of $1.50 and $2 per month, respectively, for

residence and business houses in North Carolina. The company claims that these tolls are ruinous to its business if put in effect and that present tolls are not excessive.

A report says that the main loop of the telegraph offices of the Norfolk and Western in the Virginias has been equipped with a telephone service also, though it is not said to what use the road will put the telephone service.

The laying of underground conduit for the Bell system at Asheville is virtually finished and the stringing of underground wires and cables will be started as soon as practicable. A practically new exchange will also be installed at the Walnut Street building of the company.

Maryland and Virginia and other states are promised another long-distance connection with the New York, provided the Independent Atlantic Telephone Company secures a franchise in New York. Manager Wiesong of the Keystone Telephone Company says that his own concern will build the line from New York to Princeton, thus giving the southern connection through his line and that of the Independent line.

R. F. Walker, former inspector of the Bell in Columbia, has been made manager of the exchange at Camden, S. C. D. F. Turnbull of the Lynchburg (Va.) exchange of the Bell has been named manager of the Birmingham (Ala.) exchange to succeed L. M. Hawkins, resigned. L.

Indiana Telephone Items.

The Irvine Telephone Company of Orleans has been incorporated, capitalized at $6,000. The incorporators are Reuben E. Chaltrand, W. H. Taggart, James W. Pickens and Aaron Speer.

The Spurgeon Home Telephone Company, just incorporated, will establish a telephone system in Pleasantville (Spurgeon P. O.), with lines throughout the western part of Pike and adjoining counties. The capital stock is $2,000. John W. Scales, J. A. Wiggs, Alva Dougan and Henry Sultan are the directors.

Through the efforts of Superintendent William Mullendore of the Central Union Telephone Company of Greenwood, the Greenwood Telephone Company has been absorbed by the Central Union Company. It is said that the deal was urged by local business men, who claimed that the advantage of the absorption would be to relieve the people of the annoyance and expense of the double system that has been in use for several years. The Greenwood switchboard will be removed to the office of the old company and the local patrons will be transferred to it by July 1st. Cables will be installed as soon as possible.

There are indications of a telephone war in Terre Haute as the two companies near the completion of the extensive improvements they have been making at an estimated aggregate cost of $400,000. An underground conduit system has been built in the central part of the city by both, and each company has erected a fine exchange building. The Citizens', which is the Independent company recently taken over by the associated interests which acquired the Independent plant, has had lower rates than the Central Union from the beginning. The Citizens' has many more residence subscribers than the Central Union. The rate was $1.50 a month. The Central Union has been charging $2.50, but now makes known a rate of $2 a month.

Extensive litigation is threatened at Richmond, growing out of the fact that the City Council has passed an ordinance which requires telephone companies to accept franchises that embody a maximum rate clause if they reconstruct their lines. The Central Union Telephone Company not only intends to reconstruct its system, but has already much of the material on the ground. The ordinance which the council has just passed provides that when any telephone company shall desire to reconstruct it must place all wires in the business section of the city underground. It must construct a duct of sufficient size to hold the wires of the city electric-light plant and city fire-alarm telegraph in addition to those of its own system, and shall give the city free use of this duct. Rates are to be: For four-party residence lines not to exceed $15 a year; individual lines not to exceed $18 a year; party-line service in business places or public offices, not to exceed four parties on a line, not more than $30 a year; individual lines for business places or public offices not to exceed $36 a year. These rates are to be based on 2,000 telephones or less. For each additional 500 telephones over 2,000, no company shall be allowed to charge to exceed 12½ cents a telephone a month additional to the above rates. The Central Union has given notice that it will not give up its perpetual open franchise to accept one that places a maximum limit on the rates. The Home Telephone Company announces that it will begin soon to rebuild its plant and will conform with the new city ordinance in all particulars. Under the maximum rate fixed by the council the Home company is benefited because it permits a slight increase for it. For six years the Home company has practically enjoyed a monopoly of the telephone business. S.

Telephone News from the Northwest.

The Gothard [illegible] Company, of [illegible], S. D., has filed [illegible] capital stock of [illegible] [illegible] William Murray, G. D. [illegible] and [illegible] Landon, all of [illegible], as the incorporators.

The [illegible] Telephone Company has been granted a franchise at [illegible] Lake, Minn., for a local exchange.

The Southwestern [illegible] Telephone Company, of Pipestone, Minn., [illegible] the southwestern part of Minnesota [illegible] western Telephone Exchange Company. The transfer will occur July 1st.

The contract for the erection of the new [illegible] building for the Bell telephone company at Burlington, Iowa, has been let to the [illegible] Construction Company of Rock Island, Ill.

The Moorland [illegible] Mutual Telephone Company has filed articles of incorporation with a capital of $50,000. D. F. McCarnahan is president and F. C. Cochran secretary and general manager. R.

GENERAL TELEPHONE NEWS

The Badger Telephone Company has been granted a franchise in Oconomowoc, Wis.

The Las Vegas (N. M.) Telephone Company has sold its business to the Colorado Telephone Company.

An Independent telephone company is said to be planning to install a plant in Kalamazoo, to cost between $300,000 and $400,000. It is incorporated as the Citizens' Telephone Company with a capital of $250,000. Within a year it is purposed to have a plant ready that has a capacity for 20,000 subscribers.

The secretary of the interior has authorized arrangements for establishing telephone connections with the towns on both ends of the government line of the Lower Yellowstone irrigation project in Montana and North Dakota. The present telephone line extends up and down the river a distance of about 65 miles.

The Menominee Range Telephone Company has elected the following officers: President, E. F. Brown; vice-president, Sam Perkins; secretary, R. C. Browning; treasurer, William Sunstrom; manager, Emil A. Croll. The work of rebuilding the line to Norway has been completed, and the company contemplates other improvements.

Chief Assistant Corporation Counsel Maclay Hoyne of Chicago has gone to New York to attend a conference of officials of the Chicago Telephone Company. The company is also sending experts to New York to get data regarding cost and maintenance of telephone systems, for the presentation of plans to the Chicago City Council for an extension ordinance.

W. L. Porterfield of Long Beach, Cal., president of the Long Beach Home Telephone Company and principal owner of the exchanges of San Pedro, Santa Ana, San Bernardino, Ventura, Upland, Highland, Fullerton, Ontario, Corona and Colton, has sold all of his holdings to a number of Los Angeles men, headed by J. M. C. Marble. The price was $1,350,000, and includes all of Mr. Porterfield's interest in the plants operating and several franchises owned in other cities of Southern California.

Compared with the increase in new business of the four other leading Bell telephone companies for the year 1905 the Chicago Telephone Company made the poorest showing. In 1905 the per cent. increase in stations for the Chicago company was 21, as compared with 51 for Philadelphia, 25 for the New England Bell, 40 for the New York and New Jersey and 24 for the Central District of Pittsburg. The percentage of increase in gross earnings for the same period was 12 per cent. for Chicago, 19 for Philadelphia, 10 for the New England Bell, 15 for the New York and New Jersey and 10 for the Central District.

The Southern Montana Telephone Company of Dillon, Mont., is making arrangements to extend its service to the ranches in what is known as the Big Hole Basin. Frank A. Hazelbaker of the company recently spent two weeks in the vicinity of Wisdom, Jackson, Fox, Bowen and Briston, and as a result nearly all the large ranchers have signed a two-year contract at $2 a month for the telephone service. The company will install an exchange in the basin and build several hundred miles of main lines. Many of the ranchers have agreed to build the pole lines from their homes to the main lines. Long-distance connection will be given.

MANUFACTURERS AND DEALERS.

A statement issued to its stockholders the Automatic Electric Company of Chicago says that for the first five months of the present year it has completed or is installing approximately 11,000 lines and is building in the factory nearly 24,000 lines. The prospects are that it will reach 75,000 lines during the year. One of the largest contracts is the 10,000-line equipment for the Home Tele-

[illegible]

Chicago Edison and Commonwealth Electric Companies' Reports.

Annual reports [illegible] Chicago Edison and Commonwealth Electric companies [illegible] 27th, show that these companies are in a prosperous condition.

Earnings and expenses of the Chicago Edison Company for the year ended March 31st are as follows:

Gross earnings [illegible]		$[illegible]
Expenses including [illegible]		[illegible]
Net earnings for the year		$[illegible]
Balance surplus, March [illegible]		$[illegible]
Net earnings [illegible] ending March [illegible]	$[illegible]	
Less:		
Special depreciation reserve [illegible] (Under the terms of the trust deed of the company's general mortgage)		
Debenture and bond interest [illegible]		
	[illegible]	
	$[illegible]	
Dividends paid:		
May 1, [illegible], 2 per cent	$[illegible]	
August 1, [illegible], 2 per cent	[illegible]	
November 1, [illegible], 2 per cent	[illegible]	
February 1, [illegible], 2 per cent	[illegible]	
	[illegible]	
Surplus March [illegible]		$[illegible]

In conducting the affairs of the company it was necessary, in order to provide funds for the needed extensions of the generating plants and distributing system in taking care of the increasing business, to increase the outstanding capital stock during the year by the amount of $1,070,000. There was no increase in the bonded indebtedness.

Affairs of the Commonwealth company also show it to be in a prosperous condition. To provide funds for the needed extensions of the company's generating plants and distribution system in taking care of its increasing business, the outstanding capital stock was increased during the year by the amount of $1,000,000, and the outstanding first-mortgage bonds were increased by a like amount.

The continued success of the Fisk Street turbine generating station has been such as to lead the directors to enlarge its capacity. Four more turbines (in addition to the four already in service) have been ordered and will be installed this year, each of which is guaranteed to develop 10,000 horsepower at the time of maximum load, making the plant capable of producing a total of over 00,-000 horsepower.

Following are the earnings and expenses of the Commonwealth company for the fiscal year ended March 31st:

EARNINGS AND EXPENSES

Gross earnings including merchandise sales			$[illegible]
Expenses including cost of merchandise sales			[illegible]
Net earnings for the year			$[illegible]

SURPLUS

Balance surplus, March 31, 1905			$[illegible]
Net earnings for year ended March 31, 1906		$[illegible]	
Less:			
Special depreciation reserve (Under the terms of the trust deed of the company's general mortgage.)	$[illegible]		
Interest on bonds and debentures	[illegible]		
		[illegible]	
			[illegible]
Surplus March 31, 1906			$[illegible]

New Light Schedule for Aurora, Elgin and Chicago

The management of the Aurora, Elgin and Chicago Railroad Company, on June 15, 1906, put in effect the following schedule of rates for electric lighting: For business houses, 12 cents a kilowatt-hour will be charged for burning connected load 30 hours a month, and all additional current at six cents a kilowatt-hour, rates subject to a cash discount of 10 per cent. for prompt payment in 12 days from date of bill; all business houses using more than 4,800 kilowatt-hours a year, or an average of 400 kilowatt-hours a month, will receive current at 10 and five cents; all those using more than 9,000 kilowatt-hours a year, or 750 kilowatt-hours a month, are to receive current at eight and four cents; in residence lighting, all sockets and outlets in living rooms are to be figured as having 16-candlepower 50-watt lamps installed (the term

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Electric Power in Ice Cream Freezing

The arrival of the warm season is always a satisfaction to the ice-cream manufacturer, and before the prospect of increased output in the coming months becomes a reality, there ought to be a time for the central-station man to press home some vigorous arguments in behalf of the motor-driven freezer. The load is worth having, for it is largely non-peak output, and even if it were added to the evening peak there would be sufficient capacity in every station at this season to handle it at a profit.

The cost of freezing ice cream by electric power is a very small matter in proportion to the output. A nine-gallon outfit driven by a one-horsepower motor costs in round numbers $200, and it will freeze this output of ice cream in about 18 minutes with an average energy consumption of about 600 watts. An output of 18 gallons per hour ought to be easily produced in such a plant. With power at eight cents per kilowatt-hour, the cost of freezing 18 gallons is about 5¾ cents, or less than one-third cent per gallon. An output of 180 gallons per day, continued for 60 days, would cost only $34.56 for power, or less than one-fifth of one per cent of the selling price, supposing the product to be sold at 50 cents per quart. The cost of freezing such an output by hand would be utterly prohibitive. In any case, the advantages of the power being directly applied by a motor mounted on the machine, the doing away with inefficient and dirty belts and shafting, the compactness of the entire arrangement and the release of the attendant's services for other work during the period of freezing are too great to be passed by. A little energetic work along this line by the central-station solicitor among bakers, druggists and confectioners, hotelkeepers and restaurateurs ought to result in some desirable new business in the hot-weather period.

Newspaper Versus "Follow-up" Advertising.

The question often comes up in organizing a business-getting campaign as to which is the most profitable method of advertising, through the local newspapers or by a similar sum expended in a follow-up system of mailing cards, circular letters, etc. This question was asked in the 1906 Question Box of the National Electric Light Association and received two replies, one by Converse D. Marsh of the Bates Advertising Company of New York city and the other from the Philadelphia Electric Company.

Mr. Converse believed in the mail solicitation when carefully mapped out. But if this work is not done with thought and care, the circulars, letters, folders, etc., may be thrown together in such a haphazard manner as to be practically worthless as an advertising medium. He had in mind one particular case where a certain circular letter was poorly worded. By changing six words in the letter the percentage of answers increased from three-fourths of one per cent. to 9.5 per cent. Newspaper publicity is always valuable, but the direct results of it cannot be run down as directly as in the case of the other method.

The reply from the Philadelphia Electric Company says: "As a general proposition, money spent in newspaper advertising for the electric-lighting company will not bring as direct or as remunerative results as the same amount of money spent in the follow-up system."

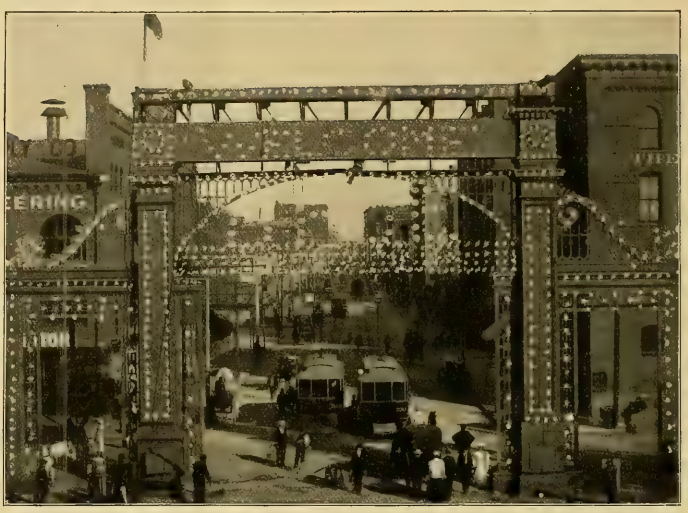
Combining Burglar Protection and Advertising.

Central-station solicitors who are giving special attention to electric signs and store lighting may add to their supply of business-getting argument the unique scheme of a Hyde Park (Ill.) market proprietor who gets advertising and protection at once from his electric lights. The store is lighted with ordinary incandescent bulbs, effectively distributed. At closing time in the evening the lamps are unscrewed from their sockets and placed in two series of sockets set in the rear wall of the store above the counters. These sockets are so placed that when the lamps are inserted and the current is turned on they spell out the words "Butter," "Cheese," or any other words, for that matter. The contents of the store are so placed that the lights throw few shadows. The watchman can gaze into every corner, and passers-by cannot fail to see the "watch-light ad." The store has protection and advertising at one outlay, and the central station adds to its output.

Electric "Welcome" Arch to Greet the Elks at Denver.

More than 50,000 people will attend the Elks' convention, which meets in Denver, and every one of that large concourse of people will be confronted with one of the strongest advertising mediums a city could have, namely, the welcome arch which has been built in front of the entrance to the Union Depot in Denver. The arch spans the entire width of the street and will be covered with 1,400 lights. The word welcome will be a blaze of light, and will give the most glowing kind of a greeting to all who enter the city's gates. No other method could express the hospitality of Denver's citizens with more effectiveness.

The building of the Denver arch is a monument to the favor in which electrical lighting for advertising purposes is held. It was the outgrowth of a vigorous campaign for lighting began by the Denver Gas and Electric Company several years ago. Lighting for commercial purposes became so popular and such a strongly attractive feature for



ELECTRIC "WELCOME" ARCH TO GREET ELKS AT DENVER.

the city that it was a subject of much flattering comment from visitors to the city. In Denver if anything is good they push it. They saw that lights were the thing, and they began to foster the spirit in favor of them. "Boost for the City of Lights" became the popular cry of everyone, and as a result Denver became widely known throughout the country, and deservedly so, as "The City of Lights." The sentiment which was the result of this popular clamor for lights brought about the building of the arch. It was thought that no other way of welcoming visitors to the city was more effective, and a popular subscription brought $13,000 for the construction, from all classes of individuals and business firms. This public-spirited investment will bring returns a thousandfold to Denver, as the arch will make a strong and kindly impression on every visitor coming into the city.

Electricity in a Bakery.

The uses to which electricity may be put in a bakery are numerous. In considering power for places where food is to be cooked, cleanliness is one of the most necessary items, and electricity is the cleanest power possible.

Steckel's Bakery in Hackensack, N. J., is an example of a bakery which has taken advantage of central-station power as furnished by the Public Service Corporation of New Jersey, and is operating its dough mixers by an electric motor. These mixers, says the Public Service Monthly, do the work in about one-third of the time consumed when it is done by hand. Another advantage which bakers find in using electric power is the small amount of space it takes up in their bake shops. This same point is an argument in favor of electric power wherever floor space is limited.

Getting and Retaining New Business.

In the symposium on "Some Methods Used in Securing and Retaining Business," prepared for the Atlantic City convention of the National Electric Light Association, there are a great many helpful suggestions made by the authors of the various papers. Mr. George B. Tripp of Colorado Springs was among those contributing, and the following are some of the suggestions made in his paper:

Each central-station manager must of necessity analyze the conditions which surround his particular plant and plan for the obtaining of new business, consistent with the earnings of his company. For example, it would not seem to be good policy to go out after new business and wage an expensive campaign if the kilowatt capacity of the plant were tested to its limit and the company were trying to reduce its floating indebtedness. Assuming, however, that the company has station capacity to spare and that it is simply a matter of adopting a plan to build up and increase its business along conservative lines, the expenses of which would be in keeping with its earnings, then I believe a successful campaign could be planned along the following lines:

A business department should first be instituted with a manager in charge. Then the territory of the city should be divided into districts and a solicitor detailed for each district, so that one man would look after and solicit from consumers in a territory of from 6,000 to 8,000 population.

By limiting the territory your solicitors may repeat their calls, and will thus not only succeed in obtaining new business and check up all business which they have previously secured, but may, in addition, keep in touch with the consumers of the company to a degree not possible when your campaign is carried on only in a general way.

The manager of the business department and the heads of the operating departments should meet with the solicitors each morning, and not only should matters pertaining strictly to the business department be discussed, but the solicitors should gradually become acquainted with the main features of the operating departments, so that they can converse intelligently with consumers on questions which may be asked and which may materially affect the policy of the company.

Solicitors should be remunerated on a basis which will hold their interest. Therefore they should be paid either on a commission basis or a small salary, plus a commission. To be successful, solicitors must first have a fair knowledge of the devices which they are to sell, of the rates that apply, and, further, they must be in a position to satisfy the consumers of the fairness of the charges which the company makes for its service. The solicitor must at all times use uniform courtesy and patience in his endeavors to obtain business, which factors have a great bearing on the success which the company may enjoy in the community which it serves.

"Follow-up" letters is a method which can be used to great advantage, coupled with the work of good solicitors. I am a great believer in advertising, if used judiciously, but place solicitation first and above all other methods for obtaining new business.

Electric-sign business, I think, is now conceded to be one of the most profitable classes of business that we can obtain. In Colorado Springs we have

secured contracts for 40 electric signs, equaling gross earnings of about $3,500. The contract provides that the consumer install the sign at his own expense and that the company shall charge a flat rate for current consumption and maintenance of lamps on a four hour basis.

It is true that the electric-sign load crosses the maximum peak of the year, but it is rather unusual for the residential lighting load to cross this peak. The average hours' use of the demand in this latter class of business equals only about 1½ hours, as compared with a four hour use in sign lighting.

Before starting on this electric-sign campaign we found it necessary to go before the City Council and ask that an ordinance be passed permitting the installation and erection of signs projecting over the sidewalks, provided, however, that these signs were lighted by electricity. The main argument used in securing the passage of this ordinance was that the streets would be more adequately illuminated, that the streets could be policed more easily and at less expense, and, further, that the interests of the business men and taxpayers would be enhanced because of the brilliantly lighted main thoroughfares.

We also find that there is a considerable field and a growing demand for electric flatirons, which are sold a cost and which will add, at a conservative estimate, $10 per iron per year to the company's earnings.

The installation of high-efficiency lamps is also a satisfactory method of popularizing the use of electricity, and a company, in my judgment, cannot make any mistake by suggesting to the consumer a method of reduction in the cost per unit of light, as it will mean a greater use of the total units in the long run, and therefore an increase in the daily width of the peak and load factor of the station.

The question of how to retain profitable business is also a feature not to be overlooked by any central-station company. The writer is of the opinion,

First—That the rates for service must be as low as possible, commensurate with the costs and securing a fair return on the investment. Charges for both lighting and power service should be based on the hours' use of the service, reductions to follow the decrease in operating costs. The latter naturally show a material reduction as you increase your sales per kilowatt of station capacity, which result can be brought about by adopting a two-rate system, based either on the connected load or the demand system. It is unnecessary for me to enter into a discussion of the merits of any particular system of charging. A system, however, that tends to induce the consumer, particularly in your commercial district, to use current for lighting or power purposes longer hours each and every day of the year not only increases your income per thousand dollars' investment, but just as surely increases the security of your holding such a consumer in line and making a "booster" of him for new business in your district.

Second—The service must be maintained at the highest standard, which means that the station regulation must be kept up as efficiently as the best engineering practice will allow; that the various current devices used by the consumer must be inspected by the company's representatives as often as necessary not only to secure a maximum income from the use of same, but, in addition, to see that said devices are operating efficiently.

Further, it is extremely essential that complaints be answered promptly and claims adjusted with a view of not only securing for the company the return justly due, but that, above all other considerations, the claims be settled on a basis entirely satisfactory to the consumers. The best results are attained by adopting a conciliatory rather than an arbitrary policy in your treatment of claims and complaints.

Third—The company should inaugurate in its general policy that each and every consumer should be made to feel that his business is of the preferred class and that the company needs it. In other words, give the consumer the attention that he is accustomed to receive from his mercantile house or the salesman from whom he buys goods, and not assume that he must come to you for the commodity that you sell.

Public-service corporations should deal with the general public and with the municipality that each serves from the point of view that the electric company has nothing to conceal, and is ready at all times to answer sensible criticisms. Municipal-ownership agitation has in the past gained strength because of the secrecy that has shrouded the reports of operating companies, which has resulted in the general public suspecting that companies were earning enormous dividends.

Let us be fair on this proposition: In the first place, by issuing bonds on the properties in an equitable way; by declaring reasonable dividends on the stock; building up a surplus or sinking fund that is in keeping with the bond issue; and, when earnings exceed the amounts necessary for these charges, then reduce the rates for service rather than increase the dividends. This may sound like an ultra-conservative policy, but such, I believe, is the policy we must enforce in the future to successfully retain the business that we have secured.

Business-getting Methods.[1]

By Jesse W. Frueauff.

We all realize that a perfect load factor is our ideal, and that the better our load factor can be made, the more closely have we approached success. So far as the lighting end of the business goes, the development of the last few years has shown that long-hour display or advertising lighting presents the most opportunities for improving the load factor. The tendency toward this class of lighting has spread like an epidemic over the entire country, and it has now come down to simply a question of how to get the business.

The use of electric power, particularly through the daylight hours, is another feature that commends itself to the central station, and is doing much to build up the steam load factor, giving us better station results, particularly in the line of boiler fuel and station labor costs.

How, then, to secure the desirable business is the problem before us. The company, realizing the difference between the desirable and undesirable business, must necessarily make efforts to secure business along systematic lines, for if this distinction is overlooked, we are soon apt to take on, inadvertently, business that requires a larger and larger investment without adequate return.

We have all passed the day when we feel that business will come to the office, and we must simply provide means to take care of it. It is now up to us to put ourselves in the position of the merchants with wares to sell in competition with others, and we must go out and find our market and convince the customer that our wares are the ones that will bring him the greatest profits and the greatest convenience.

The writer feels that the best results in getting business are secured through systematic solicitation, followed up and interwoven with general and personal advertising. We must see our customers, know their wants and aim to supply them. In many cases we must begin by creating a desire for what has seemed a new article or an expensive luxury. Solicitors or representatives must be thoroughly drilled in their work and should be conversant with the general methods of manufacture, in order to intelligently approach the possible user.

We have found that best results are secured by a constant interchange of ideas among the men engaged in the same line of work, and by a constant and continual drilling and education of the men by some one well posted on the subject. At the outset, it is well for a new man to go about with one who has solicited before, and in that way learn the general line of arguments that are used to induce the consumer to buy; to learn to make a favorable impression upon the prospective consumer, how to adjust complaints, if made, and how finally to close an order. We have found that, while many men are thoroughly posted on the advantages of the use of electric light or power, they are not able to hold the interest of the customer, and it is of prime importance that they know how to present the proposition.

Too much attention cannot be given by the representative to the complaints, either real or imaginary, which come to his notice. One dissatisfied consumer in a district can undo weeks of work of the most capable representative, and the satisfactory adjustment of a complaint has often resulted in an order, and has made the consumer an active solicitor for the company.

With business men, as well as with the housewife, much of their conversation is taken up with the comparison of their methods. The man with the well-lighted store explains to other merchants his reasons for the lighting and the benefits he has derived, just as the housewife with electric light in her home tells of the advantages it has over oil lamps and the other antiquated methods used by her neighbors.

As the class of business secured by the representative may be good or bad, it is necessary that he should be encouraged in attracting the best business and discouraged in taking on the poor. A contract bringing a revenue of $100 a year from one consumer may carry with it a very satisfactory profit to the company, while the same amount of revenue from another party may prove wholly inadequate to pay the costs occasioned, so we have felt it necessary to make our basis of pay to the representatives follow this plan, making the remuneration to the man increase as the value of the business secured increases.

Too much stress cannot be laid on the satisfactory results that can be secured by judicious advertising in connection with the visits of the solicitor. It is often impossible for a merchant to give a solicitor any of his time when he happens to drop in to see him, and by the use of letters asking for an appointment, stating clearly why an interview is sought, time may be saved for the company and for the merchant, for he is waiting to receive you if he has made an appointment.

1. Abstract of a paper read before the National Electric Light Association, Atlantic City, N. J., June 6, 1906. Mr. Frueauff is general manager of the Denver Gas and Electric Company.

The [illegible] of [illegible] results [illegible] what we have to [illegible] bringing [illegible] the [illegible] thought [illegible] of the [illegible].

The [illegible] unless followed up [illegible] a trained [illegible] after reading [illegible] call and [illegible] business [illegible] down and look for the [illegible] This applies in every [illegible] ably more [illegible] establishment.

One of the very important features in the getting of new business is the personal [illegible] used by the company. We can readily [illegible] secure results that would [illegible] expense of a [illegible] business campaign [illegible] followed up persistently and systematically.

One visit to all of our customers or prospective customers will not accomplish much. In many cases the first visit will scarcely give the solicitor an opportunity to meet the consumer, or the entire interview will be taken up with the discussion of the company's policy, or in the discussion of some grievance, but it must be borne in mind that these interviews, while not directly productive of good, in the long run are bound to pay handsome dividends.

Our experience, covering a period of several years, shows that the most of our orders are closed after the fourth or fifth visit, and that practically no orders are taken the first time a prospective customer is seen. We have found [illegible] that where solicitation has been followed up and interwoven with general advertising and with special letter writing, the number of visits has been cut down and the orders secured on an average of about three visits.

The statements just made apply only to the business and commercial districts. In the residence districts we have found it comparativly easy to secure lighting orders on the second visit, but it takes a great many visits to increase their consumption, through special uses, such as for long-hour burning of porch lights and the use of special appliances, such as sewing-machine motors, curling-iron heaters, chafing dishes, and so forth.

Coming down to a specific branch of business-getting, we strongly recommend the use of specialists in particular lines. For example, we have found that a man well versed in the building and designing of electric signs is of material assistance to the representative; that is, while the representative is able to interest the merchant in a proposition for a sign and to convince him of its desirability for his business, if he can then bring to the merchant a man who can give him ideas on how his place may be lighted and advertised to bring out his particular line, it will bring more satisfactory results for the merchant and will usually enable us to secure a larger and more permanent proposition.

We have a man who devotes all of his time to drawing sketches that are submitted by the representative and sign expert. Oftentimes half a dozen sketches are submitted, after the merchant has concluded to put up a sign, before any of them catches his fancy, but it pays well to go to this expense and have him thoroughly satisfied at the outset that he has something particularly adapted to his case.

It is the same with the solicitation of electric power. A special man, who is thoroughly posted on the adaptability of electricity for motive power, can bring the merchant to the closing point much more quickly than if the work is undertaken alone by some man who is fairly well versed in all parts of the business, but is not a specialist in this line. We all like to feel when buying that we are doing business with someone who knows thoroughly what he has to sell and how it can be applied. The use of these specialists in connection with the regular representative will tend to impress the prospective customer with the reliability of our proposition.

Another specialist who is of great value to the lighting company is a man to follow up new buildings. He can arrange with the architects when plans are drawn, and advise with the builders as the work progresses, as to how the building shall be wired and as to the general scheme of illumination.

We have realized the importance of an illuminating engineering education on the part of some of our representatives, and at present have a number of them taking a special course with an illuminating engineer of national prominence. We have found their ideas, when presented to the merchants, have been highly appreciated, and we believe that as time goes on there will be a noticeable improvement in our methods and standard of illuminating, due to the fact that they are considering the lighting of the places from a thoroughly professional standpoint and not, as has been our trouble in the past, in trying to see how many

globes can be crowded into a given space and enough lights secured, overlooking the thought of its artistic or economic effects.

Careful records should be kept by the representatives of the work they are doing, and records kept in the office of the possibilities outside. Here, again, we find that system plays an important part. With the records kept of the date when the consumer was last visited and the results of the last interview, much time can be saved in going out again and in knowing how to approach him and knowing what his needs are.

One of the most profitable sources of business lies with our present users in increasing their standard of illuminating, and, with business houses, in impressing upon them the possibility for display lighting. This particular part of the business is to be commended. Practically no further investment is needed to secure this business, consequently the profits are very much greater than where new connections have to be made, and once having made a start with the merchant it is easier to get him to use more. With many of our sign, window and outlining consumers we have increased their use of light two or three fold, as the advantages of this class of business have impressed themselves on the merchant's mind.

Canadian Electrical Association.

The Canadian Electrical Association held its sixteenth annual meeting in the Cataract House, Niagara Falls, N. Y., on Tuesday, Wednesday and Thursday, June 19th, 20th and 21st. As originally planned, it was intended to hold the meeting on the Canadian side at Niagara, but the new hotel was not completed, and this necessitated a change to the New York side. The opening session was held Tuesday afternoon, President A. A. Wright, M. P., of Renfrew, Ont., calling the meeting to order at 2:25 p. m. The president at once introduced Mayor O. W. Cutler of Niagara Falls, N. Y., who made a very happy address of welcome, pointing out to the electrical engineers that it was "the long-haired men and short-haired women" who had raised trouble about the progress of their profession, as demonstrated at Niagara, destroying the scenic grandeur of the falls. He expressed the belief that more water is now going over the falls than ever before, and that the engineers should do their part on returning home to quiet the fears about Niagara being destroyed. It was arranged to have Mayor R. P. Slater of Niagara Falls, Ont., join in welcoming the engineers to Niagara, and he followed Mayor Cutler, making the welcome an international event in this respect. Mayor Slater agreed with Mayor Cutler as to the length of the hair worn by those who have created erroneous impressions about the Falls. He recognized that Niagara is a very nice place for bridal couples, and that holidays are all right, still it was not his belief that the people of the twentieth century intended that power representing the energy of 15,000,000 tons of coal should be allowed to go to waste. He referred to the fact that the Welland Canal and the Erie Canal were diverting water from the Falls, but that nothing is said about it. "Fool legislation," said he, "is unnecessary to take away rights granted in the original franchises of the Niagara companies."

President Wright responded to the words of the mayors, saying it was the first time the association had met on other than Canadian soil, and the first time they had had the pleasure of being welcomed by two mayors. He quoted Professor Fessenden of Washington, D. C., as saying the Falls of Niagara are capable of developing 6,000,000 horsepower, representing a capitalization value of $2,000,000,000. In his annual address President Wright, among other things, said:

"It is by no means undesirable that I should draw your attention to the valuable work the Dominion government has performed in sending a number of able and competent gentlemen to Europe to investigate the best methods practiced there for smelting certain grades of ore by electricity. On the return of these gentlemen from prosecuting their investigation a sufficient sum of money was placed at their disposal by the government to establish one of these experimental smelting works at Sault Ste. Marie, and the results of these experiments have surpassed our most sanguine expectations. The following are the results as reported by Dr. Haanel himself:

"First—Magnetite can be as economically smelted by the electrothermic process as rematite.

"Second—Ores of high sulphur content not containing manganese can be made into pig iron containing a few thousandths of a per cent. of sulphur.

"Third—The silicon content can be varied as required for the class of pig to be produced.

"Fourth—Charcoal, which can be cheaply produced, from mill refuse or wood, which could not be otherwise utilized, can be substituted for coke as a reducing agent without being briquetted with the ore.

"Fifth—A ferro-nickel pig can be produced, practically free from sulphur, and of fine quality, from wasted nickeliferous pyrrhotite.

"Sixth—The experiment made with titaniferous iron ore containing 17.82 per cent. of titanic acid permits the conclusion that titaniferous iron ores up to perhaps five per cent. titanic acid can be successfully treated by the electric process.

"I need scarcely tell you that these are results of vast commercial value to the mine owners of the Dominion."

At this time W. H. Wiggs of Quebec, Can., was given the floor, and he invited the association to visit Quebec in 1908, to assist in celebrating the anniversary of the founding of the Dominion, an event that occurred July 3, 1608.

The report of Secretary C. H. Mortimer of Toronto gave the total number of members as 390, made up of 238 active and 152 associate members, a reclassification of the active and associate members accounting for an apparent reduction in the number as compared with the report for the previous year. The death of Mr. H. N. Dignan of Bowmanville, Ont., was given appropriate mention. It was stated in the report that the cash on hand is $1,131.47, a balance that gives the association a good standing financially. In closing his report Secretary Mortimer tendered his resignation as secretary, demands of business making it necessary.

A paper on "The Engineering Features of the Ontario Power Company's Plant" was presented by V. G. Converse. The paper was illustrated by stereopticon views as it was read, and proved very entertaining. R. G. Black, R. T. McKean, A. A. Dion and J. W. Campbell participated in the discussion that followed.

The question box was then taken up, in charge of A. A. Dion of Ottawa.

Tuesday evening was devoted to the reading of papers, the first being on "The Engineering Features of the Plant of the Electrical Development Company of Ontario, Ltd." This paper was by F. O. Blackwell and was illustrated. H. M. Buck followed with a paper on "The Engineering Features of the Canadian Niagara Power Company's Plant." Both papers were closely listened to, and there was brief discussion.

Wednesday morning the feature was a paper on "Legal Points of Interest to Electrical Engineers," by Robert McKay of Toronto, Ont. Seldom is it the pleasure of any convention to have presented a paper of such great interest. Naturally, the points of law were those of Canada, but the audience was from that country. Mr. McKay's paper was exhaustive in its treatment of many matters. Following the presentation of the paper, Mr. McKay allowed himself to be questioned as to the law in various cases. The prompt, clear manner in which he responded was a delight to the convention, and the minds of the engineers were cleared of knotty points about stringing wires over railways and through trees on the Canadian side; also as to the responsibility for accidents of various kinds.

On Wednesday afternoon the members of the association met at the terminal station of the International Railway Company, where they boarded electric cars and were taken to the Canadian side of the river. They gazed on the scenic grandeur of the Falls, and inspected the plants of the Ontario Power Company, the Canadian Niagara Power Company and the Electrical Development Company of Ontario, Ltd. At this latter plant they made a trip into the tunnel, and viewed the surprising underground work of this great development. Rain and sunshine were features of the afternoon, but the dampness did not materially mar the outing. A searchlight trip to the Niagara Gorge, arranged for Wednesday evening, was abandoned.

Thursday morning John T. Farmer of Montreal presented his paper on "Steam-plant Accessories." Mr. Farmer did not read his paper in full, simply referring to the important parts, and the discussion of the members will be submitted to the secretary in writing in time for the Proceedings.

On motion of John Murphy of Ottawa, the executive committee was authorized to amend the constitution and report at the next meeting.

Thanks were extended to A. A. Dion of Ottawa for his able supervision of the Question Box, and, while the matter of next year's Question Box was left to the executive committee, the expression was that Mr. Dion should be asked to take charge of it.

The executive committee will decide the place of next meeting, keeping in mind the advisability of meeting in Montreal about the same time as the American Street and Interurban Railway Association.

The election of officers was then taken up, with this result:

President—R. G. Black of Toronto.

First vice-president—R. S. Kelsch, Montreal.

Second vice-president—W. R. Ryerson, Niagara Falls, Ont.

Secretary-treasurer—T. S. Young, Toronto.

There was but one change in the executive committee. This was the substitution of Louis W. Pratt of Brantford in place of J. A. Kammerer of Hamilton, so that the committee is as follows: James Robertson, Montreal; A. A. Dion, Ottawa; R. F. Reesor, Lindsay; Charles B. Hunt, London; Louis W. Pratt, Brantford; J. J. Wright, Toronto; W. Williams, Sarnia; Lewis Burran, Quebec; H. O. Fisk, Peterboro; J. W. Purcell, Walkerville.

A very hearty vote of thanks was extended Mr. C. A. Mortimer, the retiring secretary, as well as to the power companies that extended courtesies.

The Exhibits.

It is possible that the number of exhibit was lessened by the fact that the association met in the United States instead of in the Dominion of Canada, but still there were several very creditable exhibits noted at the Cataract House and International.

The Oneida Community, Ltd., interested many with its exhibit of its popular galvanized chain for the suspension of arc lamps, a working installation being shown in the Cataract House office lobby.

The Canadian General Electric Company had parlors A, B and C on the second floor of the Cataract House, where it received friends, but made no exhibit.

Allis-Chalmers, Limited, of Montreal, exhibited a number of beautiful framed bromide enlargements of some of the machinery which the company has already built and installed during its short career. The most noticeable was the power house of the Northern Aluminum Company, Limited, at Shawinigan Falls, Que., containing the largest interpolar generators ever built. As usual, the company printed and circulated, at four intervals, the "Register" of names of those in attendance, which is always a serviceable feature of these conventions. Among the representatives of the company present were Messrs. Alfred Collyer, sales manager; H. A. Burson, electrical engineer; R. A. Stineon, W. V. Warren, John S. MacLean, Montreal; T. J. Lynch, George C. Burnham and J. A. Shand, Toronto.

The exhibit of the Canadian Westinghouse Company, Limited, was placed in the large first-floor parlor of the Cataract House, where the chief feature was the Nernst lamp, for which the Canadian Westinghouse Company is licensee manufacturer for Canada. The lamp was shown in all sizes and types. The new series lamp attracted a great deal of attention. This was shown in two types, for socket and gooseneck suspension. Among the other detail apparatus manufactured in Canada by the company were shown fan motors, recording wattmeters, transformers and arc lamps. The company was represented by a number of representatives from different offices, among whom were the following: Paul J. Myler, general manager and second vice-president; N. S. Braden, general sales manager; H. U. Hart, chief engineer; H. D. Bayne, Montreal manager; T. F. Dryden, Toronto manager; A. E. Fleming, manager Nernst lamp department; C. W. Henderson, E. M. Breed, S. W. Smith, W. M. Andrew, W. W. Lovell, R. J. Dunlop, W. H. Eisenbeis, C. G. Keyes, G. F. Foot and W. H. McLaren.

The Pittsburg Transformer Company, represented by H. G. Steele, occupied a portion of the main lobby of the Cataract Hotel with a complete and artistic display of its product.

New Electrical Equipment for Cotton-Mill Work.

The application of electric motors to the operation of textile mills has proved conclusively that by this method of drive, economies are obtained which are not possible with any other method, such as increased quantity of goods manufactured, as well as the elimination of heavy belts and shafting. In the cotton industry the rapidly increasing demand for electrical equipment is especially noticeable, one illustration being a recent order from the Dan River Power and Manufacturing Company of Danville, Va., for a new plant, placed with the Baltimore office of the Westinghouse Electric and Manufacturing Company.

The contract is practically a duplicate of the present installation, which has been in operation about 18 months. The new plant, when completed, will, it is said, be one of the best electrical installations for cotton-mill work in the country. The mills are designed by the well-known firm of Lockwood, Green & Co. of Boston, and have the latest type of cotton-mill machinery.

The power plant is on the Dan River, about a mile distant from the mills, and will contain, when completed, three 750-kilowatt and three 500-kilowatt alternating-current revolving-field generators of the waterwheel type, with two 125-kilowatt direct-current exciters and complete switchboard equipment.

The recent order for new apparatus includes one 750-kilowatt revolving-field 6,600-volt 25-cycle three-phase waterwheel generator, two 500-kilowatt generators with the same characteristics, switchboard equipment, bank of three 600-kilowatt oil-insulated water-cooled transformers complete with oil controlling switch, low-tension switchboard, and 24 440-volt three-phase induction motors, which will be used for operating the different machinery in the cotton mills. The sizes of the motors are as follows: Fourteen 100-horsepower; five 150-horsepower, two 50-horsepower, two 40-horsepower, and one 75-horsepower.

The Buffalo (N. Y.) and Lackawanna Traction Company has been incorporated with a capital stock of $1,000,000. The company proposes to operate a new street-car line in Buffalo, which will be operated by electricity or by power other than steam. It will be five miles long. Joseph B. Mayor and William F. Sheehan of New York and others are incorporators.

A New Type of Polyphase Induction Motor.

A new and novel type of polyphase induction motor is now being manufactured by the Stanley G. I. Electric Manufacturing Company of Pittsfield, Mass. The new "riveted frame" motor, as it is called, is a decided departure from the usual form taken by such apparatus as will be seen by the following description and illustrations:

The original method of induction motor construction was to support and completely surround the motor proper, consisting of the laminated iron core and the windings, in a frame box of cast iron. This practically encloses the motor, preventing free radiation of heat to the air, and in many designs the heat is partially retained by air spaces between the laminations and the frame. These spaces often act as pockets for the collection of dirt and thus further prevent the dissipation of heat.

The method in the new motor is to support the core and windings in frames designed so that the laminations are freely exposed to the air. In the larger sizes the laminations are built up in ribs, to which the punchings are secured.

In the smaller sizes it has been possible to do away with these cast-iron ribs and hold the frame together by means of a riveted construction, which leaves the laminated iron core freely exposed to the air around its entire periphery. In this way it is unnecessary to use end castings of greater diameter than the laminations, and thus the dimensions and weights of the motors are greatly reduced. The design and construction are such that the assembled structure is made absolutely rigid and incapable of distortion.

Figs. 1 and 2 are an end view and a side view, respectively, of a three-horsepower polyphase induction motor.

The field windings consist of form-wound coils carefully proportioned so that when they are in place there are no undue strains on the insulation. Carefully selected insulating material is used, and by a special process the field winding as a whole is thoroughly saturated with a suitable insulating compound after it has been placed in the slots, making it practically moisture proof.

The heads or end shields which contain the motor bearings are bolted to the frame. They are so arranged that by bolting them on in different positions the motor may be operated on the floor, wall or ceiling without any other change, the oil reservoirs being kept in a horizontal position.

Bearings are self-aligning and of liberal proportions so as to reduce their wear to a minimum. They are oiled by means of rings, and the oil reservoirs carry an ample supply of oil. Gauges which indicate the amount of oil in the reservoir and taps for drawing off the oil are provided.

The armature or rotor is of the short-circuited or squirrel-cage type, the simple and indestructible character of which is well known. No switches or moving electrical contacts whatever are used, so that the motor is unaffected by dust or dirt. Furthermore, there is no danger from electric sparks. The laminated punchings are mounted directly on the shaft and held in place by an exceedingly simple and ingenious arrangement. The armature bars or conductors are placed in the slots, and the overhanging portions of the teeth assist in preventing the bars from being displaced by centrifugal force. The rings on the ends of the armature which short-circuit the bars are so fastened to them as to reduce the resistance of contact to a minimum. The free radiation of the heat is greatly facilitated by the use of several thin disks instead of a single solid ring.

Special attention has been given to the question of heating. [illegible] lamination and [illegible] the exterior but in the interior, where [illegible] perature frequently [illegible] tors are guaranteed to operate [illegible] their full rated output without the temperature rise of any part exceeding 40 C. and for two hours at 25 per cent overload without the temperature rise exceeding 55 C. above the surrounding air.

A comparison of this new type with an early Stanley motor of higher speed and the same output which was on the market 15 years ago, illustrates strikingly by its much smaller size the progress in induction-motor engineering, especially when it is remembered that the present motor excels the old type in points of efficiency and general performance to as marked a degree as in size and weight.

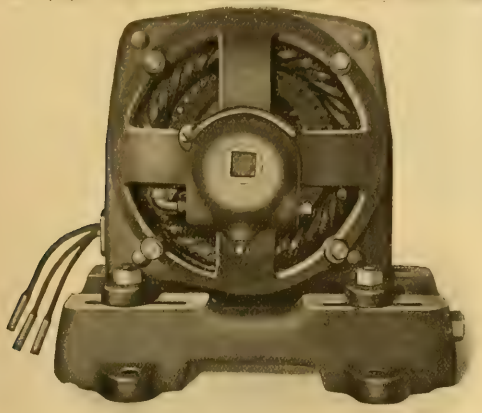


Fig. 1. End View.

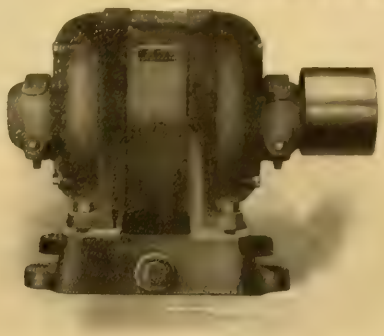


Fig. 2. Side View Showing Exposed Laminations.

A NEW TYPE OF POLYPHASE INDUCTION MOTOR.

Stationary Engineers Visit Allis-Chalmers Shops at West Allis.

Members of Illinois Association, No. 28, of the National Association of Stationary Engineers, on the invitation of the Allis-Chalmers Company, extended through R. D. Tomlinson, the company's condenser expert, and also national president of the National Association of Stationary Engineers, paid a visit of inspection to the new West Allis Works of the Allis-Chalmers Company, Milwaukee, on June 10th. The guests arrived from Chicago, 130 strong, and were conveyed in special cars to the company's plant at West Allis, a western suburb of Milwaukee. The photograph, which is here reproduced, was taken shortly after the party's arrival at the works, where the visitors were grouped about the galleries of a 30,000,000-under every-day working conditions, was an object of particular interest in view of the rapid strides recently made by the gas engine into general favor as a power unit, especially for use in the steel and iron industry. Allis-Chalmers gas engines now on order for installation in steel mills of the country alone aggregate approximately 25,000 boiler horsepower. The Allis-Chalmers steam turbine was also an object of interest on the part of the visiting engineers.

The extensions to the West Allis Works, which consist of three new machine shop units as well as additions to foundry, erecting and pattern shops, will be ready for occupation by the latter part of the summer. Those new buildings were pointed out to the visiting engineers as the future centers of Allis-Chalmers steam-turbine, gas-engine and electrical-machinery manufacture, by means of which the total floor area of the West Allis shops is extended to cover over 32½ acres.

The inspection of the West Allis Works by the Association engineers was made in accordance with a well-defined policy toward the promotion of the educational as well as fraternal welfare of that organization. The National Association of Sta-

STATIONARY ENGINEERS AT THE ALLIS-CHALMERS SHOPS.

tionary Engineers, organized 24 years ago, boasts a present active membership of 20,000 in good standing, which is composed of some 450 local associations covering every state in the Union.

Latest Types of the Duntley Air-cooled Portable Electric Drills.

The success of any portable tool depends upon its ability to perform the work for which it was designed with the greatest dispatch and the least consumption of energy, its ease of manipulation and its freedom from liability to break down under hard usage and rough handling. The remakable success attained during the last two years by the Duntley portable electric drills, manufactured by the Chicago Pneumatic Tool Company, makes a detailed mechanical and electrical description of the construction of these tools of much interest.

The drills are built in three distinct types, each adapted to its own particular class of work, but all embodying practically the same mechanical features, differing only in the design and general arrangement of the electrical parts. These three types are known as the single-motor, two-motor and three-motor drills, respectively.

The single-motor drill, which the manufacturer

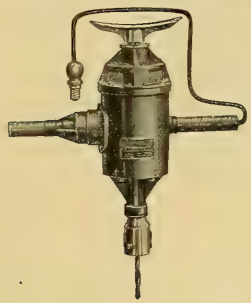


FIG. 1. SINGLE-MOTOR TYPE OF BREAST DRILL.

considers adapted to all classes of general work for drilling in iron or steel up to 1¼ inches in diameter, is, as its name would signify, provided with one revolving electrical element or armature. Figs. 1 and 2 are general views of the single-motor drills ranging in size from three-eighths inch capacity for the breast drill to 1¼-inch capacity for the type 1-M-3-19. The magnetic field casing is a steel casting of high permeability, to which

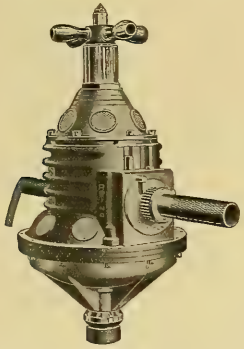


FIG. 2. SINGLE-MOTOR DRILL OF ONE AND ONE-FOURTH INCH CAPACITY.

are bolted drop-forged pole-pieces. The armature is of the slotted type, with hand-wound coils of double silk-covered magnet wire, secured in place by means of wedges, no binding wire being used. The commutator is built of hard-drawn copper bars, insulated with the best grade of amber mica, and the commutator sleeve is of machinery steel. The shaft is of high-carbon steel, with the pinion cut as an integral part of it, and is hardened and ground at the bearings. The bearings are of the most approved ball type, with provision for slight end play of the armature. Carbon brushes are used.

Handles are of round hollow pipe, located near the line of center of gravity of the drill, and the flexible leading-in cable is passed through one of these handles. A special quick-break switch is mounted in the drill-housing at the base of one of the handles and is entirely protected from external injury. The switch cuts off all current entering the drill, including the shunt-field current. A reversing switch is furnished when so ordered, and is arranged so that the drill cannot be reversed without first throwing off the current by pushing the "off" button on the switch. The breast drill and type 1-M-1-10 drills, having capacities of three-eighths inch and one-half inch in iron, respectively, are shunt wound, while the larger drills are compound wound.

Fig. 3 is an illustration of the planetary gear with case. This system of gearing, first intro-

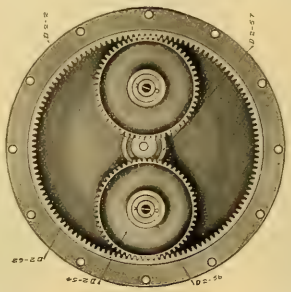


FIG. 3. PLANETARY GEAR AND CASING OF DUNTLEY DRILL.

duced in the Boyer air drills, manufactured by the Chicago Pneumatic Drill Company, brings into action two teeth of the pinion, balances all strains on the bearings and produces a symmetrical tool with all of the strains in one straight line between the point of the drill and the point of the feed screw.

Provision is made for the application of grease to the gears, which are all hardened by a special

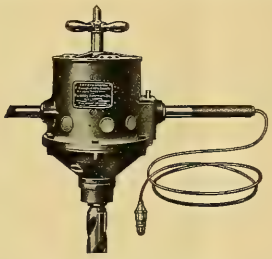


FIG. 4. THREE-MOTOR DRILL.

process. The gears when running at their normal peripheral speed of about 475 feet a minute are absolutely noiseless, and on a drill capable of drilling 1¼-inch holes in iron or steel, the energy required to drive them up to this speed empty is about 18 watts, or one-fortieth of a mechanical horsepower. The total energy required by this drill running empty at full speed is 83 watts,

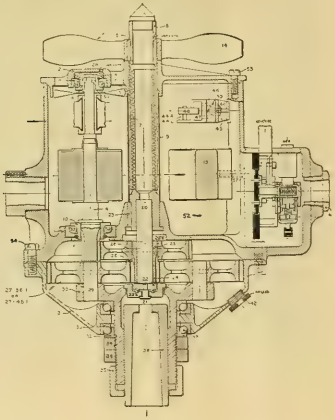


FIG. 5. SECTIONAL VIEW OF TWO-MOTOR DRILL.

or one-ninth horsepower, including all mechanical and electrical losses. The temperature rise of the drill after 10 hours full-load service will not exceed 35° C., or 63° F. above the surrounding air. This is accomplished by the excellent electrical design in connection with a special ventilating system which keeps a stream of cold air pouring through the windings at all times. A fan is provided on the armature shaft and revolves at the speed of this shaft, which is comparatively high and imparts a good velocity to the air. With the larger drills of this type, working on 1¼-inch holes in good cast iron, one cubic inch of metal per minute can be easily removed. This is equivalent to one inch in depth a minute of a hole 1¼ inches in diameter.

For drills capable of drilling holes larger than 1¼ inches diameter, if one armature is used, the armature becomes quite large in diameter, and the speed must necessarily be reduced to keep down the peripheral velocity. It is for this larger work that the two and three-motor drills become desirable. By the use of two or three small armatures, properly geared to the main driving spindle, a greater power can be secured for a given weight on account of the higher speeds that the armature can be run at with perfect safety. This seeming multiplicity of parts is made perfectly simple and free from liability to trouble by the special design and the superior construction used on these drills.

Fig. 4 shows the general outside appearance of a three-motor drill, and Fig. 5 a sectional view of a two-motor drill. Since the construction of these

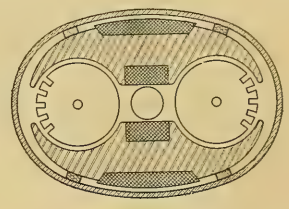


FIG. 6. ARRANGEMENT OF ARMATURES AND FIELDS IN TWO-MOTOR DRILL.

drills is somewhat analogous, they will be described together. Figs. 6 and 7 show the plan arrangement of the armatures and fields, which are peculiar to the Duntley drills and constitute one of the most important features. The outer casing is of non-magnetic material. It will be noted that the magnetic flux in each drill is in series through the armatures, thus insuring the same speed for all three armatures (or two as the case may be).

The fields are compound wound, and a very low starting current is required, and at the same time a fairly close speed regulation is obtained. The fans are placed on the upper or commutator ends of the armature, and the air is drawn in here and forced out at the lower end. The electrical construction of the parts, including the switch, is the same in general as for the single-motor drills previously described. The planetary-gear arrangement is similar, involving only such

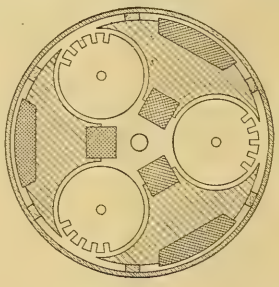


FIG. 7. ARRANGEMENT OF ARMATURES AND FIELDS IN THREE-MOTOR DRILL.

modifications as are made necessary by the increase in the number of driving pinions.

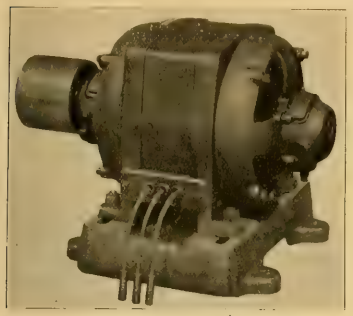
The two and three-motor drills are, as previously stated, adapted to heavy drilling, and are used for drilling in iron or steel up to 2¼ inches and for boiler-plate reaming and stay-bolt tapping. On large holes they have removed 2¼ cubic inches of cast iron a minute with comparative ease.

The Navy Department, in its recent power extensions to the New York navy yard, has, through its Bureau of Yards and Docks, adopted Westinghouse-Parsons steam turbines, which will be installed in building No. 41. The present installation will comprise two 500-kilowatt units operating under 150 pounds steam pressure, 28-inch vacuum, and on superheated steam at 100° F. The power plant supplies three-phase alternating current at 2,300 volts, and 60-cycle frequency, to machine shops, dry docks, and other general purposes about the New York yards, including lighting of buildings. Boilers will be of the Stirling water-tube type, with Foster internal superheaters. Worthington surface condensers will be used.

Small Riveted-frame Induction Motors.

The General Electric Company is placing on the market a new line of low-powered polyphase induction motors in capacities up to 7½ horsepower which embody several new and interesting features of construction. Some time ago this company began the construction of a skeleton-frame type of induction motor in the larger sizes, and the success with which these machines have operated has led to the building of the smaller sizes on the same principle. In the older designs of motors it has been customary to build such machines with a solid magnet frame. The new design has proved its superiority, however, and, without sacrificing rigidity or strength, much unnecessary material has been eliminated, decreasing the weight of the machine and increasing the ventilation and general efficiency.

In the new motors, low temperatures, light weight of active material per horsepower and compactness and rigidity have been embodied in the construction of the stator. The cast-iron hoods, common in most motors over the stator laminations, are omitted, and the stator punchings are assembled, clamped between cast-iron rings or flanges, and permanently secured by bolts riveted at the ends. In the enclosed type, the same principle is followed, but additional steel flanges of a larger diameter are leaved into the stator laminations, increasing the radiating surface and thus offsetting to a large degree the smaller amount of ventilation existent with the closed end shields. The resulting



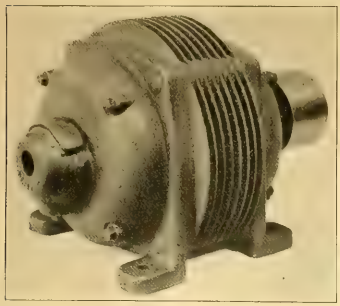
RIVETED-FRAME INDUCTION MOTOR.

stator, while novel in appearance, is very efficient and the reduction in output with the enclosed type of motor is greatly minimized.

Aside from the decreased weight per horsepower, and the compactness and rigidity, the ventilation in the new design is greatly improved, due to the direct contact of the laminations with the air, thereby increasing the heat radiation and insuring low operating temperatures at considerable overloads.

The rotor used in both open and enclosed motors is of the squirrel-cage short-circuited type, having no rubbing contacts.

The qualifications of compactness and good efficiency of the electrical design which adapt these motors to all classes of small power purposes, are extended by several mechanical features which make the motor very easy to install. The motors may be used with or without a sub-base, and mounted on floor, wall or ceiling, without additional fixtures. By turning the bearing brackets or end shields through 90 degrees or 180 degrees relatively to the frame, the bearings are swung into their proper position for any location. When the motors are belted it is desirable to use a sub-base, and such a one is provided with adjusting gear and screw for belt tightening. The same base is used for any position of the motor, and provision is made for distributing the weight evenly on the base in all



INDUCTION MOTOR TOTALLY ENCLOSED.

Alternating-current Overload and Reverse-current Relay.

Protection of circuits, operating in parallel, against a reversal of the flow of energy, has been one of the most difficult problems in the design of alternating-current power systems. For this purpose relays which act when the current reverses are employed to operate electrically controlled circuit-breakers. Heretofore these reverse-current relays have been of two general types. The first consists of some form of magnet, wound with two coils, one of which is supplied with current proportional to the voltage and the other with current proportional to the current in the line. These coils under normal conditions oppose each other, but when the line current reverses their effects are added and operate the breaker. The defect of this method is that the low power factor and low voltage of the line current during short-circuit or other exceptional conditions prevent correct operation.

The second general type of relay for this purpose consists of a wattmeter fitted with moving contacts, which can be adjusted to trip the circuit-

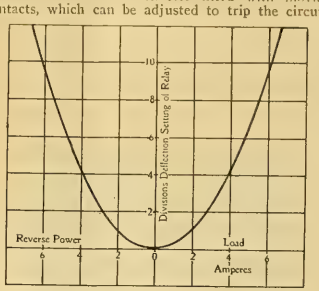


FIG. 1. PERFORMANCE OF OVERLOAD AND REVERSE-CURRENT RELAY, CURRENT ONLY, ZERO VOLTAGE.

breaker at any predetermined load in true watts in the direct overload direction or in the reverse-power direction. This type has the fundamental defect that when the voltage or power factor becomes low, the torque of the wattmeter is also low, as its torque is proportional to true watts.

A type of instrument for the service which contains many advantages consists of a relay of the wattmeter type modified so that it will have practically the same torque at low power factors as at high power factors. The instrument should also be operative when the voltage is zero, and should have the additional feature of inverse time element, so as to exercise a selective influence and trip the circuit-breaker in trouble without interrupting the circuits which are not affected. Such a relay has been designed by the Westinghouse Electric and Manufacturing Company and is said to fill the required conditions to a remarkable degree. As it is used principally for polyphase circuits, it consists of two electromagnets which operate two disks mounted on the same shaft, the mechanical construction being very similar to that of the type C Westinghouse integrating polyphase wattmeter. Instead, however, of driving a regising dial, the shaft is controlled by a spring, and a moving arm is arranged to close a contact which is connected to the tripping coil of the circuit-breaker. The inside of the electromagnet

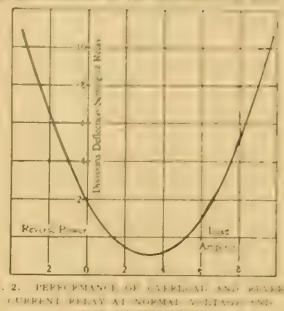


FIG. 2. PERFORMANCE OF OVERLOAD AND REVERSE-CURRENT RELAY AT NORMAL VOLTAGE AND UNITY POWER FACTOR.

trated by the accompanying curves. In Figs. 1 and 2 the ordinate represent the setting of the stationary contacts and the abscissas the corresponding currents required to close the contacts. Values to the right represent power in the normal direction and those to the left represent power in the reverse direction, or power fed back toward the generator.

With current only, i. e., with zero voltage on the line, the instrument is an ordinary ammeter-type overload relay whose deflections are proportional to the square of the current. This condition is clearly illustrated by Fig. 1.

It should be noted that all curves shown are the result of actual test and correspond very closely to the calculations made in advance.

With normal voltage and unity power factor the current shown in Fig. 2 is obtained. This curve is similar to the curve in Fig. 1, except that it is shifted considerably to the right, thus shifting up the effect of the voltage element of the relay, which acts to deflect the movement in the direction of normal power. It will be seen that for a given setting a much greater current is required to close the contact when power is passing in the normal direction than when it is reversed. Furthermore, the tripping currents in the normal-power direction are much greater in this case than is that illustrated in Fig. 1, with the same setting of contacts. For this reason the relay may be set to operate on a very low reversal, but, at the same time, it will prevent ordinary overloads from tripping the breaker and opening the circuit. Of course, a short circuit

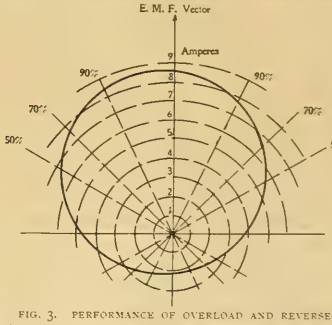


FIG. 3. PERFORMANCE OF OVERLOAD AND REVERSE-CURRENT RELAY AT 100 PER CENT VOLTAGE, 100 PER CENT CURRENT AND VARYING POWER FACTOR.

would greatly reduce the voltage, and thus the conditions shown in Fig. 1 would result, and the relay would operate.

The curve in Fig. 2 may be taken to represent the performance of the instrument fairly closely for any working power factor from 70 per cent. leading current to 50 per cent. lagging current. The exact effect of variation in power factor with 100 per cent. voltage and 100.5 current is clearly shown in the vector diagram in Fig. 3, the tripping currents for a certain setting of the contacts being plotted as vectors and the voltage being vertical.

If the relay contact is set at No. 7 (see Fig. 2), a current of 8½ amperes will close the contacts

at 100 per cent. power factor. This will represent usually an overload of 70 per cent., the relay operating from series transformers having five-ampere secondaries. At this setting 2.2 amperes,

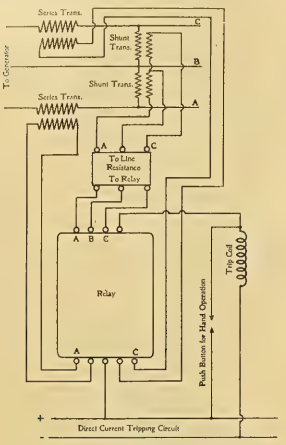


FIG. 4. CONNECTIONS OF OVERLOAD AND REVERSE-CURRENT RELAY TO TRANSFORMERS.

or 44 per cent. of full load current, will trip the circuit-breaker on reverse power.

It will be seen that the relay may be set for any desired ratio of overload to reverse, by moving the position of the stationary contact. Loops in the winding of the coil are provided so that absolute values of these quantities for any ratio of overload to reverse can be obtained.

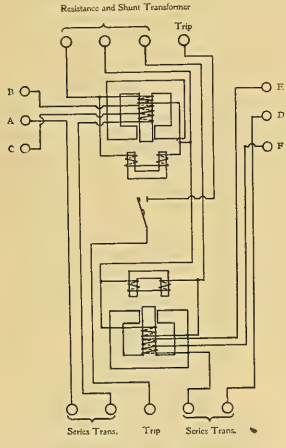


FIG. 5. DIAGRAM OF INTERNAL CONNECTIONS OF OVERLOAD AND REVERSE-CURRENT RELAY.

There is an adjustment which varies the value of the inverse time element of damping feature of these instruments.

A number of these instruments have been installed on some of the largest power systems in the country and have given satisfactory results. In actual operation, when the tripping coils of the breakers take a large current, an auxiliary relay is provided to save the contacts of the main relay, which are designed to carry only about one ampere.

The diagrams in Figs. 4 and 5 show the connections from the relay to the transformers.

The growth of the awakening to the value of good illumination is well evinced by the distribution of membership in the Illuminating Engineering Society. This society, although only formed last January, already has 563 names on its roll, nine being from foreign countries and the balance scattered through 32 states. The largest membership is naturally in those states where branches have already been formed. The four leading states are New York, with 192 members; Pennsylvania, with 123 members; Massachusetts, with 69 members, and Illinois, with 56 members.

Test of 5,000-kilowatt Steam Turbine in Fisk Street Station.

In March, 1906, a series of tests were made on one of the 5,000-kilowatt Curtis steam turbines which has been in commercial service for about one year in the Fisk Street Station of the Commonwealth Electric Company, Chicago, Ill. The turbine set is one of four installed in this station. The tests were conducted under the supervision of the representatives of the purchaser, Sargent & Lundy, and those of the General Electric Company.

The generating unit consists of a 5,000-kilowatt turbine, direct connected to a six-pole three-phase 5,000-kilowatt 9,000-volt 500 revolutions-a-minute revolving-field generator. All the tests, except those for speed, were made under regular commercial-load conditions. On account of the change in frequency during the speed tests the load was absorbed by a water resistance, composed of plates in the Chicago River. It was found that the commercial-load water rate was identical with that obtained by use of a water rheostat, other conditions remaining the same.

In the commercial tests the load dispatcher maintained a constant load on the turbine under test by varying the tension of the auxiliary governor spring, controlled from the switchboard by a motor. Steam pressure and superheat were kept as constant as possible by proper attention to the boilers.

The load was measured by special indicating wattmeters, connected to independent potential and current transformers. All instruments were carefully calibrated at Schenectady and the calibration later verified in the laboratory of the Commonwealth Electric Company. As an additional precaution to insure accuracy, the readings taken were checked by readings obtained from a duplicate set of instruments calibrated by the Electrical Testing Laboratories of New York. The load readings were recorded at intervals of two minutes.

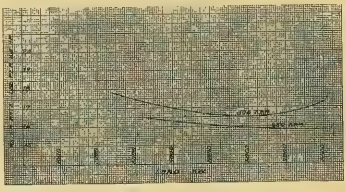


FIG. 1. WATER-RATE CURVES OF 5000-KILOWATT CURTIS STEAM TURBINE.

All tests were made at about 150° F. superheat, the temperature being read by calibrated mercury thermometers. The thermometers were placed in wells filled with mercury and proper correction was made for the exposed stem. Temperatures and pressures were recorded every five minutes.

The amount of steam used was obtained by dis-

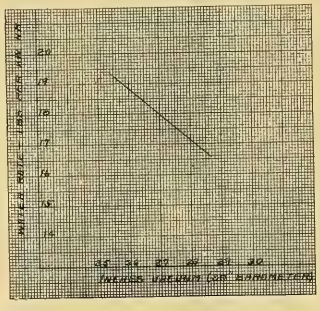


FIG. 2. CURVE SHOWING RELATION OF WATER RATE AND VACUUM.

charging the condensed steam into tanks, where it was weighed. After each run the condenser was tested for leaks, which, as shown by the tables, were of small amount.

TABLE I.

Load K. W.	Steam Pressure (gauge).	Superheat, Degrees Fahr.	Gross Flow, Lbs. per Hour.	Condenser Leakage, Lbs. Hr.	Back Pressure, Inches Mercury.	R. P. M.	Water Rate, Lbs. per Kw. Hr. Actual.	Water Rate, Lbs. per Kw. Hr. * Reduced.	Notes.
3,340	171	151	56,690	1,070	.89	500	16.66	17.29	Water Rheostat
5,040	169	180	98,370	950	1.72	500	16.40	16.55	Commercial
2,920	172	158	50,930	1,050	1.08	500	17.08	17.61	Commercial
4,860	179	180	81,550	1,700	1.55	500	16.50	16.81	Water Rheostat
7,525	175	147	130,200	820	2.00	500	17.19	16.91	Water Rheostat
4,050	180	171	80,570	220	1.48	500	16.25	16.55	Commercial
0	178	150	3,520.	220	1.40	500	.....	.....	Full Voltage

*Reduced to 150° F. superheat, 1½ inches back pressure, 175 pounds (gauge) steam pressure.

TABLE II.

Load K. W.	Steam Pressure (gauge).	Superheat, Degrees Fahr.	Gross Flow, Lbs. per Hour.	Condenser Leakage, Lbs. Hr.	Back Pressure, Inches Mercury.	R. P. M.	Water Rate, Lbs. per Kw. Hr. Actual.	Water Rate, Lbs. per Kw. Hr. ** Reduced.	Notes.
†3,530	170	165	55,900	1,070	.85	650	15.55	16.40	Water Rheostat
5,140	180	179	81,930	1,700	1.50	650	15.67	16.03	Water Rheostat
8,090	177	141	131,160	820	2.03	650	16.11	15.80	Water Rheostat

**Reduced to 150° F. superheat, 1½ inches back pressure, 175 pounds (gauge) steam pressure, 650 revolutions a minute.
†Average of two points.

TABLE III.
(Summary Table I.)

500 revolutions per minute.
150° F. superheat.
1½ inches back pressure.
175 pounds (gauge) steam pressure.

Load.		Water Rate.
2,500 kilowatts	(½ load)	17.74
3,750 kilowatts	(¾ load)	17.08
5,000 kilowatts	(full load)	16.62
6,250 kilowatts	(1¼ load)	16.52
7,500 kilowatts	(1½ load)	16.90

TABLE IV.
(Summary Table II.)

650 revolutions per minute, load.
150° F. superheat.
1½ inches back pressure.
175 pounds (gauge) steam pressure.

Load.		Water Rate.
3,750 kilowatts	(¼ load)	16.35
5,000 kilowatts	(full load)	16.07
6,250 kilowatts	(1¼ load)	15.88
7,500 kilowatts	(1½ load)	15.80

The detailed results of the test at 500 revolutions a minute are shown in Table I. Table II. indicates the readings obtained at 650 revolutions a minute. To make the tests comparable, all results were reduced to 150 degrees superheat, 1½ inches back pressure and 175 pounds (gauge) steam pressure. The reduced water rates are given in the ninth column of Tables I. and II. Tables I. and II. are summarized in Tables III. and IV., respectively, and from these are obtained curves shown in Fig. 1. The curve in Fig. 2 is self-explanatory.

The General Electric Tantalum Incandescent Lamps.

The latest improvement in the electric incandescent-lamp field is the now comparatively well-known tantalum lamp, which has a filament composed of the rare metal tantalum, capable of withstanding very high temperatures and giving a very brilliant white light. This lamp is now being produced in this country at the General Electric Company's lamp works at Harrison, N. J., and is offered by it as a lamp giving the highest efficiency of any form of commercial incandescent lamp available today.

The saving in the cost of the lighting to the customer puts a large premium upon higher efficiency lamps, and the latest production of invention and research is really notable in results obtained. The General Electric tantalum lamp gives an actual efficiency of two watts per candle, based on the mean horizontal English parliamentary standard, with an average useful life on direct-current circuits of 700 hours or more.

The construction and general appearance of the new lamp are clearly shown in the accompanying illustrations. When used with the special holophane pagoda reflectors provided with the lamps, the downward lighting efficiency is increased to one watt per candle or better. Two forms of reflectors are provided, the distributing form (Fig. 1), which gives a characteristic meridian distribution, and the concentrating form (Fig. 2), which gives a more centralized distribution beneath the lamp.

The lamp is at present supplied by the General Electric Company in but one size, having a consumption of 44 watts and giving a mean horizontal rating of 22 candlepower. It is made for voltages of 100 to 130 volts, and fitted only with standard Edison base. It is not recommended for use on alternating-current circuits.

This lamp will enable central stations to reduce the cost of lighting to the customer, and therefore meet and resist competition, secure additional desirable business and increase its net earnings. While the first cost of the tantalum lamp is somewhat higher than that of the ordinary carbon-filament lamp, this additional cost is saved several times over by the consumer buying light at average meter rates given by electric-lighting companies.

Saving in Cost of Current at Various Rates of 22 Candlepower, 44-watt G.E. Tantalum Lamps.

Rate per K. W. Hour Cents.	Over Present 3.5 W. P. C. 22 C. P. Lamp.	Over Present 3.1 W. P. C. 25 C. P. Lamp.
10	$2.47	$1.80
11	2.83	1.98
12	2.97	2.15
13	3.24	2.33
14	3.47	2.51
15	3.72	2.69

The average life of the lamps is about 750 hours and the value of the tantalum lamps, as shown by the saving they secure in consumers' cost of lighting at various rates per kilowatt-hour, is given by the manufacturer in the accompanying table.

It is expected that the new lamp will be supplied to lighting customers on direct current circuits on a liberal policy as to charges, either on a renewal or on a purchase basis. The lamp possesses several attractive features which will appeal

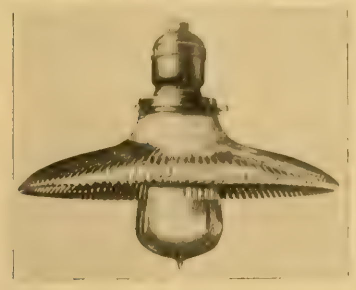


FIG. 1. TANTALUM LAMP WITH DISTRIBUTING SHADE.

both to the central station man and to his customer. The advertising value of this new lamp as a novelty represents an asset to the lighting company first introducing it to the public in its section.

On an equal pro-rated useful-life basis with present 16-candlepower 3.1-watts-per-candlepower lamps, central stations now supplying free renewals of

FIG. 2. TANTALUM LAMP WITH CONCENTRATING SHADE.

16-candlepower 3.1-watts-per-candlepower lamps could afford to supply tantalum lamps at a low figure without adding to their present lamp-renewal costs. Central stations now furnishing free renewals of 3.5-watts-per-candlepower lamps, could similarly supply the tantalum at a little higher figure without increasing their renewal costs. In any case the consumer, as shown by the foregoing table, would save several times the value of the charges of the tantalum lamp.

Aurora, Elgin and Chicago Railway to Extend Express Business.

The Aurora, Elgin and Chicago Electric Railway Company is preparing to take care of the express business between Elgin and Aurora in a manner similar to that in which the Joliet, Plainfield and Aurora road handles this business. The former company has installed an automobile service between the terminal station at the corner of Fox and Broadway and the city limits of Aurora. Twice a day the motor express car makes the trip to the limits and takes express off from the southbound car and puts it on the northbound car. Two men experienced in the express business have been placed in charge of the express department. A large room in the car barns on South Water Street has been remodeled and refitted into an express office and one of the new men is located there and receives all baggage that the people of Aurora wish to send up the river to any of the towns along the line. The other man is used as messenger and takes care of all of the express after it is placed on the car and makes the trip up and down the river twice a day. The car is said to carry a good load each trip.

A new company has been formed at Nelson, B. C., with a capitalization of $1,500,000 for the purpose of generating power for the supplying of light and motive power to the towns surrounding Moyie and Cranbrook, where many mines are situated. The new company has secured a water right on St. Mary's River. Associated with Charles Mackel of Nelson, who is the chief promoter of the new enterprise, are R. Campbell, J. A. McDonald and J. D. Mackie of Moyie, Mrs. H. Ross and L. Shaw of Vancouver and H. Hanwell of Port Hammond.

CORRESPONDENCE.

Great Britain.

London, June 12.—The competition between gas and electricity reaches an acute stage at times, while at other times little is heard of it. During the last few months, however, considerable "flapping of wings," a phrase invented by one of the London electric supply engineers, has been indulged in by both the electrical and the gas people. Naturally this has been occasioned by the success of one or the other in the matter of a particular contract. The gas people have "not got in" in connection with the lighting of the new railway terminus at Victoria, but so far as one can gather this job does not appear to have been put up for competition as was the lighting of Charing Cross Station recently, and in connection with which electricity scored an easy first. And really, when one hears so much of the superiority of gas over electricity for public lighting, it is interesting to inquire in how many instances the gas people have succeeded in open competition. Speaking for London, it is well known that the city corporation refused to allow the electric light company to put in a fresh tender, but preferred to give a small contract to the gas company because it was cheaper than the one entered into with the electric light company some 15 years previously. Again, at Charing Cross the gas company was endeavoring to "obtain the ear" of the directors of the railway company in order to prevent competition. At Westminster in London the question of superseding electric by gas lighting in the streets is also under animated discussion. Here the electric-light people have offered to give a supply free for a certain period if a long-term contract is afterward entered into, but a little suspicion has been aroused by this, and the matter has not yet been finally decided.

The difficulty which, it is alleged, has been put in the way of conducting the observations at Greenwich Astronomical Observatory by the chimneys and machinery in the London County Council's tramway generating station close by is to form the subject of a special report to the County Council.

During the past few months the air has been thick with suggestions as to how London can best be provided with an adequate supply of electric power, and new ideas have not yet ceased to multiply. We have had the propositions made by the London County Council and by the administrative County of London and District Electric Power Company; also we have the proposal that all the existing generating stations should be interconnected and unified to such an extent that a new power company would be superfluous. Now, however, several persons are anxious that the scope of the inquiry at present being conducted should be considerably widened so as to bring before the committee the views of independent experts, who are altogether innocent of any bias in favor of either scheme put forward so far. This, of course, would be really only another form of royal commission, a title which is synonymous with delay. It is clear that if the matter could only be determined on engineering grounds a decision would be quickly arrived at, but political influence is playing an active part and a final decision seems a long way off.

A tantalum lamp is being placed upon the market here, of 45 candlepower, enclosed on a four-inch globe and finished off with a holophane shade. By a special disposition of the filament in relation to the shade, the downward illumination is said to be 180 candlepower, while the efficiency is only about half a watt per candlepower. Both the useful life and the total life of the lamp are claimed to be longer than that of an ordinary lamp of the same type.

The question of industrial redistribution in Great Britain is rapidly assuming graver importance, and in this social problem is closely bound up the supply of electric power. Seeing a unique opportunity all the electric power companies that are in working order are straining every nerve to induce manufacturers in densely populated and highly rated districts to remove their works to more salubrious and economical surroundings. As a consequence the old-fashioned policy, so much a part of our nature in the past, of waiting for custom, has been abandoned, and manufacturers and others are now having the advantages of removal thrust before them. Mr. Merz was one of the first to introduce a highly organized commercial department into an electric supply undertaking, and the results are to be seen in the huge development which is being made at Tyneside. All the power companies now issue their monthly bulletins and the fashion has reached London, where the various undertakers now cultivate their customers instead of waiting for them to come. The moral of all this is that Great Britain is on the threshold of a new industrial era, due, in the main, to more enlightened views both on the part of its legislators and its electric supply authorities.

The new generating works of the Brighton Corporation, equipped with Westinghouse turbines, were opened a few days ago. The power house [illegible] Wright [illegible]

New York.

[illegible] Farms, [illegible] Chester Railroad. [illegible] the Port Morris yard at One [illegible] ninth Street. As the New York Connecting Railroad, when built, will run into the Port Morris yards also, the New Haven trains can be run over that line into the [illegible] yards in Long Island City, and thence through the Pennsylvania tunnels under the East River and into the Pennsylvania terminal now being constructed between Seventh and Ninth avenues, Thirty-first and Thirty-third streets.

Under the auspices of the Men's Evangelistic Association, and with the cooperation of [illegible] of the Western Electric Company, large and successful noonday meetings are being held at the large plant of the Western Electric Company in this city. When the whistle blows at 12 o'clock some 6,000 men and 2,000 women employes in the Western Electric Building go to luncheon. After 12:15 they begin to return. Many of them gather around a large packing box on the curb and a cornet player renders two or three patriotic airs. Prayer is then offered, a hymn sung, a prominent minister of the city delivers a 15-minute address, another hymn or solo is sung, and at 12:45 p. m., when the whistle blows again, the crowd scatters and the packing box is put away to be used the next day. E. D. Luiffen, field secretary of the association, says that the meetings spread religious influence to thousands daily, and the Western Electric Company is being commended by the Christian people of the city.

Three parks in New York are being cut into by the contractors who are making excavations to provide outlets for hot subway air. They are City Hall Park, Union Square and Bryant Square. The city, acting through the Rapid Transit Commission, is doing the ventilating, and the responsibility of infringing on park spaces rests with the Rapid Transit Commission. North of Columbus Circle the gratings for ventilating the subway will be immediately above the tracks, because there is plenty of room between the surface tracks. But further south there can be no openings in the roadway, and the gratings or louvres are put on the sides of the tunnel. Thus the air flows horizontally into a side chamber, and from it upward to the street.

Work is rapidly progressing on the Belmont tunnel under the East River from Forty-second Street to Astoria. Despite the fact that the city contends that the work is being carried on without legal authority, William Barclay Parsons, vice-president of the company, informed the court that the work of construction is being pushed forward with great rapidity. The tunnel is practically finished under Forty-second Street from Fourth Avenue to the East River, and out under the river for 30 feet beyond the pier line.

Resolutions adopted by the Board of Estimate call upon the Rapid Transit Commission to consider at once a continuous system of subways between Brooklyn, Manhattan, The Bronx and Queens. The purport of the resolution is to have a comprehensive system of connecting subways laid out so that continuous trips may be possible between the various boroughs, and to include provision for further extensions under the Narrows, so that Richmond, too, may be benefited. The board also received an interesting transit report from Harry P. Nichols, chief of the Bureau of Franchises, on the application of the Nassau Electric Railroad Company of Brooklyn for a franchise to operate a trolley line on the Livingston Street route.

Western capitalists and representatives of foreign capitalists met in the Waldorf-Astoria and discussed the formation of a syndicate to bid on the subway which is to be built down the East Side. John W. Gates, who is among the proposed capitalists, says he believes that a system of subways from The Bronx to Coney Island can be built for $50,000,000; that passengers can travel from Harlem to the sea in 30 minues, and that the fare will be only five cents. Connections with the new Pennsylvania terminal are also projected. C. I. C.

New England.

Boston, Mass., June 23.—The June meeting of the New England Section of the Illuminating Engineering Society will be held at the American House in this city next Tuesday evening. It will be a "question-box" meeting. Members have submitted 27 questions bearing on many phases of illumination. This will be the society's last meeting until fall.

The Massachusetts House of Representatives has adopted an order calling upon the gas and electric-light commissioners to transmit to the House certain information they obtained from the Edison Electric Illuminating Company and the Boston Consolidated Gas Company regarding the use of electricity for lighting purposes in Boston. Some information was not made public by the commission at the request of the companies.

The House has also ordered that the attorney-general be requested to submit to the House of Representatives his opinion as to the legality of Senate Bill No. 403, relative to investments by steam-railroad corporations in street-railway properties. This order was offered by Representative Weeks after the bill had been referred to the next Legislature by the House. When the bill was before the House, Representative Weeks tried to have the House substitute another bill, outlined in the Western Electrician last week, but was ruled out of order.

The city of Newton, Mass., has at last granted freight and express-carrying privileges to the Boston and Worcester Street Railway Company, which will now petition for the state railroad commission's approval of such rights over its entire line. The company has four express cars in readiness for the service.

The Supreme Court has overruled the defendant's exceptions to a Superior Court verdict for $2,000 in the case of John S. Woodall vs. the Boston Elevated Railway Company. The plaintiff sued for damags caused by particles of metal falling into his eyes from the company's elevated structure. The jury in the lower court found that the plaintiff was injured by the failure of the company to provide a receptacle for the metallic dust. The Supreme Court sustained these contentions. The amount of the verdict has been reduced to $1,000. A large number of persons alleged that they were suffering from the "third-rail eye" during the first few months of the operation of the elevated railway, and this Supreme Court decision may lead to many suits for damages on account of such injuries.

The S. S. Grady Company of Cambridge, Mass., has been incorporated. It has a capital of $10,000 and proposes to manufacture electrical machinery. Stephen S. Grady, William P. Horne and George C. Tabor are the incorporators.

Mayor Fitzgerald of Boston has asked the Boston Elevated Railway Company to establish an express line of surface cars between Dudley Street and Grove Hall in Roxbury, and Vice-president Sergeant has announced that until it is possible for express trains to pass accommodation cars on the same track it will be impossible to comply with the mayor's request. B.

Southeastern States.

Charlotte, N. C., June 23.—Surveys have been completed in the interests of the United Railways Company of Baltimore for a suburban line from Towson to Timonium, and the road will probably be built at once.

A plan is on foot to build an electric railway from Columbus, Ga., to Dothan, Ala., and thence to St. Andrews Bay, Fla. A number of business men of Columbus have signed an agreement to support the project.

Waynesboro, Ga., has voted $60,000 bonds for water, electric lights and sewerage.

The Southern Power Company has signified its intention of furnishing electric power to the town of Statesville, N. C., if 2,000 horsepower could be disposed of, and it is almost assured that a contract will be drawn up shortly.

The Norfolk and Jamestown Exposition Railway has been chartered, with Alex Brown, president; capital, $300,000; all of the promoters being from Richmond, Va.

The question of a municipal lighting plant for Richmond, Va., has been tabled by the finance and electricity committees and it has been determined that these committees will ask the council to advertise for bids for lighting the city from three to five years from July 1, 1907.

The Consolidated Gas, Electric Light and Power Company of Westport, Md., is installing four 2,500-kilowatt generators at the company's plant on the Patapsco River.

The Newbern (N. C.) Lighting and Fuel Company has been chartered with $125,000 authorized capital by J. H. T. Martin of New York and H. D. Wood and A. D. Ward of Newbern.

Oscar Shanks of Pittsburg has the contract for the work at the power development at Gaston Shoals, near Gaffney, S. C., where 1,000 laborers will be employed.

Anent the much-discussed plan of financing the system of the United Railways of Baltimore, it is said that the income bondholders have begun a movement to force the management of the company to change its plan of financing this big system. This is independent of the movement of the income bondholders' protective committee of the United Railways. L.

Ohio.

Cleveland, June 23.—An increase of capital stock from $1,000,000 to $12,000,000 has been made by the Indiana, Columbus and Eastern Traction Company in order to purchase the Appleyard properties and make such additions and improvements as are necessary. The Dayton and Northern will be purchased, it is said, and that part of the Dayton and Muncie from Greenville to Union City. A line will be built from Bellefontaine to Lima to connect with the Lima and Toledo, now under construction. The purchase plans also include the Columbus and Lake Michigan. The Columbus, Newark and Zanesville reduced its capital stock from $1,500,000 to $850,000, and then increased it to $6,250,000. The charter was also amended regarding the termini to include the Columbus, Buckeye Lake and Newark. It was for the purchase of this road that the capital stock was increased, as well as taking in the local railway and light properties at Zanesville. The improvements and extensions planned by the Schoepf people will in all probability be made at an early date in order to complete as far as possible the system they have in view.

A new angle seems to have developed in the Cleveland railway situation within the last few days, from the fact that an eastern syndicate has about completed a proposition to be made to the local company to lease its properties for 25 years and take up the work of securing a settlement of the franchise matter from Mayor Johnson and the city. This syndicate is represented by Cleveland men, one of whom is said to be Henry A. Everett, but the others are not known. The plan is about the same as others that have been carried out.

A few days ago the Municipal Traction Company of Cleveland was incorporated with a capital stock of $10,000, with the idea that it would act as a holding company for the Forest City Railway Company. There are to be five directors, and they will also be the stockholders and officers of the company. The idea contemplates that the company shall be under the supervision of the municipality. All extensions and new franchises secured by the Forest City Railway Company would be immediately turned over to the holding company. The terms of the agreement between the Municipal Railway Company and the Forest City are that there shall be neither preferred stock nor bonds, and that all shall share alike. A. B. Dupont of Detroit is said to be the man chosen for the head of the new holding company.

The Interurban Railway and Terminal Company of Cincinnati has accepted the proposition of the Union Gas and Electric Company for a lease of the Cincinnati and Eastern, which operates a road from Cincinnati to New Richmond.

Officers of the Cleveland, Brooklyn and Elyria held a consultation with Mayor Johnson a few days ago relative to entering Cleveland. Their plans are about the same as those of the Green & Zmunt line, and the two may co-operate on the plan of getting into the city, although the mayor said that any other roads that come into the city must come on the three-cent-fare basis.

The Forest City Railway Company of Cleveland has increased its capital stock from $250,000 to $2,000,000.

Owners of the Lake Shore Electric and the Western Ohio have under consideration the construction of a line from Fremont to Fostoria.

Reports are in circulation to the effect that the Schoepf people have secured the Lima Eastern Traction Company, which was organized to build a road from Lima to Marion.

The annual outing of the Cincinnati Street Railway Employes' Mutual Protective Association was held at Chester Park last week. The attendance was very large and a nice sum was realized for the funds of the organization. Many contests were held and sports of various kinds indulged in.

Interurban-railway men believe that the city administration at Cleveland will not interfere with the cars they use, although much has been said about the weight of cars that pass over the bridges and other street structures. The interurban roads bring in so much shopping business that most cities would hesitate to make regulations that would keep them out.

The Defiance and Fort Wayne Railway Company has been incorporated with a capital stock of $10,000 by E. B. Paxton, James H. Horan and others, with headquarters at Toledo.

The Citizens' Electric Light Company of Dayton has purchased the old stockyards property in West Dayton, where a modern light and power plant will be erected.

Under the direction of the Youngstown and Ohio River Railroad Company the Salem Railroad is being changed to an electric road. It will be extended to Lisbon and East Liverpool.

The lease of the properties of the Cincinnati Gas and Electric Company to the Union Gas and Electric Company has been ratified by the stockholders of the former. The lease is to run 99 years and the leasing company has the privilege of purchasing the business at the end of that time. Norman G. Kenan, president of the Cincinnati Gas and Electric Company, will be the president and general manager of the leasing company for the next five years. About $2,000,000 is to be spent in improvements and extensions of the properties. It is the intention to install another electric plant and to furnish both electric power and gas at as low a figure as possible. A contract has already been made for a supply of natural gas, and this will be furnished wherever desired. The deal involves about $56,000,000. O. M. C.

Illinois.

Peoria, June 23.—The Morris Gas Light Company of Morris, proposing to manufacture gas and sell electricity, with a capital of $1,000, has been incorporated. Bendett L. Brawn, J. H. Pattison and E. L. Cloves are the incorporators.

The Citizens' Telephone and Telegraph Company of Clinton County, at Carlyle, has been incorporated with a capital of $15,000 to do a telephone and telegraph business. Thomas E. Ford, August Westermann and Hugh V. Murray are the incorporators.

The Union Switch and Signal Company of Pennsylvania has been licensed to do business in Illinois with a capital of $142,857. The principal Illinois office will be Chicago.

The Central Union Telephone Company of Springfield will move into the new building by August 1st.

C. H. Wilson, general superintendent of the American Telephone and Telegraph Company, was a visitor in Springfield.

The report of the sale of the Peoria Gas and Electric Company seems to have come from the East, as no one here has any definite knowledge concerning it. Mr. Schmidt of Springfield states that Hodenpyle, Walbridge & Co. of New York, who are the owners of the public utilities in Springfield, had an option on the stock which would expire on July 8th, and that they would very probably purchase the stock, and in that case he would be placed in charge as general manager. He will, however, retain his present position in Springfield and continue to reside there.

The city of Decatur has granted the Illinois Traction Company a 50-year franchise to build a belt line about the city and to run cars on all streets on which cars are now run, except one.

The Illinois Traction Company has just issued a statement of the earnings of the system. It shows a gain for the month of May over the corresponding month last year of $16,927. The net earnings for the month just past are $99,122, whereas a year ago they were $82,195.

The Peoria-Bloomington electric railway will be in operation by January 1st. The track laying will begin in July. The work on the power house here is progressing and the bridge work is also being rushed. V. N.

Indiana.

Indianapolis, June 23.—The Muncie and Union City Traction Company has been incorporated to build an electric road through Randolph and Delaware counties to connect Union City, Winchester, Farmland, Parker City, Selma and Muncie. It also has the right to furnish light, heat and power in any of the towns and cities through which the line is to pass. James A. Van Osdall, William C. Sampson, Harry A. Nicholl, Arthur C. Murray and Calvin H. Allen are the directors. The capital stock is $500,000. It is understood that the real purpose is to take over the Muncie and Dayton traction line, which connects the cities mentioned. This line will be merged with the Indiana Union Traction Company.

C. S. Ferguson has petitioned the City Council of Columbus for a franchise for an interurban railway which he is projecting from Columbus to French Lick and West Baden. He wishes to make traffic agreements with the Indianapolis, Columbus and Southern whereby passengers may buy tickets in Indianapolis to take them straight through to the watering resorts.

Passenger service on that part of the Winona Interurban Company between Goshen and Winona was established on June 18th. A two-hour schedule is now in effect, but cars will run every hour as soon as equipment, now ordered, is received. Power will be furnished the line from the big power house being erected at Winona Lake.

Work on the Indianapolis and Cincinnati traction line between Shelbyville and Greensburg is being pushed to a speedy completion. August 1st is the day set by President Henry to open this line for regular service.

A party of business men from Indianapolis and Chicago, as guests of George J. Marott, inspected the property of the Kokomo, Marion and Western Traction Company on June 19th. Among those in the party were E. M. Johnson, Louis Lathrop, R. Boone McKee, Volney T. Malott, Sol Meyer, Hiram Miller, Frank M. Millikan, H. W. Moore, Samuel Rauh, W. J. Richards, Joseph Schaf, H. A. Schlotzhauer, John H. Holiday, Andrew Smith, A. W. Thompson, Newton Todd, Archibald A. Young, M. B. Wilson, Gavin L. Payne, Jesse Fletcher, William Fisher, William Hough of Greenfield, Fred A. Likely, C. H. Brownell, A. J. Brunt of

Anderson, John A. Butler, W. H. Coleman, John D. Collett, T. C. Day, Edgar Elliott, Fred Fenton of Chicago, George Elliott, D. K. Hassler, Otto F. Haucisen, J. H. Henley and S. L. Holliday.

The Remey Electric Manufacturing Company of Anderson has let a contract for an extensive addition to its plant. The buildings will be brick and steel and will be installed with the most modern electrical and mechanical equipment.

The Connersville Natural Gas Company has been granted a franchise by the Connersville council to establish and operate a plant for the generating and sale of artificial gas and electricity.

The plans for the new city hospital in Indianapolis include the installation of a new heating and electric-light equipment. A laundry will also be erected with electrical equipment throughout. The cost is estimated at $100,000.

The Ardmore Heat and Light Company of Muncie has incorporated, with a capital stock of $200,000. The company proposes to produce oil, gas and electricity, to build pipe lines, construct and operate gas and electric-light plants and furnish heat, light and power. John W. Smith, S. T. Murdock, J. D. S. Neeley and E. R. Curtain are the directors.

The City Council of Kokomo has revived the proposition to install a modern electric fire-alarm system in Kokomo. If the ordinance is approved by the mayor, bids will be invited in a short time.

S. S.

Michigan.

Grand Rapids, Mich., June 24.—An excellent showing is made by the municipal lighting plant of Lansing for the last year. Electric-light connections have been installed at the rate of about one a day, most of them for new houses.

The Board of Supervisors of Genesee County has granted a franchise to the Northern Light and Power Company of Montrose to erect a dam across the Flint River. A power station will be established, which will furnish current for the new Flint River and Saginaw Valley Railway.

The contract has been awarded for the electrical power equipment of the big milling plant of the Utah Copper Company. Two 2,000-horsepower generators have been ordered, which will be steam driven. Thirty motors with a combined capacity of 3,000 horsepower have also been ordered.

Little is heard of the Detroit and Bay City traction line these days. The roadbed, which was torn up just outside of the limits of Bay City last fall, has grown up to weeds, and farmers whose property is adjacent to portions of the right-of-way have built fences and enclosed it. The construction-train engine is boxed up on a sidetrack in Bay City.

The grade of the McMichael interurban road is completed from Benton Harbor to Sodus, and the rails are laid for six miles out of Benton Harbor. The promoters hae under consideration the building of the line to Niles and on through to Elkhart. Eau Claire expected to get the road, but the indications are now that the village will not be touched.

Frank G. Andrews of Detroit is pushing a project for the building of a gasoline-motor road from Detroit to Lansing. It is said that the tracks of the Detroit and Northwestern will be used from Detroit to Farmington. From there the line will run through Novi, New Hudson, Kensington, Brighton, Howell, Fleming, Fowlerville, Webberville, Phelpstown, Williamston, Meridian, Okemos and past the agricultural college into Lansing. The main line of the road will be 66 miles long and will be bonded for $18,000 a mile. The cars are of steel and will cost $12,000 each, it is said. George L. Matzm, former state banking commissioner, is to be one of the officers of the road, and the principal interests will be held by New York capitalists.

L. W. B.

Northwestern States.

Minneapolis, June 23.—If the council at Aberdeen, S. D., will grant a franchise, an interurban railroad will be built by a syndicate already organized for that purpose. It is thought that work may be started this summer.

The Electric Light Company of Pandora, Iowa, has decided to close down its plant in that village September 1st.

An air-line interurban between Des Moines, Iowa, and Omaha, Neb., is projected by Tyndale Palmer, vice-president of the Union Terminal Company of New York. The line will run through Griswold, Carson, Cumberland, Fontanelle, Greenfield and Winterset.

The Des Moines City Railway Company will let the contracts at once for the construction of a line to Carlisle, Iowa, with the intention of ultimately pushing on to Knoxville.

H. H. Clough of Elyria, Ohio, and a number of business men of Janesville, Wis., have revived the project of building a trolley line from Janesville to Madison.

The Commercial Club of Mankato, Minn., is negotiating with capitalists who profess a willingness to build a street-railway system in that city.

The Beloit (Wis.) Water, Gas and Electric Company has been taken over by St. Louis and Cincinnati capitalists, and $100,000 will be paid in improvements. J. L. Headley, president, and C. F. Headley, secretary-treasurer, will retain them management, it is said.

The Electric Light and Power Company of Shenandoah, Iowa, will build a new power house.

The Milwaukee Engineering Company has secured the contract for the construction of a $12,000 lighting plant for the county almshouse at Milwaukee.

R.

Pacific Slope

San Francisco, June 21.—The Century Electric Corporation has consolidated its business with that of the John M. Klein Electrical Company, under the name of the Century Klein Electrical Company. Both were strong concerns, and ample capital is available to carry on the business on a larger scale than before the fire. The temporary offices are at 34 Telegraph Avenue, Oakland, but within three months the company will be again located in San Francisco in a new building near the corner of New Montgomery Avenue and Minna Street. Quite a lot of rewiring of large buildings damaged by the fire is in prospect.

Three fine electric cars which had just been delivered in San Francisco from St. Louis for the United Railroads were almost destroyed by the running away and ditching of the flat cars on which they were standing.

The Battle Creek Power Company has leased to the Northern California Power Company of San Francisco its new power plant on Battle Creek, Tehama County, for a period of 50 years, at an annual rental. The Battle Creek Power Company is a new concern, having been organized by San Francisco capitalists only a few months ago. It has been considered an adjunct of the Northern California Power Company, although the company was organized by different men. By the lease the Northern California Power Company assumes all existing contracts and is to pay at maturity the $1,000,000 bonds as issued by the Mercantile Trust Company. The incorporators of the Battle Creek Power Company are Dudley C. Bates, Henry Ward Brown, Jos. E. Barry, Harold L. Wright and Walton E. Carre.

The supervisors' committee on electricity has agreed to recommend that the bond exacted of persons following the business of installing electrical connections in San Francisco be increased from $500 to $2,500. This action was taken at the request of the committee of 40 and was considered in the light of an additional precaution against chance of fire resulting from improperly installed apparatus.

The Geary Street Railroad Company, which is the only company having a cable-road plant that has attempted to repair its system, started up its cars on June 20th, after a shutdown of two months since the disaster of April 18th. The fact that the company's power house ran for two hours after the earthquake shock and operated cars until it was forced to stop the engines for lack of water, has been used to refute the assertions made by interested persons that cable roads and underground-conduit electric roads were impracticable in a city subject to earthquake. The earthquake did no serious damage to the cable trenches or slot rails of this company, and the slot was closed by the warping of rails by the fire a short distance of only about three blocks. The road could have been opened several weeks ago had it not been for the broken brick chimney, which caused the city authorities to withhold a permit for operating the road until it was taken down. Oil fuel is used under the boilers, so that a large stack is unnecessary. The road was to have been taken over by the city in a few days when the disaster came and caused the temporary abandonment of the plans for the reconstruction of the line as a municipal underground-trolley system. The contract had already been awarded to the lowest bidder, C. E. Loss & Co. The road is now being operated by the original owners, under a monthly-rental system from the municipality, with the understanding that they can have the privilege for a year at least.

The Northern California Power Company has loaded three eight-horse teams with structural iron for its new power plant on Battle Creek, a distance of 30 miles from Anderson, Cal. The power now used over the lines is generated at Kilarc and Volta stations. Last spring this company contracted with the Bay Counties Power Company to furnish it a continuous 5,000-horsepower supply. In addition to its numerous patrons, it is reported that the Redding and Red Bluff Electric Railroad will obtain its motive power from the Northern California Power Company.

The result of the special bond election in Pasadena, Cal., on May 3d, which provided $200,000 for municipal improvements, has been contested in the Superior Court, in a suit filed by the Edison Electric Company against the city of Pasadena and the council, mayor, clerk and treasurer.

The damages caused by the fire which occurred on June 11th at the Portland General Electric Company's $1,000,000 plant in Oregon City, Ore., proved no greater than reported in last week's letter.

The Board of Trustees of San Pedro, Cal., has

[redacted]

PERSONAL

John M. Curran, city electrician of Lincoln, Neb., was instantly killed June 26th by a fall from a 45-foot electric-light pole.

W. R. Cooper has accepted the position of editor of the Electrician of London, in the place of F. C. Raphael, who retires on June 30th.

Thomas Wood of Champaign, Ill., has been appointed superintendent of the McKinley syndicate interurban lines, Springfield, Ill., and St. Louis.

Julian Griggs has been appointed chief engineer of the Scioto Valley Traction Company of Columbus, Ohio, to succeed A. W. Jones, who has taken up other work.

W. H. Tapley, chief electrician of the government printing office, has tendered his resignation. Mr. Tapley recently received a flattering offer from a prominent Philadelphia electrical company, which he has accepted. He has just completed the preparation for the public printer of specifications for electrical heating equipment for use with the monotype and Mergenthaler typesetting machines, doing away with the inconvenience and unhealthfulness of escaping gas fumes.

The funeral of Ashahel K. Eaton was held on June 17th at the home of his son in Brooklyn, N. Y. Mr. Eaton was noted as an inventor and scientist. He was 84 years old and was born in Stockbridge, Mass. After graduating from Hamilton College in 1840, he devoted his life to experimenting in chemistry and science. Among his inventions are a process for tanning, a method for manufacturing crucible steel, and a telephone, which was on the market 20 years ago. At one time he occupied the chair of his cousin, the late Darwin G. Eaton, in the Packer Collegiate Institute.

ELECTRIC LIGHTING

The citizens of Acworth, Ga., have voted to issue $25,000 in bonds to improve the light and water plant.

Ed. Harper and others have organized a company and will purchase the local light plant at Camden, Ark.

The Carmen (Okla.) Electric Light and Power Company has been incorporated with a capital stock of $75,000.

The municipal lighting plant at Kingwood, W. Va., has been destroyed by fire. The loss is said to be large.

The citizens of Pottsdam, N. Y., have voted to issue $24,000 in bonds for the establishment of a municipal lighting plant.

The Alliance Gas and Electric Company of Alliance, Ohio, expects to increase its plant, putting in steam turbines and new boilers.

The Village Board of Fredonia, N. Y., has decided to rebuild the village lighting plant. The estimated cost is $10,000. A committee has been appointed to draw up plans.

The City Council of Salt Lake, Utah, has passed an ordinance granting J. S. Manley and L. H. Curtis the right to construct and operate electric-light, heat and power plants, and distribute current commercially.

The Seneca Edison Company, furnishing electric light to Waterloo and Seneca Falls, N. Y., has made an application to the State Commission of Gas and Electricity for consent to its consolidation with the Geneva Power and Light Company. A meeting of the commission is to be held in Albany on July 6th. In case the right to consoli-

date is granted, it is said the company will arrange to take power from Niagara Falls.

The Cherryvale Electric Light and Power Company of Cherryvale, Kan., offers for sale $25,000 in bonds for improvements. Charles T. Fertig, 20 North Tejon Street, Colorado Springs, Colo., can be addressed.

Contracts for the lighting of the village of West Milwaukee, Wis., have been awarded by the Town Board to the Milwaukee Electric Railway and Lighting Company. The rates that have been given the town are $84 a year for a 2,000-candlepower light burning all night.

Since the city of Port Washington, Wis., appropriated $75,000 for buying a municipal light and water plant, three expert engineers, chosen as appraisers, have informed the mayor of Port Washington that the city could buy light and water cheaper of a private corporation than it could furnish them itself.

The Burlington municipal lighting plant, Burlington, Vt., has recently contracted with the Westinghouse Machine Company for a Westinghouse-Parsons turbo-generator unit. The turbine will be direct connected to a three-phase 2,300-volt 60-cycle alternator, running at 3,600 revolutions a minute, and will operate on 150 pounds of steam, with 28-inch vacuum.

The new $10,000 electric-light plant at LaBelle, Mo., was completely destroyed by fire June 17th. There was no insurance. The plant was owned by the city, where municipal ownership prevails. The citizens will rebuild at once, and have agreed the amount shall be raised by popular subscription. The boilers in the old plant, it is thought, may be used again.

Dissatisfied with the charges for electric light, a number of Plainfield (N. J.) merchants have about agreed to join in organizing a company to build and operate a plant for their benefit. They have been inspecting similar plants in Newark, and are much impressed with the idea. It is proposed to build a $30,000 plant in the rear of the stores of those interested, and, if permit can be had from the Common Council, to cross the street with wires and supply others in the business district.

Announcement has been made of the consummation of a deal whereby the present owners of the Belleville (Ill.) Gas and Electric Light Company transfer their interest and rights to the property to a syndicate of Chicago, headed by K. A. Ames, the consideration being $500,000. There will be no change in the management, for the present, at least, it is said. Harry Kircher will be retained as manager. The Belleville Gas and Electric Light Company was reorganized about four years ago, with L. D. Turner, R. D. W. Holder of Belleville and former Mayor M. M. Stephens of East St. Louis as the principal stockholders.

In view of recent franchise negotiations, the Minneapolis (Minn.) General Electric will put a new electric-light rate into effect on July 1st, it is said. The rate for electric light in the city will be 14 cents a kilowatt-hour for the first 52 hours' use a month of the consumer's maximum demand, and 6.6 a kilowatt-hour for all in excess. Bills are subject to a 10 per cent. 10-day cash discount. The rate is based on present operating conditions of the company and is subject to revision from time to time. The new rate in no way affects the city lighting, which is $84 a light. Power rates are also unaffected, being left in open competition with other power.

The Meriden Electric Light Company of Meriden, Conn., has recently ordered a 500-kilowatt Allis-Chalmers turbo-generator unit to be installed at the power house in Meriden late in the fall, for lighting and power purposes. In addition to the turbine and generator proper, the Allis-Chalmers Company will also furnish a structural steel foundation frame and a surface condenser, with 2,000 square feet of cooling surface, including centrifugal circulating pumps, air pumps, etc. The turbo-generator is the standard 500-kilowatt construction, wound for 60 cycles, 2,300 volts, two-phase, with a steam pressure of 125 pounds a square inch. The turbine is direct connected to the revolving field of the generator. The turbine and alternator rotors, each carried on two bearings, will rest on a continuous bed plate, which is provided with suitable slides to allow for the expansion and contraction of the turbine cylinder, and in order to preserve the alignment of the entire unit.

ELECTRIC RAILWAYS.

The New World Electric Railway Company of Cooke City, Mont., is reported as having been incorporated with a capital stoock of $3,000,000.

A franchise was granted June 18th by Secretary of State Morton to the Jackson (Tenn.) Railway and Light Company of Madison County, with a capital stock of $600,000. The incorporators are S. S. Bush, A. Cox, Alan McDonald, John Wisdom and Charles D. Lehmikuhl. The corporation proposes to construct electric railways in the city of Jackson and also in the county of Madison outside of the city and upon and over the various roads of the county. The company also proposes to generate electricity for lighting, heating and general commercial purposes.

The Hillsboro, Bellfast and Peebles Traction Company of Cincinnati, Ohio, has been organized to build an electric road from Cincinnati to Hillsboro. P. M. Hughes of Lovett, Ohio, is president.

The Roanoke and Salem Traction Company of Salem, Va., has been incorporated with a capital stock of $25,000. O. L. Stearnes is president, W. B. Dillar treasurer and R. W. Kime general manager, all of Salem.

The wires, track and power house of the Chicago Southern Traction Company have been completed and cars have been run over the line. The new road offers street-car service between Sixty-third Street, Chicago, via Harvey, to Chicago Heights.

The Citizens' Association of East Washington, D. C., is appealing to the Senate committee on the District of Columbia for an extension of the lines of the Capital Traction Company in East Washington. Street-railway facilities are said to be inadequate, especially north and south lines.

It is said to be the determination of the Detroit and Lansing (Mich.) Short Line and the new Detroit, Ann Arbor and Adrian railway to use the Union Pacific Keane car, which is run by a gasoline engine on the principle of the automobile. This is expected to reduce the cost of building and equipping the road nearly 40 per cent.

Regular monthly conferences of the general superintendents of the Illinois Traction System are held in the different cities along the line, for the purpose of attending to the small matters pertaining to the welfare of the road which come up month by month. The June meeting was held in Springfield recently and was attended by Assistant Manager W. J. Ferris of Champaign, General Superintendents M. L. Harry of Staunton, M. G. Linn of Bloomington, J. P. Doan of Jacksonville, H. J. Pepper of Champaign, W. H. Owens of Edwardsville, A. V. Schroder of Decatur and J. A. Glover of Champaign.

Common Councilman Ferguson of Pittsburg, Pa., thinks that municipal street-car lines in the city parks would be a nice thing. He says the parks now are really not enjoyed to any great extent except by those well enough off to afford carriages and automobiles. Street-car lines should be operated so that the people obliged to live economically could get to any point in the park with little cost and without having to walk a long distance. The city would charge a very small fare, only enough to pay for the cost of operation. Mr. Ferguson says that next year an appropriation may be made for the erection of a municipal lighting plant, which could be equipped with sufficient power for the operation of the street cars in the parks.

Portland's (Ore.) next great traction improvement, says the Journal of Electricity, Power and Gas, will be the construction of a subway, or tunnel, under the Willamette River, to carry passenger and freight traffic by electric power. Plans are rapidly maturing for the subway and for a street-car system to cover East Portland, with cross street lines and three main lines to the east and north city limits, tapping the packing-house district on the peninsula. The total cost will be about $2,000,000. Work on the subway will probably begin this summer. About two months ago the undertaking was begun by Thomas McCusker of the Geiser-Hendryx Investment Company, and L. Y. Keady, one of the original promoters of the Oregon Traction Company's Portland-Forest Grove interurban railway, now being carried forward by the United Railways Company.

The Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., operates an interurban railway to Oshkosh. It recently opened a private right-of-way into Oshkosh, which brings its cars to the bridge, some distance from the business district. The work of laying tracks in lower Main Street to reach the heart of the city was opposed by the local company in Oshkosh, and when injunctions stopped the work City Attorney Cowling arranged for the discharge of the construction crew by the company and their engagement by the city engineer. Then the city attorney directed the work of laying the tracks. The local railway manager threatened the city attorney with arrest, but the latter's defense was that the city had a right to lay the track, and, according to an order from Judge Burnell, he ignored the injunction suit against the Eastern company.

PUBLICATIONS.

"Modern Rock-crushing Plants" is the title of a new bulletin from the mining and crushing-machinery department of the Allis-Chalmers Company.

A catalogue of pleasing appearance and containing well-written information upon the Universal system of machine molding has been issued by Ph. Bonvillain & E. Ronceray of Paris-Aubervilliers, France. The catalogue is in English and describes a line of machinery which conforms to all possible conditions in machine molding from the simplest castings to the most intricate. The machine can mold with non-machined frames when dry molds are needed, or without boxes when green sand is used.

The F. Wesel Manufacturing Company of Chicago has prepared an excellent catalogue upon stereotyping machinery for making plates for use on Harris automatic presses.

The E. W. Bliss Company of New York city has ready for distribution a well-written catalogue machinery for the manufacture of armature disks and segments, electrical instruments, fittings, etc. The catalogue is plentifully illustrated and contains some valuable tables.

The Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass., has issued a new bulletin descriptive of type K arc lamps. The bulletin contains descriptions of the apparatus and views of large buildings, such as Wannamaker's department store in New York, where Stanley-G. I. lamps are used.

Special publication No. 7049, describing alternating-current and direct-current motors for all classes of service, has been issued by the Westinghouse Electric and Manufacturing Company. The pamphlet is prepared primarily to enable purchasers to see at a glance just what comprises the extensive line of Westinghouse motors now on the market.

The Power and Mining Machinery Company of Milwaukee, Wis., now has on the press its catalogue No. 6, descriptive of machinery for the roasting, smelting and refining of copper and silver-lead ores. This catalogue will contain about 176 pages, size six by nine inches, amply illustrated, and will contain information of interest to the practical mining and smelting man. It will be ready for distribution about July 15th, and will be sent upon request to those interested.

Nearly all modern factory equipments require variable-speed drive for machine tools. To meet this requirement in factories where the conditions do not warrant the installation of a multiple-voltage variable-speed system, the Crocker-Wheeler Company of Ampere, N. J., has designed and is prepared to furnish a field-weakening motor suitable for operating on a two-wire direct-current system and giving speed ranges up to 3 : 1. This line is known as forms I-F, and full information concerning it may be obtained from bulletin No. 67, just issued.

A little pamphlet entitled "Unions for Steam Pipes" is being distributed by the Joseph Dixon Crucible Company of Jersey City, N. J. It is an illustrated description of the several varieties of unions with valuable suggestions concerning them by the well-known writer on such matters, W. H. Wakeman, an expert steam engineer and author of books on steam engineering. This pamphlet is a reprint from Dixon's house organ, Graphite, and will gladly be sent by the company to any engineer, steamfitter or anyone interested in steam pipes, upon application.

"Edison Primary Batteries" is the title of a 16-page pamphlet describing and listing the Edison caustic-potash cell. This battery is distinguished from others of the caustic-potash type by having the copper dioxide compressed into briquettes, and this method of construction is justified by a quotation from Prof. H. S. Carhart, as follows: "Recognizing the good qualities of copper oxide as a depolarizer, Edison has devised a form of design to meet the objections. The copper oxide is employed in the form of a compressed slab, which, with its connecting copper support, serves also as the negative plate. In recent cells the device has been resorted to of reducing a superficial film of copper on the oxide before it is sent from the factory."

SOCIETIES AND SCHOOLS.

The State University of Iowa has recently ordered two alternating-current Crocker-Wheeler generators of 50 and 200 kilowatts, respectively, to furnish light and power for the university.

Purdue University, Lafayette, Ind., is enlarging its present machinery equipment for the engineering laboratory by the addition of an Allis-Chalmers centrifugal pump, to be directly connected to a horizontal Corliss engine. The centrifugal pump is of the standard horizontal type, having double suction for perfect lateral balance of enclosed impeller. The pump has a nominal capacity of 4,000 gallons a minute against a total head of 10 feet, when operated at maximum efficiency, and a capacity of 10,000 gallons a minute under certain conditions. The pumping unit is for laboratory work and will be provided with all the necessary adjuncts for careful testing and accurate experimental work.

TRADE NEWS.

C. E. F. Ahlm, consulting and designing engineer of Cleveland, Ohio, has removed from the Williamson Building to the Caxton Building. Mr. Ahlm, besides his mechanical engineering and auditing, makes tests, specifications, designs and reports on electric-railway, light and power plants and fur-

nishes preliminary determinations in feeder systems, etc.

The village of Nashwauk, Minn., will receive bids for installation of 50-kilowatt dynamo, wiring, pole line and engine, up to 7.30 p. m., July 10th, all installed complete. Certified check for five per cent. of amount bid.

It is now reported that the purchase of the United States Carbon Company by the National Carbon Company has been completed. The United States plant will furnish the National company a needed increase in capacity and avoid the necessity of construction at a cost of perhaps $500,000.

Sealed proposals are being invited until July 10th for furnishing the depot quartermaster in New York with 66,719 incandescent electric lamps, more or less. Specifications and proposal blanks can be obtained upon application to Col. W. H. Miller, Army Building, 39 Whitehall Street, New York city.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until July 10th for furnishing arc lamps, globes and carbons, incandescent lamps, conduit and fittings, lamp cord and miscellaneous electrical supplies embraced in schedule 2, obtainable at the Navy Pay Office in New York or upon application to the bureau.

A request has been made, through Consul Benjamin F. Chase, by business men of Catania, Spain, for American-made gas engines for operating with "Dowson gas" or "poor gas" as a power. Names of the Catania business men may be obtained upon application to the Bureau of Manufactures, Washington, D. C.

The Bureau of Yards and Docks, Navy Department, is inviting sealed proposals until July 21st for installing four turbo-alternators, engines, generators, switchboard, wiring, etc., together with boilers and accessories, electric equipment, pumps and piping, at the Charleston (S. C.) navy yard. Plans and specifications will be furnished upon application to the commandant of the navy yard.

By referring to file No. 183, the Bureau of Manufactures, Washington, D. C., can give information concerning inquiries from two electrical firms at Cape Town, South Africa, which are open to the further sales of American electrical goods. One house sells large quantities of supplies throughout South Africa. The other is a manufacturer's agency, and travels the whole of South Africa.

Some important changes have been made in the staff of the Power and Mining Machinery Company of Milwaukee, Wis. W. A. Lieblein has been appointed manager of the Salt Lake City branch, with offices in the Commercial Club Building. W. C. MacDowell, formerly connected with the mining department of the New York office, has recently been appointed manager of the El Paso (Texas) office of that company. Mr. MacDowell's territory will comprise all of Old Mexico, New Mexico and parts of Texas and Arizona. N. B. Roper, formerly chief engineer for the Cananea Consolidated Copper Company, Cananea, Mexico, [illegible] gaged by the Power and Mining Machinery Company as mining engineer to represent it at the New York sales office [illegible] Street.

The Mann [illegible] Company [illegible] relocated its offices [illegible] Fremont and Howard streets, San Francisco. The company [illegible] one of the first to resume operations in the [illegible] district, and has taken contracts for a large amount of work in addition to the orders on hand [illegible] to the fire. Work is progressing rapidly on the company's new shops and warehouses in the Potrero district at Seventh and Hubbell streets. Temporary pattern and forge shops are already in operation on the new site.

The foreign commerce of the United States during the fiscal year which ends with the month promises to exceed in both imports and exports that of any previous year. The details of 10 months of the year's commerce have been announced by the Department of Commerce and Labor through its Bureau of Statistics, and should May and June show as large a monthly average as that of the 10 months for which the record has been made, the imports will be $1,225,000,000 and the exports $1,780,000,000, or a total of a little more than $3,000,000,000.

The California Electrical Works, Pacific Coast agent of the Western Electric Company, announces the opening of its Seattle branch, which will occur about August 1st. Its temporary office is now located at 439 and 440 New York Block, in charge of Mr. P. J. Aaron, and all inquiries and orders from the Northwest territory should be addressed to the company at that point. It will be the company's aim to carry at Seattle the complete stock of electrical supplies that the great growing Northwest demands, and to make quick deliveries of the established standards with which the Western Electric Company and its branches have been so long identified.

Some very important changes were made recently in the arrangement of the Chicago offices of Westinghouse companies. Formerly the offices of the Westinghouse interests occupied the fourth floor of the New York Life Building. They are now located on the fourteenth floor, and are occupied by the Westinghouse Electric and Manufacturing Company, Westinghouse, Church, Kerr & Co. and the Westinghouse Machine Company. Later on, the Westinghouse Air Brake Company and the Union Switch and Signal Company will move in, when the entire floor will be Westinghouse. The quarters of the Westinghouse Electric and Manufacturing Company are conveniently arranged, a large central area being occupied by the office force, and around two sides of this room, and facing on the streets, being the private offices of the management and the salesmen. There is also a large compartment devoted to the filing system, which, owing to the growth of the business done by this office, has become very bulky. The filing system in an office of this size is one of the hardest problems to contend with, and everything has to be carefully systematized under a card-index plan. The offices of the other Westinghouse interests are arranged in [illegible]

BUSINESS

[illegible]

The H. W. Johns-Manville Company, [illegible] Street, New York city, has [illegible] year been meeting with [illegible] installation of its J-M [illegible] on pipes in mines and [illegible] weather conditions. In [illegible] company has demonstrated the [illegible] steam considerably over a [illegible] actual working conditions prove the J-M [illegible] tion felt covering to be efficient and [illegible] when exposed to the most severe [illegible] company will be glad to give full information regarding this product to anyone interested.

The Delaware, Lackawanna and Western Railroad Company has contracted with the Westinghouse Machine Company for two Westinghouse-Parsons steam turbines, to be installed in its passenger terminal at Hoboken, N. J. The turbines will operate under a steam pressure of 150 pounds, 28-inch vacuum, and moderate superheat, driving 500-kilowatt three-phase 60-cycle Westinghouse generators of the rotating-field enclosed type. These machines will supply current to the station and yards. Internal superheaters will be used, while the condensing system will be Worthington barometric. Babcock & Wilcox boilers will supply steam, using small anthracite coal.

The Weston Electrical Instrument Company of Waverly Park, Newark, N. J., has this year taken Caxton Brown, sales manager of the New York office, into the Newark factory, as secretary of the company and sales manager, and in his place has put Stanley Brown as manager of the New York office. In connection with this office, there has been installed a repair department, whose duty it is to take care of the repairs in the metropolitan district, and particularly to look after emergency calls. The company is very much pleased with the present instrument outlook, and is exceedingly busy preparing new models for measuring apparatus to meet the wider demands of modern electrical requirements.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 19, 1906.

823,505. Electric System of Transmission. Charles G. Burke, Brooklyn, N. Y., assignor of one-half to John Q. A. Whittemore, Boston, Mass. Application filed December 9, 1902.

In a signaling system are combined a main line, means for constantly charging the main line, receiving apparatuses located at different points along the main line, and means for causing the charging means to affect one of the receiving apparatuses and to permit another to be affected when signals are sent.

823,513. Safety System for Operating Railroads. William H. Dammond, Detroit, Mich. Application filed February 17, 1905.

The source of signaling current is carried on the vehicle and connected to suitable track circuits in such a manner that the vehicle in passing over the tracks automatically signals three distinct signals for a block.

823,533. Electric-light Bracket. Eugene F. Hug, Elgin, Ore. Application filed June 19, 1905.

An electric-light support or fixture comprises an arm pivotally supported to swing in an approximately horizontal plane and constituting a conductor, and an electric lamp mounted to travel upon the arm and deriving current therefrom by direct contact in any adjusted position.

823,560. Art of Metallurgy. Enrique A. Touceda, Albany, N. Y. Application filed January 28, 1905.

Improvement in the art of metallurgy consists in converting into steam energy heat emanating from a metallurgical furnace, converting the steam energy into electrical energy, and converting the electrical energy into heat within the furnace.

823,561. Metallurgical Apparatus. Enrique A. Touceda, Albany, N. Y. Original application filed January 28, 1905. Divided and this application filed December 5, 1905.

Metallurgical apparatus embodies a metallurgical furnace, means for converting heat emanating from the furnace into electrical energy and means for converting the electrical energy into heat within the furnace. (See cut on next page.)

823,568. Commutator. William L. Waters, Milwaukee, Wis. Application filed December 5, 1904.

A sleeve on the commutator is provided with two sets of shoulders, the end plates of the armature engaging the sleeve against one set of shoulders, the commutators, two in number, are mounted on the sleeve, and each engages one of the other shoulders, the segments of one commutator being suitably connected with the coils of the armature. Conductors join corresponding segments of the commutators.

823,569. Brush Holder. William L. Waters, Milwaukee, Wis. Application filed January 20, 1905.

Mechanical details are described.

823,579. Transmitter Support. Sidney A. Beyland, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed February 28, 1905.

In a transmitter support, the base and transmitter mount are provided with co-operating curved friction surfaces, a single securing device and spring take-up. Means are supplied to prevent side play.

823,619. Composite Electrical Lamp and Prismatic-glass Reflector. Otis A. Mygatt, New York, N. Y. Application filed March 31, 1904.

Combined with a socket is an incandescent lamp therefor having a spherical bulb, a portion of the surface of which is of clear glass and the major portion frosted. A filament is located eccentrically in the bulb of the lamp, a reflector holder being formed at a permanent part of the socket, and a prism-glass reflector carried thereby in proximity to the bulb of the lamp, but out of contact therewith.

823,620. Illuminator. Otis A. Mygatt, New York, N. Y. Application filed May 20, 1904.

A special form of shade for electric lamps is described.

823,621. Illuminator. Otis A. Mygatt, New York, N. Y. Application filed April 19, 1905.

A special form of shade and bulb for an electric lamp is made the basis of the patent.

823,642. Collecting Brush for Electric-current Generators and Motors. Otto Siebers, Dresden, Germany. Application filed July 9, 1903. Renewed January 2, 1906.

A collecting brush consists of sheets of metal, each of which is twice the width of the brush, folded over at the center and inserted one in the other in zigzag manner so that each member of each folded sheet is between the two members of another folded sheet. A sheet incases the series of folded sheets, having its ends inserted between the latter, the folded sheets and the casing sheet being held together by solder applied on the outside.

823,646. Signaling System. Jacob B. Struble, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed February 12, 1903. Renewed April 11, 1905.

The signaling system comprises a source of alternating power current, a power circuit, signaling circuits formed by the track and electrically separated from each other, a direct-current supply for each of the signaling circuits and signaling devices controlled from the signaling circuits.

823,648. Railway Signaling. Louis H. Thullen, Edgewood, Pa. Application filed February 5, 1904. Renewed May 10, 1906.

In a signaling system for use on electric railways employing alternating current as motive power and a rail for the return, there are a series of block sections, a closed track circuit for each block section which includes a portion of both track rails, a source of direct current for each track circuit, a translating device included in each track circuit and an inductive winding included in the track circuit for preventing alternating current effectively operating the translating device.

823,650. Apparatus for the Electrolysis of Water. Karl J. Vareille, Levallois-Perret, France. Application filed November 15, 1905.

An electrolytic apparatus comprises a tank, a number of superposed V-shaped troughs, and electrodes interposed between the walls of the troughs, the troughs and electrodes being so arranged that the bottom of each trough projects below the lower edge of the corresponding electrode. (See cut on next page.)

823,668. Alarm Signal Arrangement for Use in Connection with Railways. Richard W. Clery, Maryborough, Ireland. Application filed January 20, 1906.

Associated parts of the device are a post and a semaphore arm carried thereby, means carried by the post and connected to the arm, arranged and adapted to be actuated by a moving vehicle and when so actuated to close an electric circuit and to release an alarm mechanism carried by the vehicle.

823,671. Electric Water Purifier. Albert E. Dieterich, Washington, D. C., assignor to E. E. Sager and F. E. Holt. Application filed April 10, 1906.

A casing having a water inlet and a water outlet, a double-spiral member mounted within the casing to form double-spiral water passages therein, and means for connecting the double-spiral member to the terminals of an electric circuit, are the essential features of the apparatus.

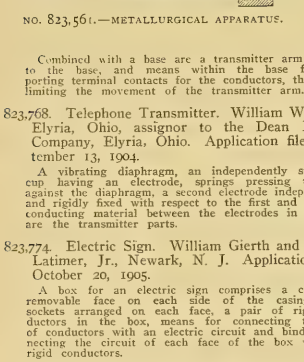
823,682. Synchronizing Mechanism for Timepieces. Augustus L. Hahl, Chicago, Ill. Application filed September 26, 1903.

Escapement mechanism of the clock is controlled by the armature of an electromagnet.

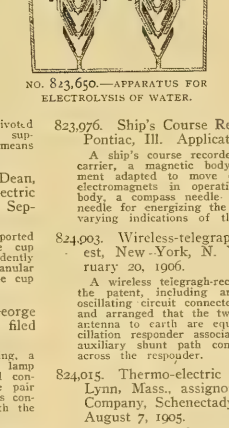
823,724. Electrical Receptacle and Plug. John C. Hatzel and Edgar L. Morley, New York, N. Y. Application filed February 2, 1904.

An electrical receptacle comprising an oblong porcelain box open upon its upper side has recessed extensions located at the ends of the open side of the box, two open slots leading from the outer side of each of the recessed extensions and means for securing circuit wires in the recessed extensions.

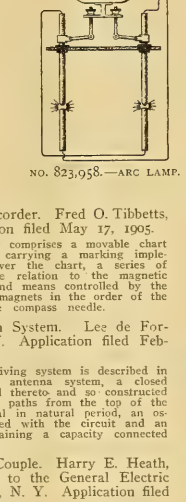
823,758. Supporting Arm for Telephone Transmitters. Sidney A. Beyland, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed May 12, 1904.



NO. 823,561.—METALLURGICAL APPARATUS.



NO. 823,650.—APPARATUS FOR ELECTROLYSIS OF WATER.



NO. 823,958.—ARC LAMP.

Combined with a base are a transmitter arm pivoted to the base, and means within the base for supporting terminal contacts for the conductors, the means limiting the movement of the transmitter arm.

823,768. Telephone Transmitter. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed September 13, 1904.

A vibrating diaphragm, an independently supported cup having an electrode, springs pressing the cup against the diaphragm, a second electrode independently and rigidly fixed with respect to the first and granular conducting material between the electrodes in the cup are the transmitter parts.

823,774. Electric Sign. William Gierth and George Latimer, Jr., Newark, N. J. Application filed October 20, 1905.

A box for an electric sign comprises a casing, a removable face on each side of the casing, lamp sockets arranged on each face, a pair of rigid conductors in the box, means for connecting the pair of conductors with an electric circuit and binders connecting the circuit of each face of the box with the rigid conductors.

823,811. Automatic Circuit Making and Breaking Device for Automobiles and the Like. Andrew L. Riker, Bridgeport, Conn., assignor to the "Locomobile" Company of America, New York, N. Y. Application filed October 8, 1903.

An automatic circuit making and breaking device comprises an electromagnet, a resiliently mounted armature member, a positive stop for the retractile movement thereof and a resiliently mounted contact member adapted to be engaged by the armature member after the initial movement of the latter, the armature member being between the magnet and the contact member.

823,820. Prong Insulator. Louis Steinberger, New York, N. Y. Application filed July 10, 1905.

A body portion of insulating material provided with spouts and a metallic member connected with the body portion and provided with prongs disposed intermediate of the spouts, make up the parts of the device.

823,822. Carrier System. Joseph A. Suerth, Chicago, Ill. Application filed August 7, 1905.

A carrier system includes the carrier-supporting means, a carrier, electromagnetic mechanisms at communicating positions for imparting motion to the carrier, suitable circuit connections intervening between the positions and switching apparatus whereby the magnetic mechanism at one position may have its operation effected at another position.

823,886. Telephone. Thomas J. Merryman and Carl L. Allen, Lincoln, Neb. Application filed August 25, 1904.

The transmitter circuit includes resilient contacts and binding posts with which the contacts normally engage. The lamp circuit has its terminals secured to binding posts disposed adjacent to those of the transmitter circuit, a source of electrical energy for the circuits and a push-bar for actuating the contacts to open the transmitter circuit and close the lamp circuit, completing the apparatus.

823,912. Insulator. August Biele, New Haven, Mo. Application filed July 25, 1905.

Details are described.

823,958. Electric Arc Lamp. Edwin J. Murphy, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed September 9, 1904.

A twin arc lamp having a number of movable electrodes is provided with an electromagnetic winding and a core or armature for positioning the movable electrodes. A member made of magnetic material is adapted to be acted upon magnetically by the winding to arrest the movement of the electrode-positioning mechanism when in a definite position. (See cut.)

823,968. Electric Locomotive. Edward D. Priest, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 28, 1905.

In an electric locomotive are the locomotive frame, a driving axle, a motor armature mounted upon and supported by the axle, a bearing member between the locomotive frame and axle and a motor frame adjustably suspended from the bearing member.

823,969. Electric Locomotive. Edward D. Priest, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 28, 1905.

Mechanical features of the structural design are set forth.

823,976. Ship's Course Recorder. Fred O. Tibbetts, Pontiac, Ill. Application filed May 17, 1905.

A ship's course recorder comprises a movable chart carrier, a magnetic body carrying a marking implement adapted to move over the chart, a series of electromagnets in operative relation to the magnetic body, a compass needle and means controlled by the needle for energizing the magnets in the order of the varying indications of the compass needle.

824,003. Wireless-telegraph System. Lee de Forest, New York, N. Y. Application filed February 20, 1906.

A wireless telegraph-receiving system is described in the patent, including an antenna system, a closed oscillating circuit connected thereto and so constructed and arranged that the two paths from the top of the antenna to earth are equal in natural period, an oscillation responder associated with the circuit and an auxiliary shunt path containing a capacity connected across the responder.

824,015. Thermo-electric Couple. Harry E. Heath, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 7, 1905.

A thermo-electric couple has one member constructed of a body of silicon.

824,021. Receptacle for Electric Lamps. Paul H. Jaehnig, Newark, N. J. Application filed May 4, 1904.

The noticeable feature about the receptacle is that the connections are all of them arranged and concealed directly in the body of the receptacle to protect them against moisture and accidental contact. Cover plates upon the body and at the sides of the holding portion are arranged to cover some of the connections.

824,028. Telegraphic Sending Device. Isidor Kitsee, Philadelphia, Pa. Application filed January 27, 1903.

Several stationary members have upon their faces contact portions of predetermined and definite character. Movable members are inserted between the stationary members, and have also upon their faces contact portions of predetermined and definite character. A movable arm is arranged to traverse the region of the contact portions and establish a circuit.

824,029. Transmitting Key for Telegraphic Circuits. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed March 25, 1904.

In combination with a transmitting key is a step-by-step movement adapted to change the polarity of the transmitting key, the step-by-step movement actuated by electromagnetic means.

824,030. Telephony. Isidor Kitsee, Philadelphia, Pa. Application filed July 23, 1904.

A telephonic system comprising two stations is connected to a line of transmission, each station embracing two bridge arms. A telephonic receiver is across the bridge arms and a telephonic transmitter operatively related to the junction of the bridge arms.

824,031. Telegraphic Transmitting Key. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed February 11, 1905.

In combination with a line of transmission are a transmitting key embracing a main lever connected to the line, a contact lever on each side of the main lever connected each through stationary contacts with the ground, stationary contacts connected to sources of current and means whereby through the movement of the main lever the line is connected to one or the other of the sources.

824,032. Telephony. Isidor Kitsee, Philadelphia, Pa. Application filed April 10, 1905.

Two outlying stations are connected, each through an all-metallic circuit with an exchange, the exchanges more or less remote from each other. A line of transmission connects inductively the exchanges with each other, the line of transmission consisting of two pairs of wires, the two wires of each of the pairs twisted in intimate relation with each other. Means are provided at each exchange to connect the outlying station with the line of transmission.

824,046. Electromagnet. Charles F. A. Sturts, San Francisco, Cal. Application filed April 28, 1905.

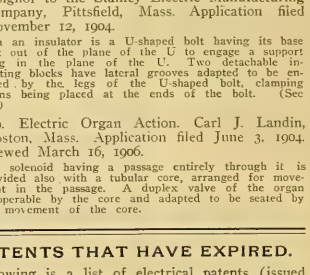
Spools and the pole piece or base upon which they are mounted, a hollow standard on the base, an adjustable rod journaled in the standard and an armature carried by the rod, with means for adjusting the rod in the standard, are the detail parts.

824,048. Insulated Coil for Electrical Apparatus and Process of Making the Same. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 11, 1903.

A coil for electrical apparatus consists of an edgewise-wound flat conductor whose convolutions are insulated from each other and cemented together by a compound of silicious matter and silicate of soda.

824,054. Electric Time Switch. Anthony B. Zierleyn, Grand Rapids, Mich. Application filed December 1, 1905.

Clockwork mechanism is so adjusted and connected to the switching mechanism as to release the switch members at a predetermined time.



NO. 824,055.—INSULATOR.

824,055. Insulator. Harry M. Acly, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed November 12, 1904.

In an insulator is a U-shaped bolt having its base bent out of the plane of the U to engage a support lying in the plane of the U. Two detachable insulating blocks have lateral grooves adapted to be engaged by the legs of the U-shaped bolt, clamping means being placed at the ends of the bolt. (See cut.)

824,079. Electric Organ Action. Carl J. Landin, Boston, Mass. Application filed June 3, 1904. Renewed March 16, 1906.

A solenoid having a passage entirely through it is provided also with a tubular core, arranged for movement in the passage. A duplex valve of the organ is operable by the core and adapted to be seated by the movement of the core.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on June 25, 1906:

405,733. Art of Preparing Elements for Secondary Batteries. W. M. Griscom, Haverford College, Pa.
405,742. Electrolier. J. M. Orford, Bridgeport, Conn.
405,745. Regulator for Dynamo-electric machines. J. H. Robertson, Rutherford, N. J.
405,750. Standing Contact Arm. C. J. Vandepoele, Lynn, Mass.
405,831. Secondary Battery. J. T. Van Gestel, New York, N. Y.
405,767. Conduit for Cable or Electric Railways. W. J. Brewer, New York, N. Y.
405,815. Electric-railway Signal. J. C. White, Sewickley, Pa.
405,823. Electric Candle. T. D. Bottome, Hoosick, N. Y.
405,831. Electric-signaling System. M. W. Dewey, Syracuse, N. Y.
405,858. Electromagnetic Motor. N. Tesla, New York, N. Y.
405,969. Method of Electrical Power Transmission. N. Tesla, New York, N. Y.
405,867. Telephone-exchange Apparatus. F. G. Beach, Chicago, Ill.
405,896. Electric-lighting System. H. W. Leonard, Chicago, Ill.
405,897. System of Electric Lighting for Railway Cars. H. W. Leonard and A. Hanson, Chicago, Ill.
405,985, 405,986, 405,987, 405,988, 405,989. Electric Arc Lamp. H. Pieper, Liege, Belgium.
405,964. Automatic Electric Controller for Railroad Trains. F. E. Kinsman, New York, N. Y.
405,970. Adjustable Support for Incandescent Electric Lights. J. T. Pearson, St. Louis, Mo.
405,978. Electrically Propelled Vehicle. R. N. Allen, Cleveland, O.
405,984. Telegraphy. C. G. Burke, Richmond Hill, N. Y.
405,985, 405,986, 405,987, 405,988, 405,989. Telegraphic Instrument. C. G. Burke, Richmond Hill, N. Y.
405,996. Machine for Making Battery Plates. W. W. Griscom, Haverford College, Pa.
406,010. Electric Meter. E. Thomson, Lynn, Mass.
406,015. Dynamo-electric Machine. T. L. Wilson, Brooklyn, N. Y.

Western Electrician

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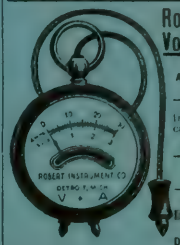

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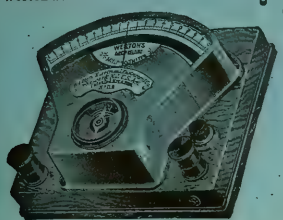
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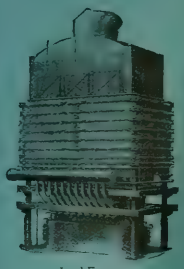
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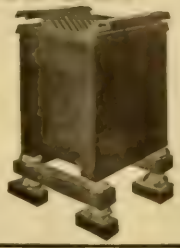

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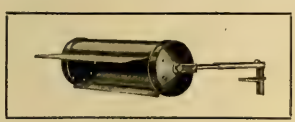

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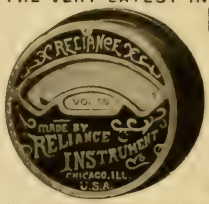

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 39
Advertising Mirrorgraph Co. 30
Aiton Machine Co. 4
Allis-Chalmers Company 2
American Battery Co. —
Amer. Circular Loom Co. 1
American Conduit Co. 33
Amer. District Steam Co. 49
American Elect'l. Heater Co. 21
Amer. Elect'l. Supply Co. 21
Amer. El. Telephone Co. 41
American Electrical Works. 29
American Platinum Works. 29
Arnold Co., The 38, 40
Automatic Electric Co. 42

Babcock & Wilcox Co. 35
Badt, F. B. 40
Bain, Forde & May —
Baker & Co., Inc. 3
Baker & Co., W. E. 40
Beardslee Chandelier Mfg. Co. —
Belden Mfg. Co. 29
Benton & Son —
Berthold & Jennings 49
Bissell Co., The F. 4
Blakely Printing Co. 38
Bossert Electric Construction Co. 18
Bracey-Forse Elec. Cons. Co. —
Brooks, Hall L. 49
Bryan-Marsh Co. —
Buckeye Electric Co. 12
Buckeye Engine Co. 35
Bullock Elec. Mfg. Co. 2
Byllesby & Co., H. M. 40

Carhartt & Co., Hamilton —
Central Electric Co. 5
Century Electric Co. 22
Chicago Edison Co. 4, 30 and colored cover.
Chic. Fuse Wire & Mfg. Co. —
Chicago Mica Co. 28
Chicago Pneumatic Tool Co. colored cover
Chicago Telephone Co. 44, 45
Colonial Sign & Insulator Co. 36
Columbia Incand. Lamp Co. —
Cope, T. J. 33
Copley-Senior Carbon Co. 30
Cornell, T. S. 40
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 20
Crolius & Son, E. R. 29
Cutler-Hammer Mfg. Co. 25
Cutter Elec. & Mfg. Company —

Dale Company, The 24
D. & T. Anchor Co. 54
D. & W. Fuse Company —
Dearborn Drug & Chem. Wks. 34
Dearborn Engraving Co. 37
Diamond Meter Company 39
Directory of Engineers 40
Dixon Crucible Co., Joseph 34
Duncan Elec. Mfg. Co. 15
Dwight Bros. Paper Co. 39

Edison Decorative & Miniature Lamp Departm't. 28
Edison Mfg. Company 30
Electric Appliance Co. 28
Electric Storage Battery Co. 3
Elect'l. Trades Exp. Co. 19
Electrician Pub. Company 19
Erie R. R. 49

"For Sale" Advertisements. 30
Ft. Wayne Elec. Works, Inc. 53
Fostoria Glass Specialty Co. 16
Fostoria Incan. Lamp Co. 27
Fowler & Co. 49
Fres-Ko Chemical Co. 31
Frink, I. P. 4

Galloway Co., J. B. 49
General Electric Co. 9, 28
General Elec. Securities Co. 40
General Storage Battery Co. 28
Gest, G. M. 33
Goldschmidt Thermit Co. 33
Gould Storage Battery Co. 6
Gregory Electric Company 30

Haller Machine Co. 29
Hardy Co., R. E. 4
Hart Mfg. Co. 35
Hartford Steam Boiler Inspection & Insurance Co. 40
Hazard Manufacturing Co. 54
Hensel & Co., John A. 14
Highland Park College. 4
Hoffman, G. W. 3
Holmes Fibre-Graph. Co. 34
Humphrey, Henry H. 40
Hunt & Co., Robt. W. 40

Illinois Central Ry. 48
Incandescent Electric Light Manipulator Company 1
Indiana Rub. & Ins. W. Co. 1
India Rubber & Gutta Percha Insulating Company 10
International Elec. Meter Co. 7
International Tel. Mfg. Co. 41

Jackson, D. C. & W. B. 40
Jeffrey Manufacturing Co. 34
Johns-Manville Co., H. W. —

Kartavert Manufacturing Co. 54
Kellogg Switchboard & Supply Company 46, 47, 48
Klein & Sons, Mathias 28
Kohler Brothers 40
Kuhlemeyer, John 29
Kuhlman Electric Co. 1

La Fayette Elect'l Mfg. Co. 28
Lake Shore R. R. 50
Leather Preserv. M. Corp. 1
Leffel & Co., James 34
Lindsley-Bauman Co. 49
Loud's Sons Co., H. M. 48

Machado & Roller 1
Maine Hub Mfg. Co. —
Manhattan El. Supply Co. 4
Marinette Gas Engine Co. 34, 35
Matthews & Bros., W. N. 21, 29
McCandless, H. W. & Co. 40
M'Giehan & Co., C. H. 39
McLennan & Company, K. 28
McLeod, Ward & Co. 3
McRoy Clay Works 33
Mica Insulator Company 28
Miscellaneous Advs. 30
Monon R. R. —
Mueller Company, William 49
Munsell & Co., Eugene 28

National Battery Co. 10
National Carbon Co. 10
National Electric Co. 32
National India Rubber Co. —
New Idea Soldering Paste Co. 3
New York Ins. Wire Co. 4
Northern Elect'l Mfg. Co. 30

Okonite Co., The 1
Oliver Typewriter Co. 49
Oneida Community, Ltd. 1
Osburn Flex. Conduit Co. 33

Pacific Coast Pole Co. 49
Parsell & Weed —
Pass & Seymour, Inc. 13
Patrick Co., R. M. 8
Peru Elec. Mfg. Co. 11
Phillips, Eugene F. 29
Phillips Insulated Wire Co. 29
Phœnix Glass Co. 1, 17
Phosphor-Bronze S. Co. 34
Pignolet, L. M. 28
Pillsbury-Watkins Co. 48
Pittsburg & L. S. Iron Co. 48
Plume & Atwood Mfg. Co. 54
Porter Cedar Company 48

Rail Joint Co., The 28
Reisinger, Hugo 13
Reliance Instrument Co. 3
Replogle Governor Works 1
Reynolds El. Flasher Mfg. Co. 54
Richardson Engineering Co 40
Robbins & Myers Co. 11
Robert Instrument Co., The 1
Robertson & Sons, Jas. L. —
Rock Island Battery Co 11
Roebling's Sons Co., J. A. 39
Ruebel & Wells 40

Safety Ins. Wire & Cable Co. 1
St. Marys Incan. Lamp Co. 26
Samson Cordage Works 34
Sandwich Pole Changer Co. 42
Sargent & Lundy —
Schott, W. H. 40 and col. cover
Schureman Co., J. L. 4
S. E. Missouri Cypress Co. 49
Simplex Electrical Co., The 1
Simplex Elec. Heating Co. 21, 28
Smiley & Gleeson 13
Smith Storage Battery Co. 10
Speer Carbon Co. 41
Spon & Chamberlain 32
Sprague Electric Co. 22
Standard Elect'l. Mfg. Co. 31
Standard Underg. Cable Co. 1
Stanley—G. I. Elec. Mfg. Co. 32
Stanton, LeRoy W. —
Star Expansion Bolt Co. 40
Sterling & Son, W. C. 49
Stevens & Co., Milo B. 1
Storey Furniture Co. 40
Stow Mfg. Company 23, 41
Stromberg-Carlson Tel. Mfg Company 43
Sunbeam Incan. Lamp Co. 31
Swedish-American Tel. Co. 41

Telephone Woodworking Co. 41
Tornquist Elect'l. Mfg. Co. —
Torrey Cedar Company 48
Trumbull Elec. Mfg. Co. 26
Turner Brass Works —

Underhill, Chas. R. 40
Universal Elec. Stor. Bat. Co. 10

Van Nostrand Co., D. —
Vought-Berger Co. 28
Vulcanized Fibre Company 54

Wagner Electric Mfg. Co. 39
Wagor Mfg. Co., P. R. 29
Weber Gas & Gasoline Engine Co. 34
Wesco Supply Co. —
Western Display Co. 31
Western Electric Company 24
Western Lumber & Pole Co. 48
Westinghouse Electric & Manufacturing Co. 51, 52
Westinghouse Machine Co. 51
Weston Electrical Inst. Co. 1
White & Co., J. G. 37
Willard Storage Bat. Co. —
Willis, G. M. 40
Wilson, Co., Jas. I. M. 49
Worcester Company, C. H. 48
Wrigley Co., Thos. 40

Yost Electric Mfg. Co. 31

Zeller Geo. A. Book Co. —

For Classified Index of Advertisements See Page 6.

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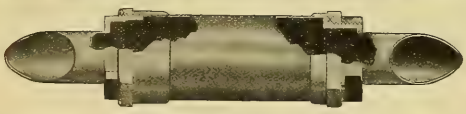

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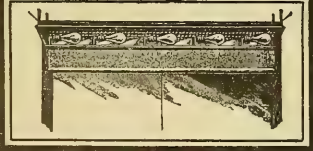

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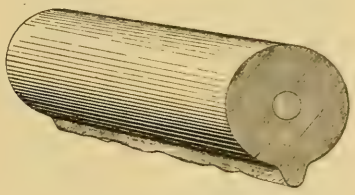

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Turner Brass Works.

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Brownell Co., The

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Bolts, Toggle.
Wrigley Co., Thos.

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Alton Machine Co.

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Electric Appliance Co.
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Speer Carbon Co.
Wesco Supply Co.

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Jeffrey Mfg. Co.

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Underhill, Chas. E.
Western Electric Co.

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Crollius & Son, E. R.
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Stanley—G. I. Elec. Mfg. Co.

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Osburn Flexible Conduit Co.
Wesco Supply Co.

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Samson Cordage Wks.

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Electric Appliance Co.
Galloway Co., J. B.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
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Western Electric Company.

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General Electric Co.
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Badt, F. B.
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Hamacek, A. F.
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Jackson, D. C. & W. B.
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Northern Electrical Mfg. Co.
Patrick Co., R. M.
Richardson Engineering Co.
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Schott, W. H.
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Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
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Wesco Supply Co.
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(See Wires and Cables.)

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Green Fuel Economizer Co.

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(See Cut-outs and Switches.)

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(See Bolts, Toggle.)

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Tools, Pneumatic.
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Embodies many important improvements and new features in the most efficient and best known principle used in electrical measuring instruments. The principle invented by the famous pioneers—Deprez and D'Arsonval.

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Free from Temperature Coefficient.

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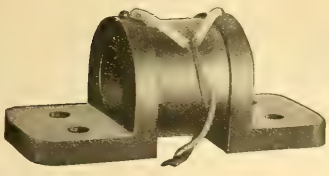

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Eliminates Zero Trouble and Insures Positive Sensitive Action.

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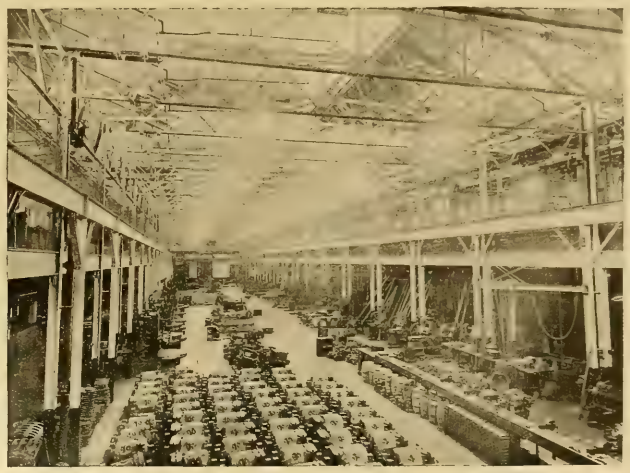
The effective distribution of light from an arc lamp is just as important as the sale of the lamp.

To satisfy the user is the aim of the seller of both the lamp and the current.

The efficient use of the current sold by a central station is just as important as the sale of the current.



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833

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MANUFACTURERS OF THE

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We can save you space and weight in your battery installations. The Morrison type of plate with its metallic surface and completely enclosed active material, insures

LONG LIFE, LOW RESISTANCE, FREEDOM FROM BUCKLING, WITH DECREASED WEIGHT OF GRID AND INCREASE OF ACTIVE MATERIAL.

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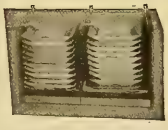

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Important point— **no "choking" gas.**
Made up in "tray form," hence for a battery of a voltage of 110, one stack would only stand **about 30 inches high.** Many other **good novel points—investigate it.**

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"Unit Accumulator"

FOR STREET RAILWAYS, CENTRAL STATIONS, TELEPHONE SYSTEMS, ETC.
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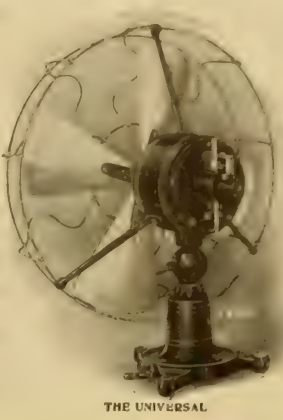
Direct Current Fans

This well-known line of Fans enters the season of 1906 with the prestige of nine successful years on the market.

There are now seven standard models for the American trade alone—a selection that has no equal.



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STYLE "A." The finest, most perfect, most efficient and strongest Electric Ceiling Fan that can be produced regardless of cost.

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THE BEST BATTERY EVER MADE

Write for samples and prices

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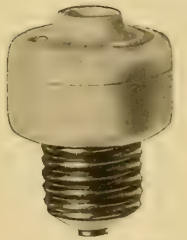
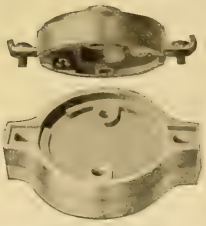
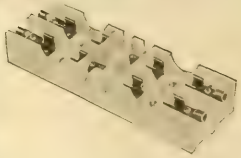


No. 31286. Attachment Plug.



No. 7422. Fuseless Rosettes.



No. 615. Block. 31-60 Amp., 250 V.

"PERU" N. E. CODE STANDARD SPECIALTIES

is the most complete line of labor-saving devices on the market, and embodies special features of safety found in no other goods. Our circulars and prices on this material will interest you.

See our Exhibit at the Electrical Show, Chicago, Jan. 15th to 27th.

A number of new specialties will be shown there.

Peru Electric Mfg. Co. PERU, IND.

"ALL COONS LOOK ALIKE TO ME"

Is an oft repeated expression—and why? It contains an IDEA that means something. For this reason, this perhaps, vulgar expression is often used. How does it apply, you say, in the incandescent lamp business? It was once a common expression among lamp buyers that "all LAMPS look alike to me." Now though we know only too well that lamps may LOOK alike, but one lamp be exceedingly poor in comparison to another.

With the beginning of this year, we therefore call your attention to the fact that "Buckeye" is not only at the top of this page but, "on top" everywhere by reason of its naturally acquired prestige with thousands of SATISFIED buyers.

Think of it! THE BUCKEYE ELECTRIC COMPANY beginning the year 1906 WILL HAVE SEEN 16 YEARS OF ACTIVE LAMP BUSINESS! When in 1891 it purchased the Sellen Process and became the first company in this country to manufacture the cellulose filament it was "on top," and NOW, at the beginning of 1906 it is still on top. A poor lamp in these days of bitter competition cannot live. As a consequence THIS BEING ONE OF THE OLDEST COMPANIES in the incandescent lamp manufacturing business MEANS SOMETHING TO YOU, "Mr. Lamp Buyer!"

In a word the fact that we have been in business for 16 years, AND HAVE KEPT AT THE TOP FROM THE START, is significant of great merit and is one good reason why you

"BETTER BUY BUCKEYE"

STANDARD OF THE WORLD

ELECTRA CARBONS

"TRADE MARK"

HIGHEST GRADE NUERNBERG

They give more light, whiter light and less dust than any other carbon. Their quality is uniform and always of the highest grade. Diameter and straightness perfect. Grand prize St. Louis World's Fair, 1904

HUGO REISINGER, SOLE IMPORTER 11 Broadway, NEW YORK

If You Build Electric Signs

THIS WILL INTEREST YOU

BECAUSE IT SAVES LABOR

P. & S. No. 877 SIGN RECEPTACLE

For Metal-Faced Signs and Metal Letters

To Mount—Insert from Rear, and Screw Porcelain Ring Into Place from Front

Manufactured by

PASS & SEYMOUR, Inc.

SOLVAY, N. Y.

NEW YORK CHICAGO SAN FRANCISCO

"FROM FACTORY TO CONSUMER"

SHELBY
INCANDESCENT LAMPS

AMERICAN
ARC LAMPS

SMILEY & GLEESON

ELECTRICAL
MANUFACTURERS' AGENTS

407 Security Building, St. Louis, U. S. A.

KEYSTONE
MOTORS AND GENERATORS

ALLFREE
AUTOMATIC ENGINES

..THE..

"HENSEL" STORAGE BATTERY

WINS

In the injunction suit of the

Universal Electric Storage Battery Co.

vs.

John A. Hensel

The court decides in favor of

THE HENSEL STORAGE BATTERY

dissolving injunction to restrain its MANUFACTURE AND SALE.

THESE BATTERIES ARE DESIGNED FOR { Stationary, Railroad, Lighting, Telephone, Automobile, Ignition, Signal Work or Power purposes of any description.

SIMPLICITY—LIGHTNESS—EFFICIENCY—LIFE

The "HENSEL" STORAGE BATTERY in connection with the "HENSEL" AIR MOTOR makes electrical power the cheapest on earth for all purposes.

Particulary adapted for lighting and heating factories, shops, stores and homes and wherever light, heat or power is required.

Power practically without cost after initial installation.

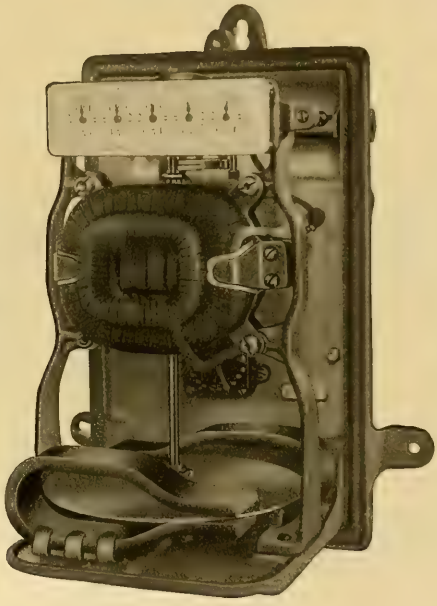
JOHN A. HENSEL & CO.

Factory and Offices, 11 and 13 Eldredge Court, Near Michigan Ave. **CHICAGO, ILL.**

AHEAD AGAIN

Latest Duncan Watthour Meter
Brand New Type—Just Out
Extremely High Torque AND Great Accuracy

2½ to 6,000 Amperes

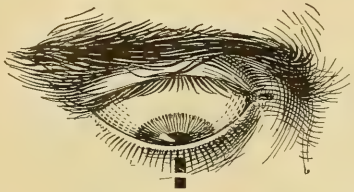


50 to 600 Volts

GUARANTEED TO MEET THE MOST EXACTING CONDITIONS

DUNCAN ELECTRIC MFG. CO.

LAFAYETTE, INDIANA, U. S. A.



2 Reasons

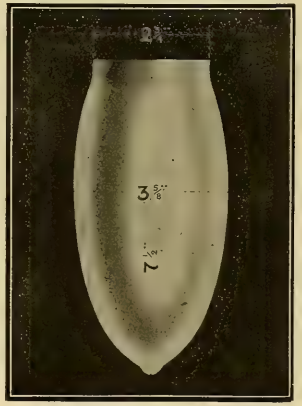
One for each of your eyes why you should use

THIS BRANDS FOR QUALITY
NOBLAC

Inner Globes

NOBLAC Inner Globes have edges ground absolutely true.

For you this means: No cracked globes—it means long lived carbons, too—because air cannot enter the globes and consume the carbons.



NOBLAC Inner Globes cannot soften.

For you this means: Carbon soot will not stick to the glass because the glass isn't soft. Others claim their glass is just the same as Noblac but the claim does not make them so.

We are looking for your inquiry—right now. : : Drop us a line to-day for our special proposition.

THIS STANDS FOR QUALITY
FOSTORIA Glass Specialty Co.

MIXERS of GLASS and SCIENCE

THIS STANDS FOR QUALITY
FOSTORIA, OHIO

PHŒNIX QUALITY

8992

PHŒNIX GLOBES POSSESS ALL THE POINTS OF MERIT NECESSARY IN THEIR USE. WE SPEND INFINITE CARE IN THE DESIGNING AND MAKING OF THESE GLOBES AND GUARANTEE THEM TO BE OF THE HIGHEST STANDARD OF EXCELLENCE AND SUPERIORITY.

8676½

INNER GLOBES

LICENSED UNDER PATENT 745,677

YEARS OF EXPERIENCE, CAREFUL AND INTELLIGENT ATTENTION TO EVERY DETAIL IN THEIR MANUFACTURE HAS RESULTED IN OUR PRODUCING

INNER AND OUTER GLOBES

FOR ALL ENCLOSED ARC SYSTEMS THAT ARE PERFECT IN EVERY RESPECT.

9321½

9319½

CATALOGUES SENT ON REQUEST.

SEND FOR CATALOGUE NO. 16, ILLUSTRATING NEW DESIGNS IN ELECTRIC INCANDESCENT GLOBES AND SHADES.

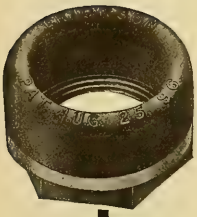
9113½

9188½

THE PHŒNIX GLASS COMPANY

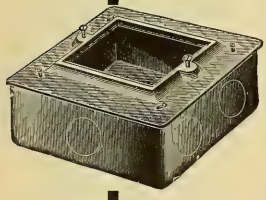
NEW YORK PITTSBURG CHICAGO

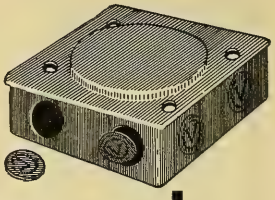
Always Specify Bossert Boxes



FIRST: Because they assure perfect protection. When the steel plug is removed, a clean round hole is left the exact size of the conduit or pipe. A heavy coating of insulating enamel covers the entire box inside and out. Settling of buildings that would break a cast-iron box will only bend a Bossert Drawn Steel Box.

SECOND: They are the most economical. They are provided with hermetically sealed plugs which are removed with one sharp blow of a hammer. The remaining hole is clean-cut and perfectly round. No time lost filing and reaming. The fact that the boxes are made of drawn steel entirely eliminates the loss from breakage, and the steel plugs reduce the time element to a minimum. For the many other points of superiority, write for booklet.





See our exhibit at First Annual Electrical Show at Coliseum, Chicago, January 15 to 27, 1906.

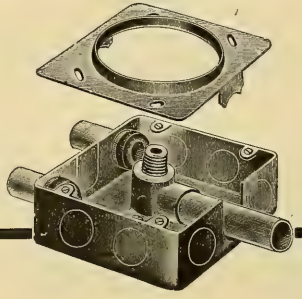
Bossert Electric Construction Co.

OFFICE AND WORKS, UTICA, N. Y.

SALES AGENTS:

R. B. COREY
Havemeyer Building
New York City

F. B. SMITH
170 Summer Street
Boston Mass.



W. P. CROCKETT
165 S. Canal Street
Chicago, Ill.

JOHN R. COLE
856 Mission Street
San Francisco, Cal.

C. W. BONGARD
130 Bay Street
Toronto, Can.

ELECTRICAL SHOW

CHICAGO COLISEUM

Formal Opening Monday, Jan. 15, at 8 p. m.

Daily, Except Sunday, Until Jan. 27, 10 a. m. to 11 p. m.

BEN FRANKLIN DAY, Wed., Jan. 17, Souvenirs for all Visitors

Northwestern Electrical Association Day, Thursday, Jan. 18

American Electrical Salesmen's Ass'n Day, Saturday, Jan. 20

TELEPHONE DAYS, JAN. 22, 23 and 24

WEIL'S ST. LOUIS BAND
(OFFICIAL WORLD'S FAIR BAND)
Every Afternoon and Evening

ADMISSION 50 CENTS
CHILDREN 25 CENTS

Chicago Electrical Show Numbers

Issues of January 13th, 20th and 27th

The coming electrical show to be held in the Coliseum, Chicago, from January 15th to 27th, gives every promise of being a big success.

The issues of January 13th and 20th of the Western Electrician will be distributed at the show; the issue of the 27th will contain a full account of the show, illustrations of exhibits, etc.

A large advertising announcement in these numbers will make your product better known to the thousands of possible users in the Central and Western states.

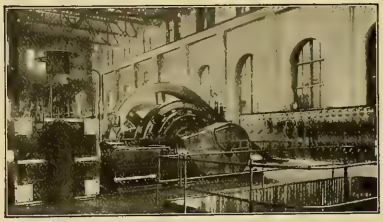
No other electrical paper gives the Western electrical fraternity a news service of any real value.

Send in your copy by January 10th for the first Electrical Show Number.

Western Electrician

510 Marquette Building, Chicago

Generators for Isolated Plants



400 K. W. Generator in Power Plant G. H. Hammond Packing Company's Chicago Establishment

The installation of an Isolated Electric Generating plant for Lighting purposes, should head your list of 1906 improvements.

Write for list of prominent users of Crocker-Wheeler Motors and Generators in and near Chicago.

CROCKER-WHEELER COMPANY

AMPERE, N. J.

CHICAGO OFFICE, - - - - OLD COLONY BLDG.

WAGNER ELECTRIC MANUFACTURING CO.

ROUND TYPE INDICATING METERS

These instruments are constructed on the D'Arsonval principle; the moving parts are light, yet of sufficient strength for the work they have to perform. These instruments have full jewelled bearings, and are absolutely dead beat, being electrically damped.

We commend these instruments to your attention and recommend them for use where a round pattern instrument is desired, as being the equal of or superior to any instrument of similar type on the market. They follow the general excellence in design and workmanship shown by all Wagner product.

Following our general policy of meeting our customers in a broad gauged and liberal spirit, we have drawn up a new guarantee on our instruments, which is unique in its liberality. If you are at all interested we should be pleased to send you copy of this guarantee.

Write for Bulletin No. 67-H

Main Office and factory: ST. LOUIS, MO.

SALES OFFICES:

ATLANTA, GA., 1422 Empire Bldg.
BOSTON, MASS., 110 State St.
CHICAGO, Ill., 1625 Marquette Bldg.
CINCINNATI, O., 1002 Young Men's Mer. Lib. Bldg.
CLEVELAND, O., 803 New England Bldg.
DALLAS, TEX., Duncan-Hobson Elec. Co.
DENVER, COLO., Gilbert-Wilkes & Co.
NEW YORK, N. Y. Whitehall Bldg.
NEW ORLEANS, LA., Spranley & Reed.
PHILADELPHIA, Pa , Real Estate Trust Bldg.
PITTSBURG, PA., 1713 Farmers' Bank Bldg.
PORTLAND, ORE., 301 McKay Bldg.
SAN FRANCISCO, CAL., 417 Rialto Bldg.

Electric Heating Appliances

WATER HEATER
No. 5205. Capacity 1 pint
Price $6.50
No. 5215. Capacity 1 quart
Price $9.00

Will boil water in three minutes. When equipped with bottle, is an ideal nursery milk warmer. May be attached to any lamp socket.

PRESSING IRONS

No. 103, 14 lbs. Price $11.50
No. 104, 16 lbs. Price $12.00
No. 106, 20 lbs. Price $13.00
Most popular size

No. 107, 20 lbs., Price $14.00
Manufacturers Iron.

Advantages of these irons too numerous to mention.

DISC STOVE
No. 3220. Diameter 5 inches
Price $6.50
No. 3230. Diameter 6 inches
Price $5.50

Used for heating or cooking anything contained in flat bottom vessels. May be attached to any lamp socket.

We make everything in the Electrical Heating Line
HIGHEST AWARDS AT THE WORLD'S FAIR, ST. LOUIS
Oldest and Largest Exclusive Makers in the World

For Full Information, Particulars, Etc., Address

AMERICAN ELECTRICAL HEATER CO.

Main Office and Factory, DETROIT, MICH. Eastern Dept., 7-9 Warren St., New York, N.Y.

KEARNEY CABLE CLAMP

(PATENTED)

IT IS EASY TO TURN CORNERS OR TO DEAD-END CABLES with KEARNEY CLAMPS.

It is not easy to do these things by splicing or serving, especially when it is cold and cables are loaded with sleet

Write us for prices.

W. N. MATTHEWS & BRO.

203 N. 2nd Street ST. LOUIS

NOW IS THE TIME

when the SIMPLEX ELECTRIC CHAFING DISH is extremely popular for serving tempting delicacies. After serving, the upper part may be removed and the electric heater used for percolating the coffee or toasting. Safer, cleaner and less expensive than with alcohol or other methods. It connects to any incandescent lamp socket and operates quickly by the turn of a switch.

"SIMPLEX QUALITY"

Sizes and styles to suit requirements. Write for Illustrated Catalog and Price List R, "Electric Heating."

SIMPLEX ELECTRIC HEATING CO.

Chicago Office: MONADNOCK BLOCK. CAMBRIDGEPORT, MASS.

No. 1205. List Price, $16.00

A NEW CATALOGUE

OF THE LATEST ELECTRICAL MATERIAL IS YOURS FOR THE ASKING

Contains

630 pages of new—up-to-date—dependable electrical supplies. Drop us a letter written on your letterhead and we will send it express prepaid.

Our trade mark signifies a square deal

We send it to the trade on application only, because our book must not be found in the hands of schoolboys or others not rightfully entitled to it.

Our business in the last year has grown beyond expectations
Let us show you the reason for this

HONESTY --- FAIRNESS --- GOOD MATERIAL --- CORRECT PRICES

WE SOLICIT YOUR CORRESPONDENCE

American Electrical Supply Company

83-85-87 Fifth Avenue CHICAGO

NOTICE

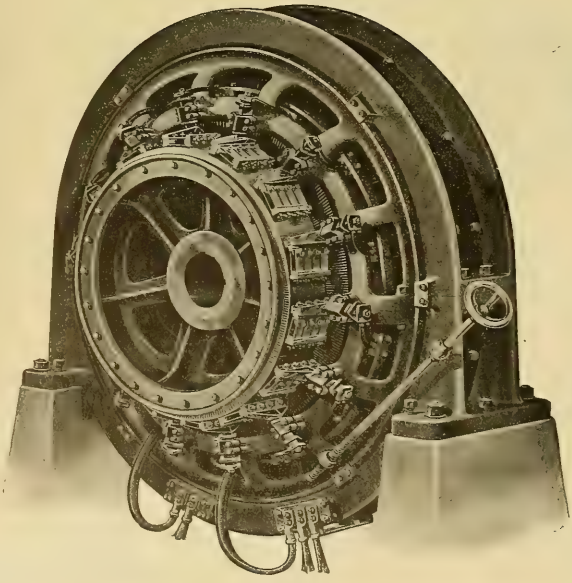
One of our competitors has recently informed the trade that our Single Phase Self Starting Motor is an infringement of patents owned by them, and threaten to sue anyone continuing the sale or use of a "Century Motor."

Some of the personnel of this company have been actively engaged in the design and construction of Single Phase Motors for many years, and the officers of this Company are thoroughly posted on the Single Phase Motor Patent Situation, and we know our rights and are thoroughly prepared to defend them and to defend any suits which may be brought against our customers for the sale or use of "Century" Motors.

CENTURY ELECTRIC COMPANY

404 N. Fourth Street, ST. LOUIS, MO.

Direct-Current Generators



FOR

Light and Power

The design and construction of these generators fulfill the most modern requirements. They have a high efficiency and great endurance under severe conditions of service. Sizes up to 1,000 K. W. Write for Bulletin No. 10514.

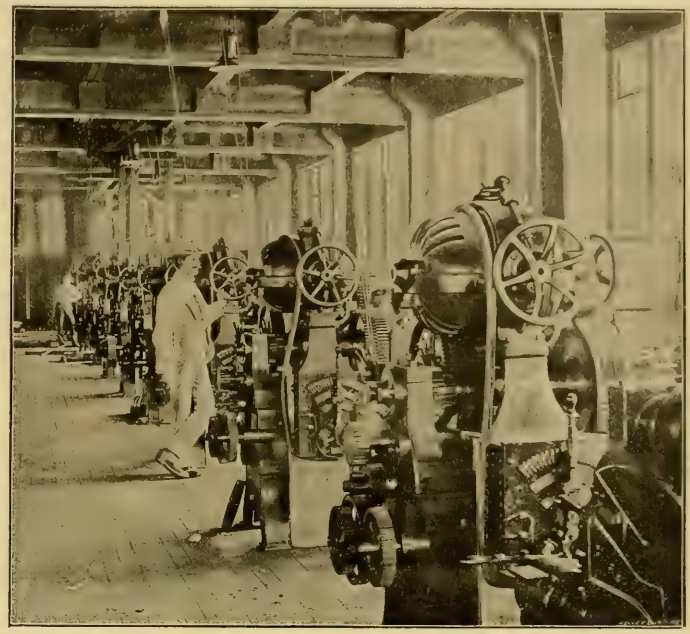
SPRAGUE

ELECTRIC COMPANY

General Offices:

527 West 34th Street, NEW YORK Chicago Office: Fisher Building

STOW
MULTI-SPEED MOTOR



IF YOU NEED

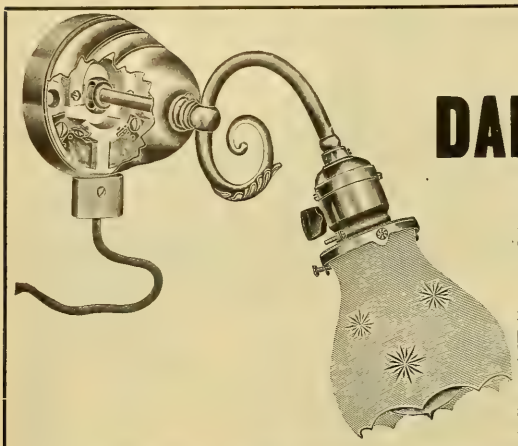
VARIABLE SPEED MOTORS
IN YOUR BUSINESS

Why isn't it better to get those that will give you EVERY conceivable speed between WIDE LIMITS, rather than a few changes of speed between NARROW LIMITS?

THE STOW MULTI-SPEED MOTOR
DOES IT

No motor on the market can compare with these in simplicity of construction—no rheostat being used—no motor gives the combination of wide speed range and infinite variety that this does. High efficiency at all speeds—speed constant at all loads are among the many characteristics that specially fit it for driving machine tools, printing presses or any other purpose where a close adjustment of speed is desirable. Let us send you our descriptive bulletin. We build these motors for direct current only.

STOW MFG. CO.,
BINGHAMTON, N.Y.



Something New for 1906

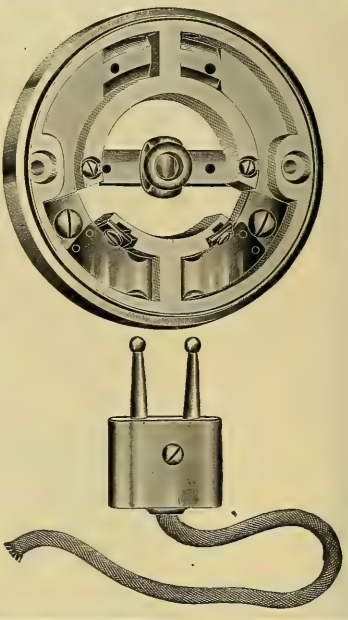
DALE'S CONNECTTOME

PERMITS connection of portable lamp, fan motor or curling iron.

CAN be fastened to the wall or outlet box and is neat in appearance.

BECOMES part of the fixture when installed.

DOES away with the necessity of splicing, soldering and taping of wires.



ABOLISHES the use of a flush receptacle and enables you to get a connection from a point neatly concealed.

For straight electric or combination brackets. Made for single or double connections. Furnished in any finish.

For Single Connection, List $2.25
For Double Connection, " 3.30
Plug Only, " .80

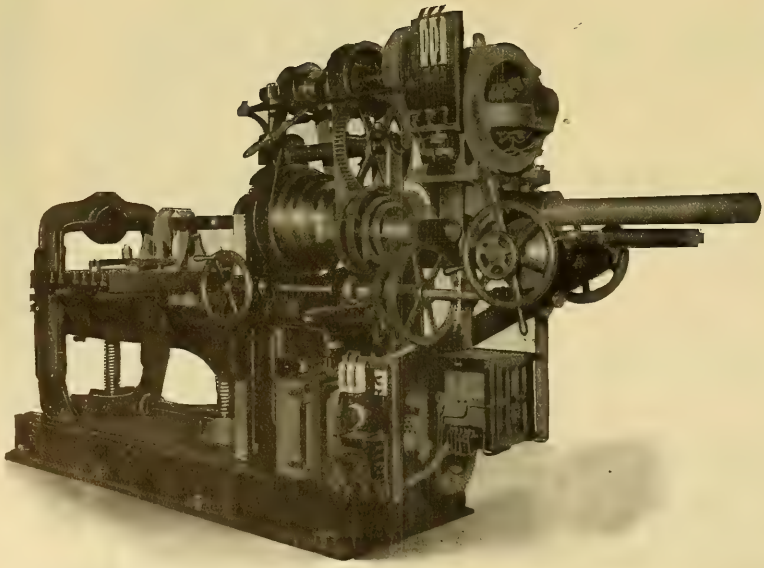
WRITE FOR DISCOUNT

THE DALE COMPANY

Ninth Avenue, Thirteenth and Hudson Streets, New York

CHICAGO OFFICE: Chamber of Commerce Bldg., Chicago, Ill.

WESTERN ELECTRIC MOTORS FOR DIRECT CONNECTION



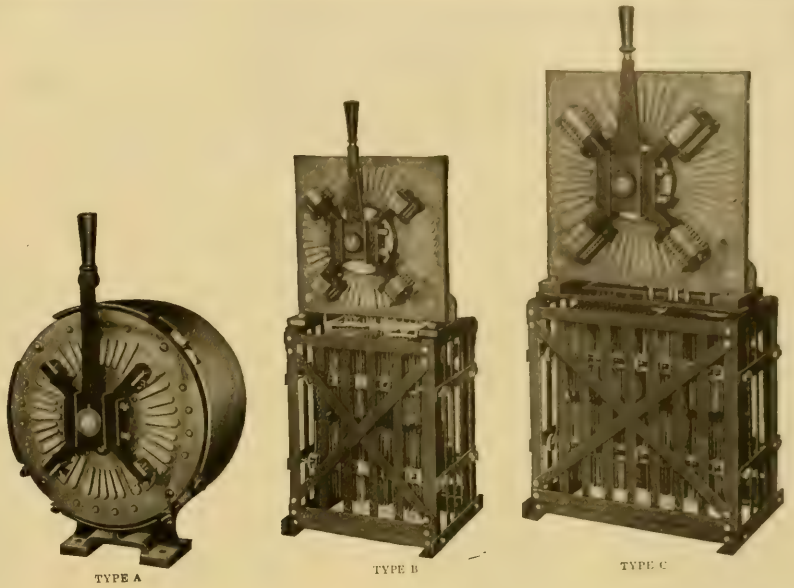
Convenience, High Efficiency and Flexibility

are the leading features.

Write for Bulletins

WESTERN ELECTRIC COMPANY

CHICAGO NEW YORK



TYPE A TYPE B TYPE C

A Simple and Serviceable Crane Controller

In the design of this controller, we have reduced destructive arcing to a minimum by providing a blowout which protects the four points at which the circuit is broken.

This blowout consists of a coil embracing and surrounding the controller shaft and can readily be seen in above cuts.

To further reduce arcing, the segments are arranged in a series of four, which divides the voltage on each segment by that number.

All parts possible are made with jigs and dies, insuring ease of renewal and positive interchangeability.

In type A the resistance units are attached to the front and can be removed from the case by taking out four screws. In types B and C connections are made on back of the slate and are easily accessible. In all types renewals can be made on the front without disturbing the connections on the back.

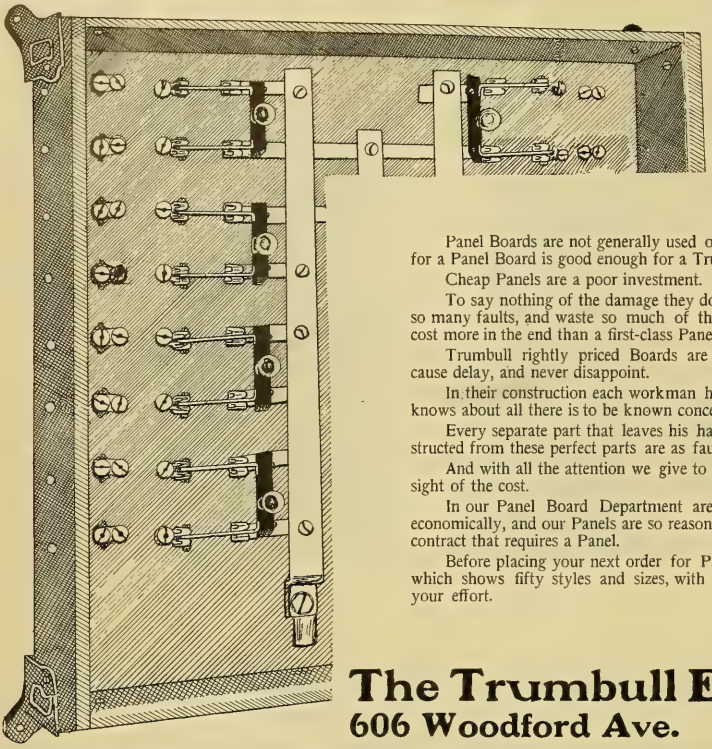
Send for bulletin 59 which describes this controller in detail.

Our catalog lists controllers for every standard purpose. We design and build special apparatus when the requirements demand same. A corps of engineers specially trained in this branch of the art is at your service.

The Cutler-Hammer Mfg. Co.

Milwaukee

New York Boston Chicago Pittsburg



Correct Panels At Correct Prices

Panel Boards are not generally used on cheap jobs, and any contract that calls for a Panel Board is good enough for a Trumbull Panel.

Cheap Panels are a poor investment.

To say nothing of the damage they do to a contractor's reputation, they develop so many faults, and waste so much of the wiremen's time in installing, that they cost more in the end than a first-class Panel.

Trumbull rightly priced Boards are the most profitable to buy—they never cause delay, and never disappoint.

In their construction each workman has but one operation to perform, and he knows about all there is to be known concerning his particular work.

Every separate part that leaves his hands is perfect, and the Panel Boards constructed from these perfect parts are as faultless as brains and skill can make them.

And with all the attention we give to producing the best Panels, we never lose sight of the cost.

In our Panel Board Department are the best appliances for producing work economically, and our Panels are so reasonable in price that they can be used on any contract that requires a Panel.

Before placing your next order for Panel Boards, send for our No. 5 catalog, which shows fifty styles and sizes, with prices—you will be amply rewarded for your effort.

The Trumbull Electric Mfg. Co.
606 Woodford Ave. Plainville, Conn.

RELIEF

The

"EUREKA" NON-TRUST LAMPS

Are the Finest Lamps in the World

Have you received our non-trust proposition?
Do you know that we have organized a $100,000 Pennsylvania Corporation?
Do you know that we have a great, modern, well conducted Lamp Factory?
Do you know that we protect you against patent litigation?
Do you know that we have broken the "corner" in the Lamp Market?
If you buy Lamps, don't you want to be informed on the situation?

THEN WRITE

LOOK FOR THE PATENT PROTECTION LABEL IN THE STEM

ST. MARYS INCANDESCENT LAMP CO.

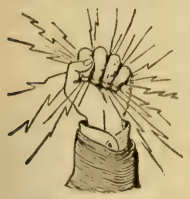
WM. M. ROTHSCHILD
President

:: St. Marys, Pa.

LOOK FOR THE PATENT PROTECTION LABEL IN THE STEM

FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,



PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND
ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO OFFICE, F. E. Donohoe, 135 Adams St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

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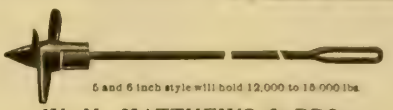
Yours truly, THE NORTHFIELD TELEPHONE COMPANY,
H. D. [illegible], Superintendent.



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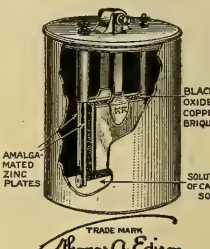

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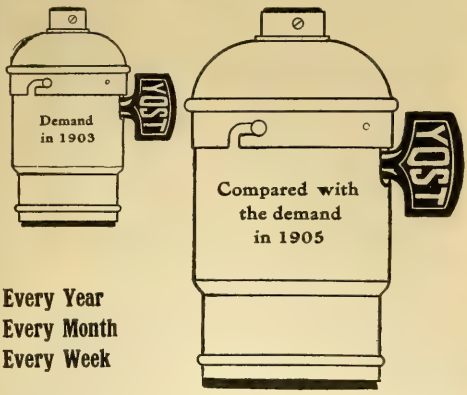

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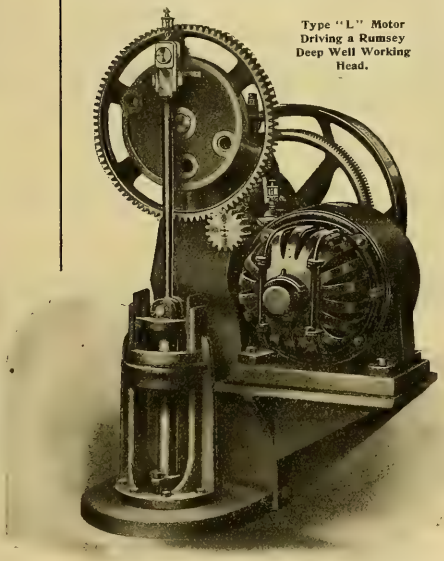

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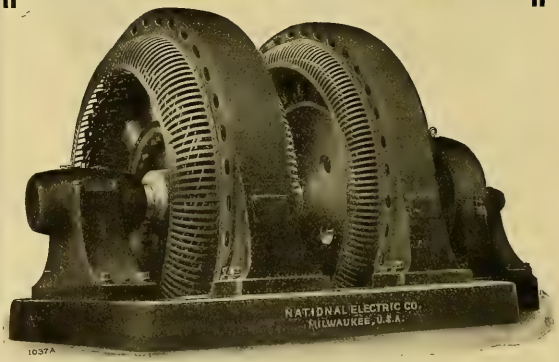

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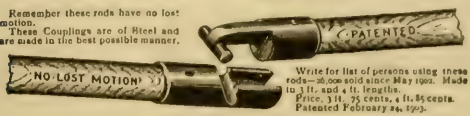

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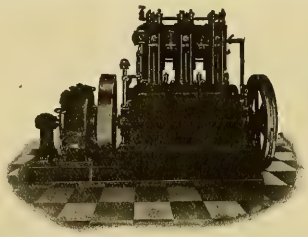

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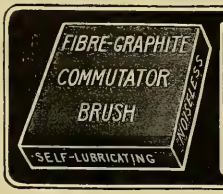

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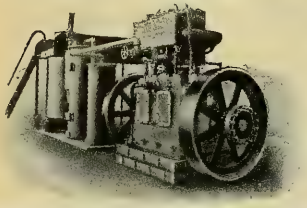

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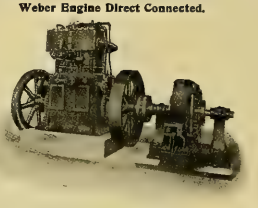

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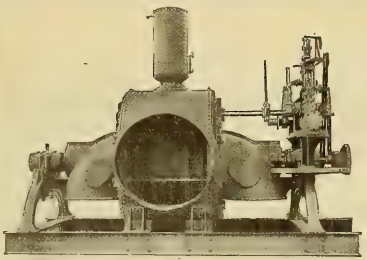

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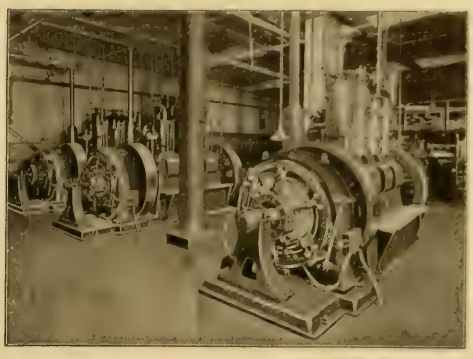

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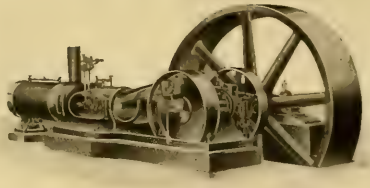

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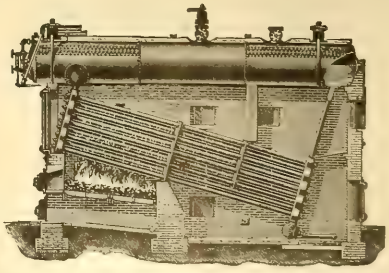

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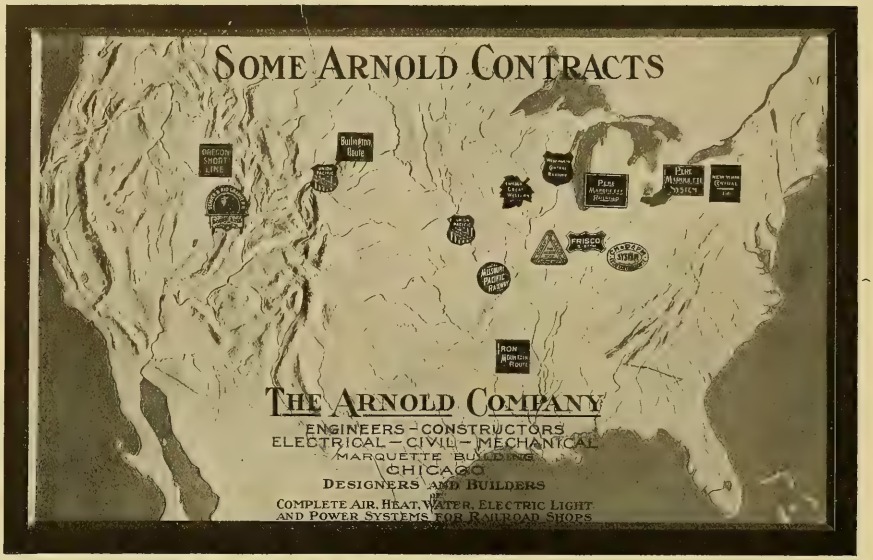

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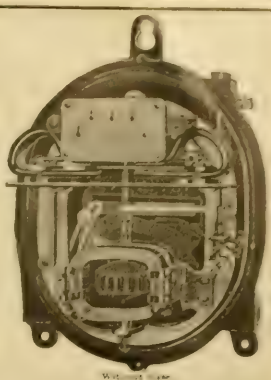

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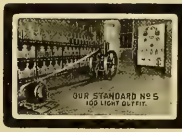

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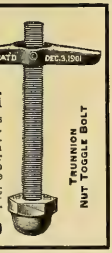

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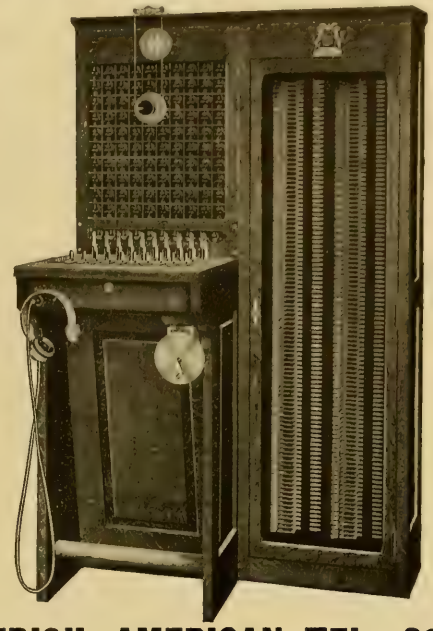

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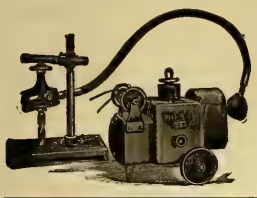

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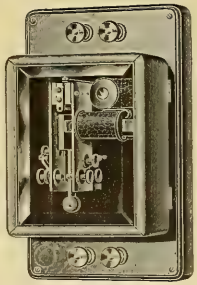

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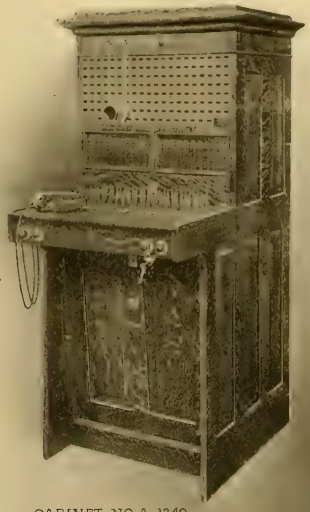

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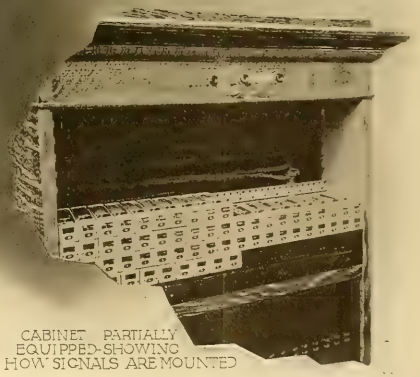

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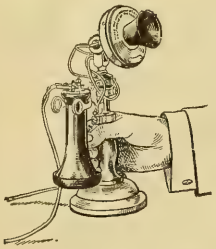

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Don't stint your facilities for telephone service. It is the last thing you ought to lessen. Your business needs a certain amount of service, and it is suicidal not to have it.

Make sure to-day that you have *enough*, and that the line isn't busy and drives people elsewhere when they want to call you up. Your private exchange may need more trunk lines, you may need a special, or an individual, or a two-party line instead of what you have.

If you have no extension service you may need that; or if you have, your business may need a private exchange. Right telephone service is a first item of business economy. Remember that.

Call up the subscribers' agent of your exchange and let him go over the situation with you. His expert knowledge is yours to use.

THE TEL

At Home

Since the City Council is considering the local telephone situation it becomes a matter of general interest to know what the actual telephone condition are in the other great cities of the world. Chicago has grown so rapidly that she might very well claim special leniency in such a comparison; but she has never shown any tendency to ask favors on account of her relatively premature development, and is not likely to begin now. On the contrary, Chicago has a right to boast of her telephone development. She has to-day ten times as many telephones as she had ten years ago. The population of the city has increased 25%, but the number of telephone stations has increased 1,000%, from 14,000 stations in the whole field of the Chicago Telephone Company in 1895 to the present number of 143,000. About 105,000 of these are in the Chicago Exchange system and 38,000 in the suburbs and adjoining counties. During the year 1905 the total gain in stations was 25,000—18,000 in the city and 7,000 in the surrounding area.

Such figures as these come as a surprise to the old world cities. You often hear the expression: They do these things so much better in Europe, as applied to many things, that it is a relief to find at least one thing that we do better than they. Imaginative writers would have you believe that every humble cottage over there has its telephone. How far this is removed from plain fact one discovers to his chagrin when he tries to find a telephone in any country district in England, for example. You have to look a long while for one in London. In that city they have only one-fourth as many instruments relatively as we have in Chicago. Taking all the leading European cities the figures are as follows:

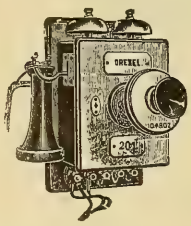
City.	Population.	Telephones.	Per 1,000 pop.
London	6,580,000	93,598	14.2
Paris	2,660,000	49,444	18.5
Berlin	1,931,000	66,744	34.5
Vienna	1,762,000	21,723	12.1
Chicago	2,000,000	110,000	55.

Perhaps some one suggests Sweden, for that country's telephone business has been exploited until it has become almost an article of faith to believe that telephones there are as thick as bones in a shad. It is rather disconcerting, then, to compare two very similar areas, embracing both city and country, Sweden and Northern Illinois about Chicago. The latter region, with only one-half the number of people has 33,000 more telephones than the whole of Sweden. With a population of five million Sweden has only 110,000 telephones, while the field of the Chicago company with about two and a half million people has 143,000.

But the telephone service itself is the thing that interests us all a good deal more than any figures. Speaking of European service generally one thing is true, that the greater the government supervision the less the efficiency and the popularity of the telephone. In London, where the telephone system managed by the general postoffice, as a department of the government, has been in competition with a private company licensed by the government, the telephone has become almost useless for business purposes on account of poor equipment. An agreement has at last been reached by which the two systems will become one and receive the much-needed improvements during the next five years. For years the network of overhead wires was bewildering, yet the various vestries would not agree on any plan of putting them underground and although some progress has been made there is still the most embarrassing confusion prevalent. Royal commissions have been sitting on the telephone ever since 1892, but they have done very little to improve matters. On the contrary new difficulties constantly develop, as for example the discontent among their own employes. Their technical workmen receive only $7.00 per week and they think they ought to get $10.00. What would American electrical workers think of that? All the way down the line wages average less than half what is paid in Chicago.

Perhaps, since Glasgow has been much in the public eye of late, a sidelight on Mr. Dalrymple's town may be interesting. An American visiting in Glasgow asked permission to use his friend's telephone in order to make a business appointment with a gentleman in Edinburgh. "Certainly you may use it," the friend answered, "if you have the time. But if you're in a hurry, you'd better take the train. It is only an hour's run and it will surely take you longer than that to get a telephone call through." It is a fact that toll and long-distance calls have to wait, standing in line as it were, until they can be accommodated.

The Englishman, however, congratulates himself whenever he thinks of his neighbor to the south. Crossing the channel to Paris he finds things still worse. In fact they are so bad that a society of telephone subscribers has been organized and holds regular meetings for the purpose of maintaining a boycott on the government system and so forcing the Chamber to improve the service. Subscribers in Paris buy their own instruments. Two men may have transmitters of an entirely different character and so be unable to talk to each other. Mr. Herbert Laws Webb sums up the whole situation there when he says, in an official report, that the central office and the subscribers' stations are all equipped with antiquated and inefficient types of instruments with which it is impossible to give satisfactory service. After the subscriber has bought his instruments and batteries and paid for part of the line from the central office he must also pay the government a fee greater than the average amount paid by the telephone subscriber in Chicago. In Paris they pay their electrical workmen a few cents more than in London, their central offices are located in government



Chicago Telep

203 Washi

EPHONE

nd Abroad

buildings for which no rent is paid, and they have every other advantage that a government monopoly can enjoy, and yet the service is so poor and the rates relatively so high that indignation meetings are held almost every week and American visitors to the gay capital come away with an object lesson that they are not likely to forget on how not to conduct a great public utility.

They will tell you in London and Paris that next to the American telephone systems Berlin is the best. And truly Berlin has reason to be proud of her service. Honest and intelligent efforts are being made to bring the plant up to a high level. Yet when the Chicago visitor goes to Berlin he realizes the difference between the conception of the telephone with which he is familiar, as a business necessity and a popular democratic servant, and the ponderous and exclusive ideals of the Imperial Telephone Department. The subscriber is made to feel there as though he were serving the system instead of the system serving him. He cannot send a call at night except on payment of an extra fee; he must do his own hand-ringing and his own calling from exchange to exchange. He talks into receivers, two of them, one at each ear, that look like soup plates and he gets, incidentally, a good deal of lung exercise out of a telephone conversation. The Berlin city system covers only 22 square miles just about one-fourth of the area of the Chicago City Exchange System alone. Telephone operators in Berlin receive about one-fifth of the amount they are paid here and all wages run from that up to one-third of the Chicago scale. Yet the Berlin subscribers do not seem to get the benefit of this cheaper labor, for the man with the lowest message service has to agree to pay $28.80 a year, which includes 400 calls, while the suburban subscribers pay just about twice what the same class must pay around Chicago.

Coming to the consideration of the telephone situation in the great cities on this side the water the facts and figures show less contrast. A comparison with New York, the only serious rival of Chicago, is aided by the fact that an impartial investigation has recently been made there and that accurate figures are easily obtainable. Representative citizens on one side and the Telephone Company on the other got together and carefully worked down to bed-rock on the problems of rates and service. The first result was a better understanding by the public of all that is involved in telephone operation, and this was followed by the arrival at an agreement on a fair basis for rates, with, later, the establishment of rates and terms of service that at once met with the cordial approbation of the public.

This simple plan of careful, impartial consideration has helped the people to realize, for one thing, that in order to maintain the service at its highest efficiency, and to preserve the already established superiority of the American teleph ne systems over European service it is necessary that companies shall make exceedingly heavy investments in specially designed buildings, in switchboards and other apparatus, often costing many times the value of the splendid buildings in which it is housed—in conduits and trunking systems and in the employment of vast armies of people both in the actual conduct of the business and in the maintenance of its mechanism. The one item of the cost of erecting substantial, creditable buildings of a special type, of fireproof construction and located expressly for the conduct of business in certain areas means, in itself, a greater expense than the average man supposes to be involved in the whole business. Then the equipment in these buildings includes highly expensive and specially designed electrical appliances, amongst them switchboards costing perhaps $300,000, and all subject to becoming obsolete at any day, owing to constant improvements, and therefore involving the immense cost of replacement.

When the committee completed its report it agreed upon a very simple and satisfactory basis for the establishment of rates, that was that the rate of charge in a specific city must be determined by the fair cost of service in that city, and that the fair cost of service should include necessary investment made in the whole plant and all operating outlays necessary to the highest efficiency of service, with a fair contingency allowance for exigencies. These are conditions that any business man will recognize as right and necessary as applied to any business; they take into consideration the necessity of constant outlay in keeping up the standards of equipment and service and in meeting the developing public needs; they are based on the wise determination not to allow a public utility like the telephone service to deteriorate or become less useful, as has been the case in the European cities.

The telephone having become indispensable to the life of the city, both business and social, the people must be given the advantage of just and equitable rates. If it should prove that in any case, through the abnormally rapid development both numerically and territorially there are cases needing adjustment, the method pursued in New York of deliberate, impartial investigation, would promise the most satisfactory settlement. And at the same time the greatest wisdom would be exercised to see that the high standard of efficiency of service should not be lowered, that the people should be protected in the enjoyment of the very best telephone service in the world and that the company should be permitted to continue to meet the demands of the development of business and to offer to the people every facility, convenience and advantage afforded by new inventions and improvements. That Chicago has one of the most perfect and highly efficient telephone systems in the world no one can doubt. It has led many other cities in improvements, in operation and in adaptation to popular needs. Examples of this are seen in the introduction of electric lamps for signaling, in the elaborate arrangements for police and fire-alarm calls, in the country weather service and the time service and in the rapid development and the flexible adaptation of the measured service and the popular "nickel" plans, by which the telephone user pays for just what he uses. The high standard in Chicago makes its deepest impression on the citizen when he contrasts it with conditions abroad and leads him to hope that nothing will ever happen to permit the present conditions to deteriorate to the level found abroad.

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4	.2	.2
4	.2	.4
5	.2	.15
6	.2	.15
10	.2	.1
12	.2	.1
14	.2	.1
16	.2	.1
20	.3	.1
24	.3	.075
30	.3	.085
40	.5	.085
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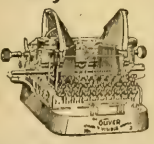

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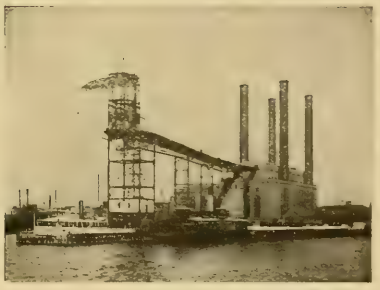

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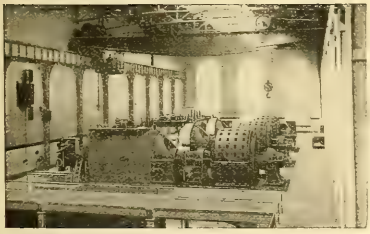

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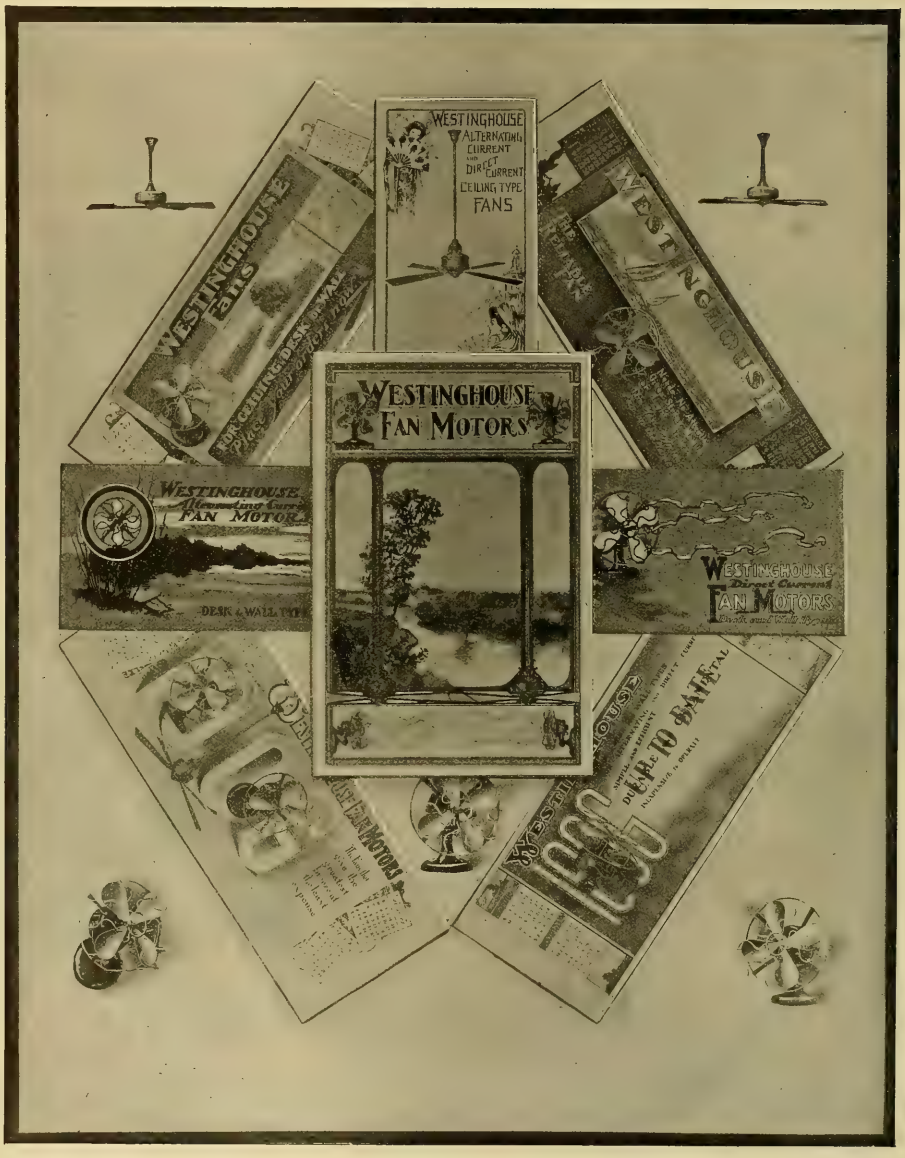

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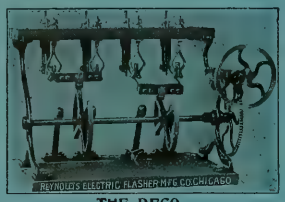

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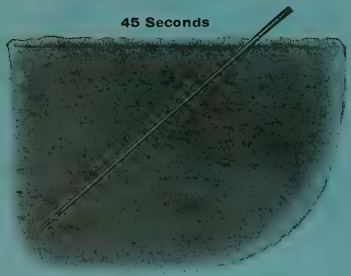

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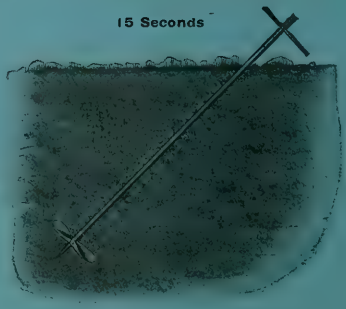

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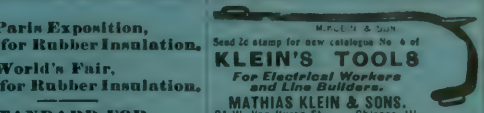

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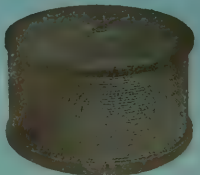

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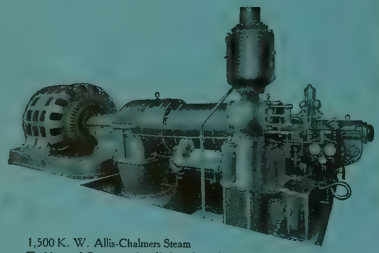

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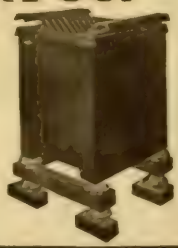

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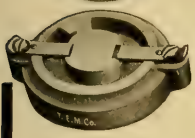

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 28
Advertising Mirrorgraph Co. 10
Alton Machine Co. 4
Allis-Chalmers Company 2
American Battery Co. 16
Amer. Circular Loom Co. 1
American Conduit Co. 19
Amer. District Steam Co. 25
Amer. Elect'l. Supply Co. 22
Amer. El. Telephone Co. 23
American Electrical Works .. 15
Arnold Co., The 20
Automatic Electric Co. 22

Babcock & Wilcox Co. ..... —
Badt, F. B. 9, 20
Bain, Forée & May 15
Baker & Co., Inc. 3
Baker & Co., W. E. 20
Beardslee Chandelier Mfg. Co. —
Belden Mfg. Co. ..... —
Benton & Son 13
Berthold & Jennings 24
Bissell Co., The F. 4
Bossert Electric Construction Co. 16
Bracey-Forse Elec. Cons. Co. 22
Brooks, Hall L. 25
Buckeye Electric Co. ..... —
Buckeye Engine Co. 19
Bull Dog Specialty Co., The 16
Bullock Elec. Mfg. Co. 2
Bylleshy & Co., H. M. 20

Carhartt & Co., Hamilton .... —
Central Electric Co. 5
Century Electric Co. 18
Chicago Edison Co. 4, 16
Chic. Fuse Wire & Mfg. Co. .. 15
Chicago Mica Co. 14
Chicago Pneumatic Tool Co. .. 19
Colonial Sign & Insulator Co. 3
Columbia Incand. Lamp Co. —
Cope, T. J. 1
Copley-Senior Carbon Co. 1
Cornell, T. S. 20
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 12
Crollius & Son, E. R. ..... —
Cutler-Hammer Mfg. Co. 10
Cutter Elec. & Mfg. Company 1

D. & T. Anchor Co. ..... —
D. & W. Fuse Company ..... —
Dearborn Drug & Chem. Wks. 19
Diamond Meter Company 28
Directory of Engineers 20
Dixon Crucible Co., Joseph .. 19
Duncan Elec. Mfg. Co. 27

Edison Decorative & Miniature Lamp Departm't. 14
Edison Mfg. Company ..... —
Electric Appliance Co. 14
Electric Storage Battery Co.. 3
Electro-Dynamic Co. 7
Electrician Pub. Company ... 20
Erie R. R. 25

"For Sale" Advertisements .. 16
Ft. Wayne Elec. Works, Inc. .. 27
Fowler & Co., John H. ..... —
Fres-Ko Chemical Co. 22
Frink, I. P. 10

Galloway Co., J. B. 25
General Electric Co. 13, 14
General Elec. Securities Co. .. 20
General Storage Battery Co.. 14
Gest, G. M. 10
Gould Storage Battery Co. 6
Gregory Electric Co. 16, 17

Haller Machine Co. 13
Hart Mfg. Co. 16
Hartford Steam Boiler Inspection & Insurance Co. .... —
Hazard Manufacturing Co. .... —
Hensel & Co., John A. 8
Highland Park College. ... 20
Hoffman, G. W. 8
Holmes Fibre-Graph. Co. ..... —
Holophane Glass Co. 9
Humphrey, Henry H. 20
Hunt & Co., Robt. W. 20

Illinois Central Ry. 25
Incandescent Electric Light Manipulator Company ..... —
Indiana Rub. & Ins. W. Co. 1
India Rubber & Gutta Percha Insulating Company ..... —
International Elec. Meter Co. 10
International Tel. Mfg. Co. ... 23

Jackson, D. C. & W. B. 20
Jeffrey Manufacturing Co. 19
Johns-Manville Co., H. W. 4

Kartavert Manufacturing Co. —
Kellogg Switchboard & Supply Company 23, 24
Klein & Sons, Mathias 1
Kohler Brothers 20
Kuhlemeyer, John 15
Kuhlman Electric Co. 15

La Fayette Elect'l Mfg. Co. .—
Lake Shore R. R. 24
Leather Preserv. M. Corp. .... —
Lee Co., C. W. 11
Leffel & Co., James 19
Lindsley-Bauman Co. 25
Loud's Sons Co., H. M. 25

Machado & Roller ..... —
Maine Hub Mfg. Co. 24
Manhattan El. Supply Co. 16
Marinette Gas Engine Co. 19
Matthews & Bros., W. N. .. 3, 15
McCandless, H. W. & Co. 15
M'Glehan & Co., C. H. 9
McLennan & Company, K. 14
McLeod, Ward & Co. 13
McRoy Clay Works 10
Mica Insulator Company 14
Miscellaneous Advs. 16
Monarch Elec. Mfg. Co 4
Monon R. R. 16
Mueller Company, William .. 25
Munsell & Co., Eugene 14

National Battery Co. 8
National Carbon Co. 13
National Electric Co. 28
National India Rubber Co. ... 1
New Idea Soldering Paste Co. 16
New York Ins. Wire Co. 1
Northern Elect'l Mfg. Co. 16

Okonite Co., The 1
Oneida Community, Ltd. ..... —
Osburn Flex. Conduit Co. 10
Otto Gas Engine Works 19

Pacific Coast Pole Co. 24
Parsell & Weed ..... —
Patrick Co., R. M. 7
Peru Elec. Mfg. Co. 27
Phillips, Eugene F. 15
Phillips Insulated Wire Co. .. 15
Phœnix Glass Co. ..... —
Phosphor-Bronze S. Co. 19
Pignolet, L. M. 14
Pillsbury-Watkins Co. 24
Pittsburg & L. S. Iron Co. 25
Plume & Atwood Mfg. Co. .... —
Porter Cedar Company 25

Rail Joint Co., The 14
Reisinger, Hugo 7
Replogle Governor Works .... —
Reynolds El. Flasher Mfg. Co. 14
Robbins & Myers Co. 11
Robert Instrument Co., The .. —
Robertson & Sons, Jas. L. 16
Rock Island Battery Co 9
Roebling's Sons Co., J. A. 1
Roth Bros. & Co 18
Ruebel & Wells 20

Safety Ins. Wire & Cable Co .. 14
St. Marys Incan. Lamp Co. .... —
Samson Cordage Works 8
Sandwich Pole Changer Co. .... —
Sargent & Lundy 20
Schott, W. H. 20
Schureman Co., J. L. 14
S. E. Missouri Cypress Co. 25
Simplex Electrical Co., The .. 1
Simplex Elec. Heating Co. 15
Smith Storage Battery Co. .... —
Speer Carbon Co. ..... —
Spon & Chamberlain. ..... —
Standard Elect'l. Mfg. Co. .... —
Standard Underg. Cable Co. .... —
Stanley—G. I. Elec. Mfg. Co. —
Stanton, LeRoy W. ..... —
Star Expansion Bolt Co. 28
Sterling & Son, W. C. 25
Stevens & Co., Milo B. ..... —
Stow Mfg. Company ..... —
Stromberg-Carlson Tel. Mfg Company 22

Telephone Woodworking Co 23
Tornquist Elect'l. Mfg. Co. .... —
Torrey Cedar Company 24
Trumbull Elec. Mfg. Co. 3
Turner Brass Works 8

Underhill, Chas. R. 30
Universal Elec. Stor. Bat. Co. 8

Van Nostrand Co., D. 21
Vought-Berger Co. ..... —
Vulcanized Fibre Company .. 22

Wagner Electric Mfg. Co. 26
Wagor Mfg. Co., P. R. ..... —
Weber Gas & Gasoline Engine Co. 18
Wesco Supply Co. 14
Western Display Co. ..... —
Western Electric Company .. 12
Western Lumber & Pole Co. .. 25
Westinghouse Electric & Manufacturing Co. 26
Westinghouse Machine Co. .... —
Weston Electrical Inst. Co. .. 1
Willard Storage Bat. Co. 8
Willis, G. M. 20
Wilson, Co., Jas. L. M. 25
Worcester Company, C. H. 24
Wrigley Co., Thos. ..... —

Yost Electric Mfg. Co. 28

Zeller Geo. A. Book Co. ..... —

For Classified Index of Advertisements See Page 6.

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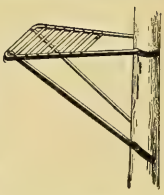

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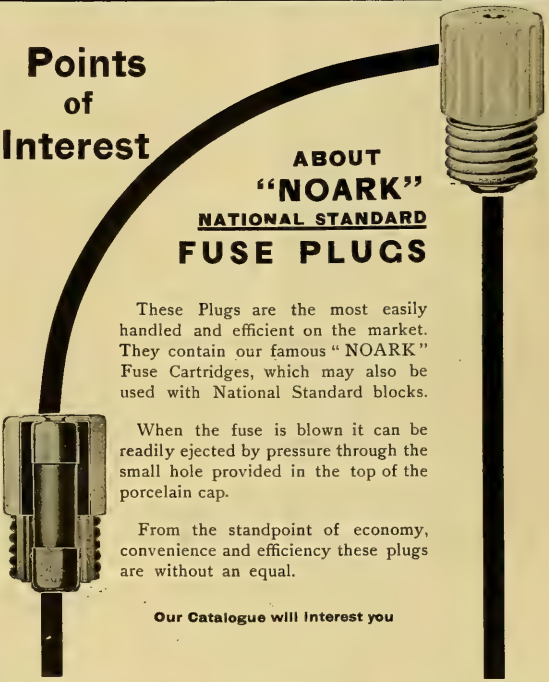

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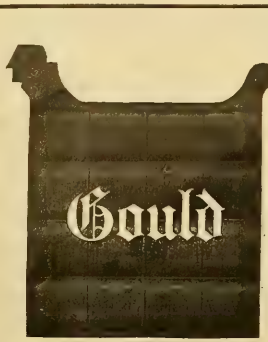

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WORKS: DEPEW, N. Y.

Bulletins.

CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjustors, Cord.
Incandes. El. Lt. Manip. Co.

Adjusters, Inc. Lamps.
Inc. El. Lt. Manipulator Co.

Advertising, Central Station.
Lee Co., C. W.

Anchors (Tel. & Tel.)
D. & T. Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works.

Boiler Compounds.
Dearborn Drug & Chem. Wks.

Boilers.
Babcock & Wilcox Co.
Brownell Co., The

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Wrigley Co., Thomas.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Copley-Senior Carbon Co.
Holmes Fibre-Graphite Co.
Western Electric Company.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
National Electric Co.
Parsell & Weed

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
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Cutler-Hammer Mfg. Co.
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Plume & Atwood Mfg. Co.

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Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Underhill, Chas. R.
Western Electric Co.

Commutator Compound.
Crollus & Son, E. R.
Fras-Ko Chemical Co.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduit and Conduits.
American Circular Loom Co.
American Conduit Company
Central Electric Co.
Electric Appliance Co.
Gest. G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McRoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest. G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Bracey-Forse Elec. Cons. Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman, Co., J. L.

Cord.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Bertnoud & Jennings.
Central Electric Co.
Electric Appliance Co.
Galloway Co., J. B
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
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Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
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Klein & Sons, Mathias.

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Underhill, Chas. R.

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Electric Appliance Co.
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Western Electric Co.

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(See Cut-outs and Switches.)

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Bissell Co., The F.

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(See Bolts, Toggle.)

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Tools, Pneumatic.
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Allis-Chalmers Co.
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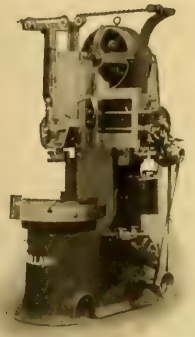

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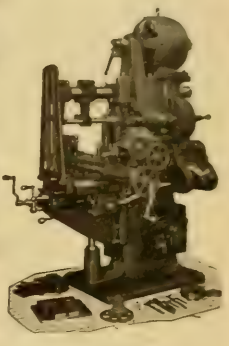

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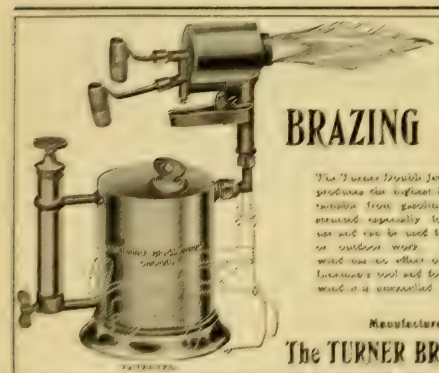

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Space 9 :: :: :: Section D

:: :: SEE :: ::

Monadnock Sign Flasher

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In Haller Machine Co.'s Exhibit

Spaces 6 and 7 :: :: Section J

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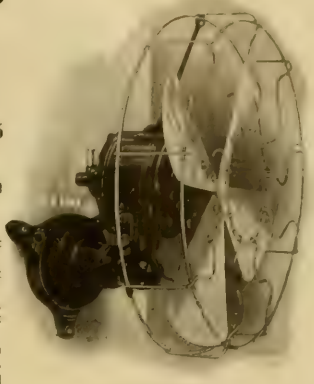

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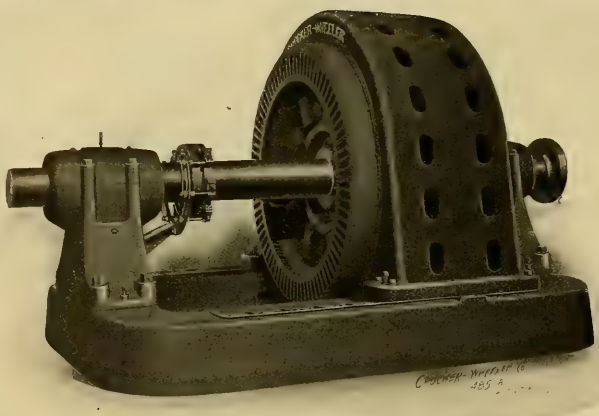

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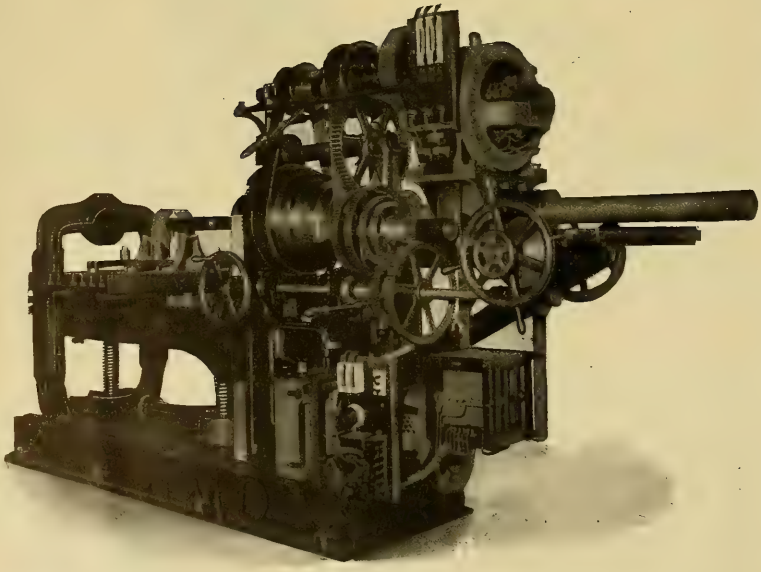

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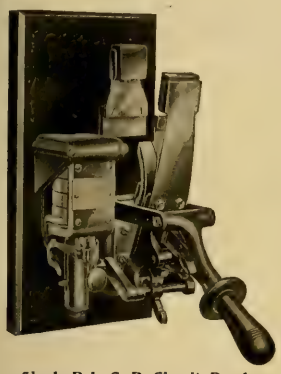

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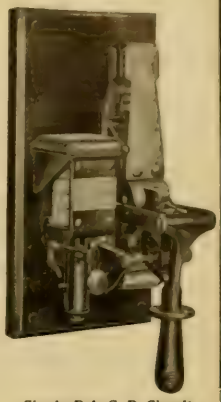

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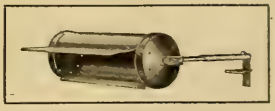

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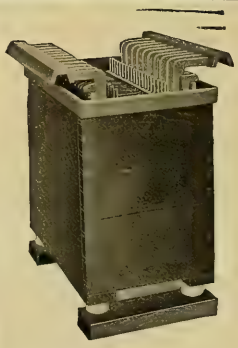

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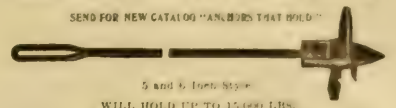

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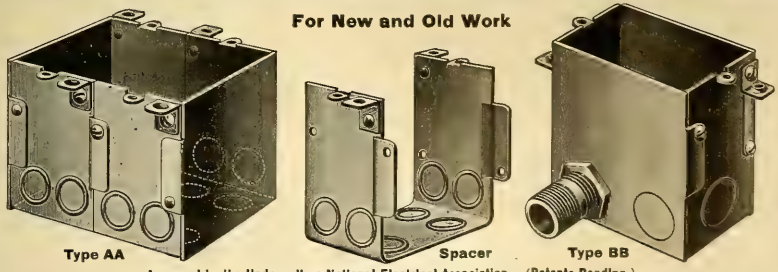

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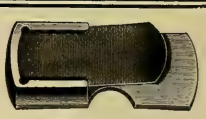

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- 1 540 C. & C., M. P., 30 K.W.
- 3 540 Western Elec., M. P., comp.
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- 1 5 Wagner, 104 volts, auto.
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- 1 3 General Electric, 110 volts.
- 1 30 General Electric, 110 volts.
- 5 10 General Electric, 550 volts.
- 5 20 General Electric, 550 volts.
- 1 100 General Electric, 550 volts.
- 3 150 General Electric, 550 volts.

110 TO 125 VOLT MOTORS

H.P.
- 1 ⅛ Akron, M. P., back geared with magnetic clutch, motor speed 1,300, speed of shaft.
- 1 ½ Crocker-Wheeler.
- 1 ½ Keystone, M.P.
- 2 1 Browning, new.
- 1 1 New England, new.
- 1 1½ Sprague Lundell
- 1 2 Jenney.
- 2 3½ Browning, M.P., new.
- 2 4 Hobart, multipolar, new.
- 2 4 Browning, M.P., new.
- 3 5 Hobart, M.P.
- 1 5 Browning, M.P.
- 2 7½ New England, M.P., new.
- 1 7½ Jenney, M.M.
- 2 7½ Hobart, M.P., new.
- 1 7½ Commercial,, M.P., new.
- 1 7½ Crocker-Wheeler, M.P.
- 1 7½ Browning, M.P.
- 1 9 Bernard.
- 1 10 Edison, self-oiler.
- 1 10 Westinghouse, M.P.
- 1 13 Bernard.
- 1 15 Edison.
- 1 18 T.-H., D 15, oil cups.
- 1 18 King, self-oiler.
- 1 18 Eddy, M.P., Type G.
- 1 18 Wagner, M.P.
- 2 20 Jenney, self-oilers.
- 1 25 National.
- 8 25 Western Electric, M.P.
- 2 30 Commercial, M.P.
- 1 30 Quaker City, M.P., 6 pole.
- 1 30 Crocker-Wheeler, M.P.
- 1 30 General Electric, M.P.
- 2 30 Westinghouse, M.P.
- 2 30 Western Electric M.P.
- 2 33 Sprague-Lundell, M.P.
- 1 33 Eddy, M.P.
- 1 35 Jenney, self-oiler.
- 1 35 Edison, self-oilers.
- 1 35 Fisher, M.P.
- 1 35 C. & C., M.P., enclosed.
- 1 35 General Electric, M.P.
- 2 35 Western Elec., M.P.
- 1 40 Muncie, self-oiler.
- 3 40 Card, M.P.
- 1 45 Excelsior, M.P.
- 2 50 Commercial, M.P.
- 1 50 Card, M.P.
- 2 60 Gen. Elec., M.P.
- 1 65 Wagner, M.P.
- 1 80 Triumph, M.P.

220 TO 250 VOLT MOTORS

H.P.
- 1 ¾ Northern, M.P.
- 1 1 Peerless, enclosed.
- 4 1 New England, brand new.
- 1 1 Northern, M.P.
- 1 1 Western Elec.
- 1 1 Browning, new.
- 1 1 Watson, M.P.
- 4 1½ Sprague-Lundell.
- 1 2 C. & C.
- 1 2 Crocker-Wheeler.
- 1 2 Westinghouse, M.P.
- 1 2 Bernard, M.P.
- 1 3 Hartley, M.P.
- 1 3 Gibbs, multipolar.
- 2 4 West. Elec., M.P., comp.
- 1 5 Muncie.
- 1 5 West. Elec., type G.
- 1 5 Gen. Elec., M.P., type C.E.
- 1 5 Browning, M.P., new.
- 1 5 Belknap, M.P.
- 2 5 Crocker - Wheeler special printing press motors, direct connected.
- 2 6 Riker.
- 1 7½ Eddy, type C.
- 1 7½ C. & C.
- 1 7½ Milwaukee, M.P., series, crane type, grease cup.
- 1 7½ Towle, M.P., new.
- 1 7½ New England, M. P., new.
- 1 7½ Towle, M.P., new.
- 1 8 Holtzer-Cabot.
- 1 8 Crocker - Wheeler, series crane type.
- 1 8 Western Electric, M.P., direct connected to Eaton & Prince elevator, complete with controller and drum, very fine, speed 250.
- 1 10 Eddy, type C.
- 1 10 Keystone, M.P., enclosed.
- 1 10 Northern, M.P.
- 1 10 Westinghouse, M.P.
- 1 10 Bernard, M.P.
- 1 15 Keystone, M.P.

H.P.
- 1 15 [illegible] M.P.
- [illegible]
- 1 20 Sprague [illegible]
- 1 20 Eddy
- 1 20 Kester
- 1 20 Western Electric, M.P.
- 1 25 Eddy, M.P., type G.
- 2 25 Western Electric, M.P.
- 1 30 Western Electric, M.P.
- 2 40 Bernard, M.P.
- 1 40 Western Elec., M.P.
- 1 50 E. & C., multipolar.
- 1 50 Am. Engine Co., M.P.
- 1 60 C. & S., self-oiler.
- 1 60 Maine, M.P.
- 1 75 Northern, M.P.
- 1 70 Fuller, multipolar.
- 1 100 Westinghouse, bipolar.

500 TO 550 VOLT MOTORS

H.P.
- 2 ½ Browning, new.
- ¾ Browning, new
- 1 1 C. & C.
- 1 1 Browning, new.
- 1 1 Towle.
- 1 1 Holtzer-Cabot.
- 2 1 New England, new.
- 1 1½ Northern, M.P.
- 1 1½ Northern, series.
- 1 1½ Belknap, self-oiler.
- 1 2 Watson, self-oiler.
- 1 2 Browning, new.
- 2 2 Browning, new.
- 1 3 T. H., self-oiler.
- 1 3 Amer. Eng. Co., M.P.
- 1 3 Westinghouse, M.P.
- 1 3½ Roth.
- 1 3½ Roth, M.P.
- 1 4 Fort Wayne.
- 1 4 Bernard, M.P.
- 1 5 Card.
- 1 5 Browning, M.P.
- 1 6 Westinghouse, M.P.
- 1 7½ Roth, self-oiler.
- 1 7½ Amer. Eng. Co., M.P.
- 1 7½ Gen. Elec., M.P.
- 1 7½ Eddy, M.P.
- 1 10 Eddy, self-oiler, type C.
- 1 10 Powell, M.P.
- 2 10 Kester, M.P.
- 2 10 Belknap, M.P.
- 1 12 Adams.
- 2 20 Bernard, M.P.
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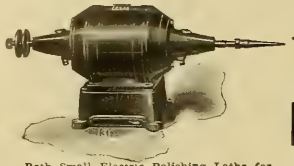

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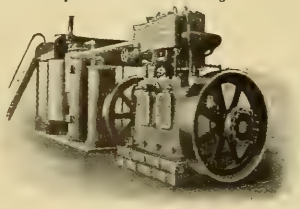

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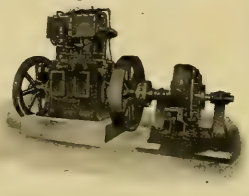

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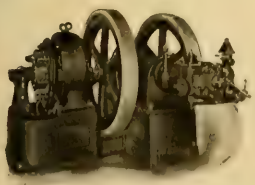

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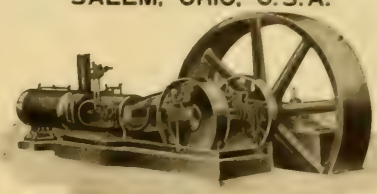

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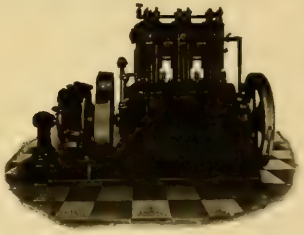

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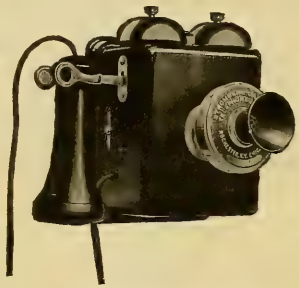

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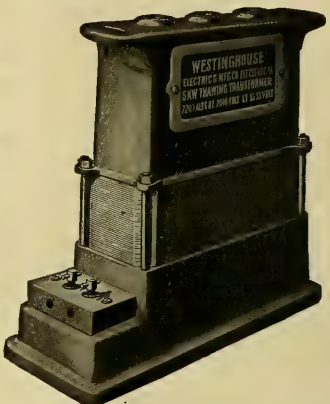

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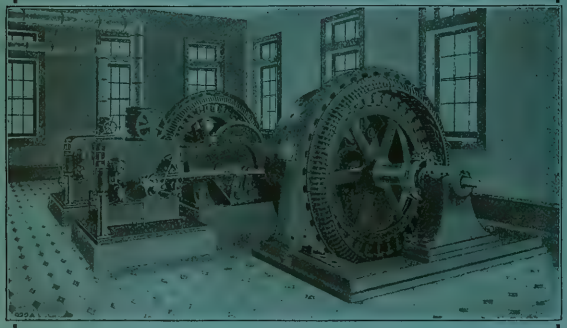

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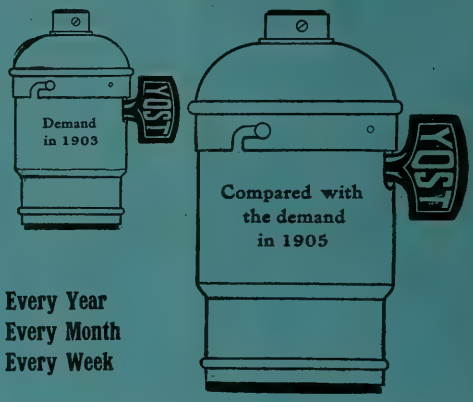

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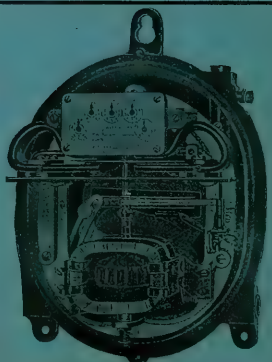
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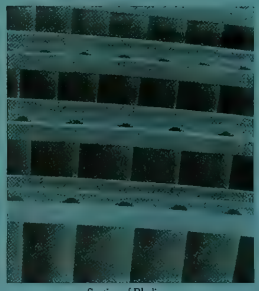

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ST. LOUIS, 1904

ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 20
Alton Machine Co. 4
Allis-Chalmers Company 2
American Battery Co. ..... —
Amer. Circular Loom Co. 1
American Conduit Co. 26
Amer. District Steam Co. 22
Amer. Elect'l Supply Co. 16
Amer. El. Telephone Co. 25
American Electrical Works .. 15
Arnold Co., The 22
Automatic Electric Co. 24

Babcock & Wilcox Co. ..... —
Badt, F. B. 9, 22
Bain, Forée & May ..... —
Baker & Co., Inc. 3
Baker & Co., W. E. 22
Beardslee Chandelier Mfg. Co. —
Belden Mfg. Co. 14
Benton & Son ..... —
Berthold & Jennings 26
Bissell Co., The F. 4
Bossert Electric Construction Co. 20
Boston Incan. Lamp Co. 20
Bracey-Forse Elec. Cons. Co. —
Brooks, Hall L. 26
Buckeye Electric Co. 7
Buckeye Engine Co. 23
Bull Dog Specialty Co., The 14
Bullock Elec. Mfg. Co. 2
Byllesby & Co., H. M. 22

Carhartt & Co., Hamilton .... —
Central Electric Co. 5
Century Electric Co. 16
Chicago Edison Co. 4, 16
Chic. Fuse Wire & Mfg. Co. —
Chicago Mica Co. 14
Chicago Pneumatic Tool Co .. 14
Colonial Sign & Insulator Co. —
Columbia Incand. Lamp Co. .. 10
Columbus Citizens Tel. Co. .. 19
Cope, T. J. 26
Copley-Senior Carbon Co. 14
Cornell, T. S. 22
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 18
Crolius & Son, E. R. ..... —
Cutler-Hammer Mfg. Co. 4
Cutter Elec. & Mfg. Company —

D. & T. Anchor Co. 18
D. & W. Fuse Company ..... —
Dearborn Drug & Chem. Wks. 23
Diamond Meter Company .... —
Directory of Engineers 22
Dixon Crucible Co., Joseph .. 23
Driver-Harris Wire Co. 16
Duncan Elec. Mfg. Co. 29

Edison Decorative & Miniature Lamp Departm't. 14
Edison Mfg. Company 16
Electric Appliance Co. 14
Electric Storage Battery Co.. 3
Electrician Pub. Company ... 5

"For Sale" Advertisements .. 16
Ft. Wayne Elec. Works, Inc. .. 29
Fowler & Co., John H. 27
Fres-Ko Chemical Co. ..... —

Galloway Co., J. B. 26
General Electric Co. 13, 14
General Elec. Securities Co. .. 22
General Storage Battery Co. .. 14
Gest, G. M. 26
Gould Storage Battery Co. .... —
Gregory Electric Co. 16, 17

Haller Machine Co. 1
Hart Mfg. Co. 20
Hartford Steam Boiler Inspection & Insurance Co. 16
Hazard Manufacturing Co. 1
Hensel & Co., John A. ..... —
Highland Park College. 22
Hoffman, G. W. 22
Holmes Fibre-Graph. Co. 23
Holophane Glass Co. ..... —
Humphrey, Henry H. 22
Hunt & Co., Robt. W. 22

Illinois Central Ry. 27
Incandescent Electric Light Manipulator Company ..... —
Indiana Rub. & Ins. W. Co. 1, 12
India Rubber & Gutta Percha Insulating Company 8
International Elec. Meter Co 9
International Tel. Mfg. Co. .. 25

Jackson, D. C. & W. B. 22
Jandus Electric Co. 30
Jeffrey Manufacturing Co. 23
Johns-Manville Co., H. W. ..... —

Kartavert Manufacturing Co. 1
Kellogg Switchboard & Supply Company 24, 27
Klein & Sons, Mathias 14
Kohler Brothers 22
Kuhlemeyer, John 18
Kuhlman Electric Co. 15

La Fayette Elect'l Mfg. Co. .. 14
Leather Preserv. M. Corp. 3
Leffel & Co., James 23
Lindsley-Bauman Co. 27
Loud's Sons Co., H. M. 27

Machado & Roller 14
Maine Hub Mfg. Co. ..... —
Manhattan El. Supply Co. 15
Marinette Gas Engine Co. 23
Matthews & Bros., W. N. .. 3, 15
McCandless, H. W. & Co. 3
M'Glehan & Co., C. H. 22
McLennan & Company, K. 14
McLeod, Ward & Co. 18
McRoy Clay Works 26
Mica Insulator Company 14
Milwaukee Engineering Co. .. 22
Miscellaneous Advs. 16
Monarch Elec. Mfg. Co ..... —
Monon R. R. ..... —
Mueller Company, William .. 27
Munsell & Co., Eugene 14

National Battery Co. 8
National Carbon Co. 4
National Electric Co. 20
National India Rubber Co. .... —
Nat'l. X Ray Reflector Co. .. 19
New Idea Soldering Paste Co. 22
New York Ins. Wire Co. 24
Northern Elect'l Mfg. Co. 15

Okonite Co., The 1
Oneida Community, Ltd. 1
Osburn Flex. Conduit Co. 26
Otto Gas Engine Works. ..... —

Pacific Coast Pole Co. 27
Parsell & Weed 15
Patrick Co., R. M. 6
Peru Elec. Mfg. Co. 3
Phillips, Eugene F. 15
Phillips Insulated Wire Co. .. 15
Phœnix Glass Co. 1
Phosphor-Bronze S. Co. 23
Pignolet, L. M. 14
Pillsbury-Watkins Co. 26
Pittsburg & L. S. Iron Co. 27
Plume & Atwood Mfg. Co. 15
Porter Cedar Company 27

Rail Joint Co., The 3
Reisinger, Hugo ..... —
Replogle Governor Works .. 15
Reynolds El. Flasher Mfg. Co. 1
Robbins & Myers Co. 20
Robert Instrument Co., The .. 15
Robertson & Sons, Jas. L. .... —
Rock Island Battery Co 9
Roebling's Sons Co., J. A. 25
Ruebel & Wells 22

Safety Ins. Wire & Cable Co .. 24
St. Marys Incan. Lamp Co. .... —
Samson Cordage Works 16
Sandwich Pole Changer Co. .. 25
Sargent & Lundy ..... —
Schott, W. H. 22
Schureman Co., J. L. 1
Simplex Electrical Co., The .. 1
Simplex Elec. Heating Co. 1
Smith Storage Battery Co. 8
Speer Carbon Co. 14
Spon & Chamberlain 21
Standard Elect'l. Mfg. Co. 8
Standard Underg. Cable Co. 1
Stanley—G. I. Elec. Mfg. Co. 13
Stanton, LeRoy W. ..... —
Star Expansion Bolt Co. 23
Sterling & Son, W. C. 27
Stevens & Co., Milo B. 14
Stow Mfg. Company 1
Stromberg-Carlson Tel. Mfg. Company 25

Telephone Woodworking Co. 25
Torrey Cedar Company 27
Trumbull Elec. Mfg. Co. 16
Turner Brass Works ..... —

Underhill, Chas. R. 22
Universal Elec. Stor. Bat. Co. 8

Van Nostrand Co., D. ..... —
Vought-Berger Co. ..... —
Vulcanized Fibre Company .. 1

Wagner Electric Mfg. Co. 11
Wagor Mfg. Co., P. R. ..... —
Weber Gas & Gasoline Engine Co. 23
Wesco Supply Co. ..... —
Western Display Co. ..... —
Western Electric Company .. 18
Western Lumber & Pole Co. .. 26
Westinghouse Electric & Manufacturing Co. 28
Westinghouse Machine Co. .. 28
Weston Electrical Inst. Co. 1
Willard Storage Bat. Co. ..... —
Willis, G. M. 22
Wilson, Co., Jas. L. M. 26
Worcester Company, C. H. 26
Wrigley Co., Thos. ..... —

Yost Electric Mfg. Co. 20

Zeller Geo. A. Book Co. 24

For Classified Index of Advertisements See Page 6.

Motors, Switches, Arc Lamps, Circuit Breakers, Etc., Etc.

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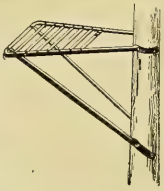

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Chicago Electrical Show Report Number

The WESTERN ELECTRICIAN of January 27th will contain a complete account of this interesting event, pictures of exhibits, etc., also a full report of the North-Western Electric Light Convention and the Electrical Salesmen's Meeting held in Chicago this week.

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No other electrical paper gives the Western electrical fraternity a news service of equal value.

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjustors, Cord.
Incandes. El. Lt. Manip. Co.

Adjusters, Inc. Lamps.
Inc. El. Lt. Manipulator Co.

Anchors (Tel. & Tel.)
D. & T. Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works.

Boiler Compounds.
Dearborn Drug & Chem. Wks.

Boilers.
Babcock & Wilcox Co.
Brownell Co., The

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. Shook Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Copley-Senior Carbon Co.
Holmes Fibre-Graphite Co.
Western Electric Company.

Cable Hangers.
Bissell Co., E. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
National Electric Co.
Parsell & Weed

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanised.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clusters.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Underhill, Chas. R.
Western Electric Co.

Commutator Compound.
Crolius & Son, E. R.
Free-Ko Chemical Co.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduit and Conduits.
American Circular Loom Co.
American Conduit Company
Central Electric Co.
Electric Appliance Co.
Gest. G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McRoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest. G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Bracey-Forse Elec. Cons. Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman, Co., J. L.

Cord.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Galloway Co., J. B.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Tornquist Elec. Mfg. Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.

Dynamos and Motors.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Parsell & Weed.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Bryan, Wm. H.
Byllesby & Co., H. M.
Cornell, T. S.
General Elec. Securities Co.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Jackson, D. C. & W. B.
Kohler Brothers.
Milwaukee Engineering Co.
Northern Electrical Mfg. Co.
Patrick Co., R. M.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Stanton, LeRoy W.
Underhill, Chas. R.
Willis, G. M.

Electrical Instruments.
(Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators-Conveyers.
Jeffrey Mfg. Co.

Engines, Corliss.
Allis-Chalmers Company.

Engines, Gas and Gasoline.
Allis-Chalmers Company.
Benton & Son.
Marinette Gas Engine Co.
Otto Gas Engine Works.
Weber Gas & Gasoline Engine Co.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Jandus Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Karlavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixture Hanger, Adjustable
Kuhlemeyer, John

Fixtures, Gas and Elec.
Beardsley Chandelier Mfg. Co.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Electric Appliance Co.
Johns-Manville Co., H. W.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

Glassware, Electric.
Addison Glass Co.

Globes, Reflectors and Shades.
Addison Glass Co.
Haller Machine Co.
Holophane Glass Co.
McLeod, Ward & Co.
Nat'l. X. Ray Reflector Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Incandescent Electric Light Manipulator Co.
Vought-Berger Co.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Iron Castings.
Alton Machine Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Wagor Mfg. Co., P. R.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
St. Marys Incan. Lamp Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Machinery, Automatic.
McGehan & Co., C. H.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Overalls.
Carhartt & Cc., Hamilton.

Patent Attorneys.
Bain, Foree & May.
Stevens & Co., Milo B.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Berthold & Jennings.
Brooks Hall L.
Fowler & Co. John H.
Kellogg Switch. & Sup. Co.
Lindsley-Bauman Co.
Loud's Sons Co., H. M.
Mueller Company, William.
Pacific Coast Pole Co.
Pillsbury-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Peru Electric Mfg. Co.

Porcelain.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Protectors, Telephone Exchange.
Tornquist Elec. Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.
Southwestern Elec. Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Highland Park College.

Searchlights.
Benton & Son.

Second-Hand Machin'y.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.

Signs, Electric.
Haller Machine Co.
Western Display Co.

Sockets & Receptacles.
Yost Elec. Mfg. Co.

Soldering Sticks, Salt and Paste.
Bull Dog Specialty Co., The
Crolius & Son, E. R.
New Idea Soldering Paste Co.
Western Electric Co.

Solenoids.
Schureman Co., J. L.
Underhill, Chas. R.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co.
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Universal Elec. Stor. Bat. Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Columbus Citizens Tel. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co.
Vought-Berger Co
Wesco Supply Co.
Western Electric Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
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Chicago Pneumatic Tool Co.

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(Bullock El. Mfg. Co.)
Century Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
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Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Allis-Chalmers Co.
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Phillips, Eugene F.
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Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

Woodwork, Telephonic.
Telephone Woodworking Co

For Alphabetical Index of Advertisements See Page 3.

At the close of this, our sixteenth year, we take the opportunity to thank you, our patrons, for the large increase in business that has come to us during 1905—during 1906 we will endeavor to do even better than before.

With the beginning of this year, we call your attention to the fact that "Buckeye" is not only at the top of this page but, "on top" everywhere by reason of its naturally acquired prestige with thousands of SATISFIED buyers.

Think of it! THE BUCKEYE ELECTRIC COMPANY beginning the year 1906 WILL HAVE SEEN 16 YEARS OF ACTIVE LAMP BUSINESS! When in 1891 it purchased the Sellen Process and became the first company in this country to manufacture the cellulose filament it was "on top," and NOW, at the beginning of 1906 it is still on top. A poor lamp in these days of bitter competition cannot live. As a consequence THIS BEING ONE OF THE OLDEST COMPANIES in the incandescent lamp manufacturing business MEANS SOMETHING TO YOU, "Mr. Lamp Buyer!"

In a word the fact that we have been in business for 16 years, AND HAVE KEPT AT THE TOP FROM THE START, is significant of great merit and is one good reason why you

"BETTER BUY BUCKEYE"

Gorham Building, New York City.

INDIA RUBBER & GUTTA PERCHA INSULATING CO.

AUTHORIZED MANUFACTURERS

HABIRSHAW RED CORE

Used Throughout Gorham Building,
New York City

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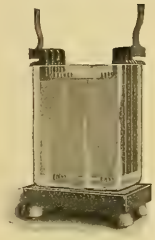
YONKERS, NEW YORK
W. M. HABIRSHAW
President and General Manager

SALES DEPARTMENT
13-15 CORTLANDT ST., NEW YORK CITY
J. B. OLSON, Manager of Sales

RELIABLE **"Unit Accumulator"**

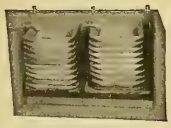


FOR STREET RAILWAYS, CENTRAL STATIONS, TELEPHONE SYSTEMS, ETC.
Ask for catalogue and bulletin on "A WATER POWER SYSTEM"

National Battery Company

ELECTRIC STORAGE BATTERIES
BUFFALO, N. Y.

Branch Offices:
NEW YORK, CHICAGO



THE ELECTRO-CHEMICAL TRAY BATTERY

Important point— **no "choking" gas**.
Made up in "tray form," hence for a battery of a voltage of 110, one stack would only stand **about 30 inches high**. Many other **good novel points—investigate it.**

SMITH STORAGE BATTERY CO., - - Zoar, O.

Universal Electric Storage Battery Co

MANUFACTURERS OF THE

MORRISON BATTERY

We can save you space and weight in your battery installations.
The Morrison type of plate with its metallic surface and completely enclosed active material, insures

**LONG LIFE, LOW RESISTANCE,
FREEDOM FROM BUCKLING,
WITH DECREASED WEIGHT OF
GRID AND INCREASE OF
ACTIVE MATERIAL.**

**BATTERIES FOR
CENTRAL STATIONS, RAILWAY LIGHTING,
TELEPHONE AND SIGNAL WORK,
ELECTRIC VEHICLES, GAS IGNITION.**

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CHICAGO ILLINOIS

THE BRIGHTEST IN THE FIRMAMENT

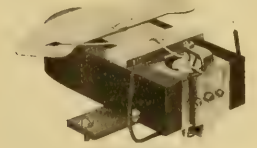
STANDARD ELECTRICAL MFG. CO., NILES, O.

Voltmeters and Ammeters

FOR

Direct Current Use

LARGE ROUND PATTERN



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Unexcelled for Workmanship, Design and Accuracy

New descriptive catalog mailed upon request

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THEY CAN'T DOWN US

ALTHOUGH our plant was entirely destroyed by fire on January 11th, 1906, we are now doing business just the same as before. Our new plant will be larger and finer than ever. We will be ready to deliver

ROCK ISLAND DRY CELLS

not later than February 1, 1906. Send in your orders now.

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F. B. BADT & CO.

1504 Monadnock Block

CHICAGO

WESTERN AGENTS FOR

Weston Instruments

Space 9 :: :: :: Section D

:: :: SEE :: ::

Monadnock Sign Flasher

(Motorless, Simple, Current Saving)

In Haller Machine Co.'s Exhibit

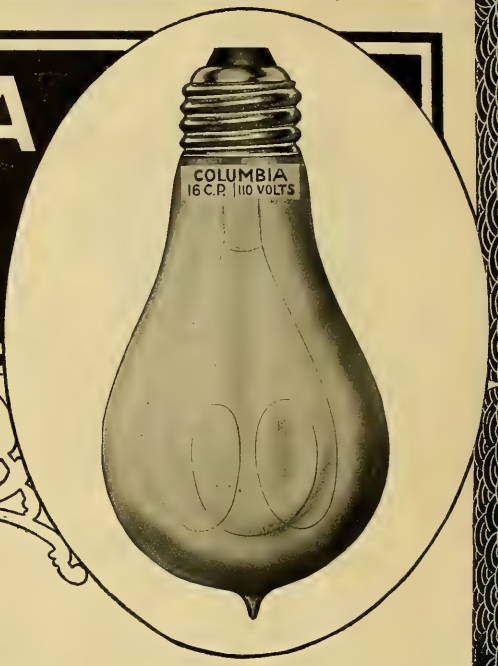
Spaces 6 and 7 :: :: Section J

COLISEUM

JANUARY 15th to 27th

1906

COLUMBIA LAMPS GIVE MOST LIGHT



is what you want to know.
Not what we say—
but what it does.

Buyers of INCANDESCENT LAMPS desire THE MOST LIGHT FOR LEAST CURRENT.

For more than sixteen years

COLUMBIA LAMPS

have met every requirement of most exacting station managers, and throughout the world are acknowledged to be

UNEQUALED IN QUALITY

Copy of our "Wallet Full of Wisdom" mailed on request. Order from any of our offices. LAMPS IN STOCK. Complete stock of Economical Turn Down Lamps enables us to make prompt shipments at all times.

The Columbia Incandescent Lamp Co.

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PHILADELPHIA: 1227 Real Estate Trust Building
CHICAGO: Central Electric Company
SAN FRANCISCO: 105-107 Battery Street
MEXICO, MONTEREY: Van Voorhis Hnos.

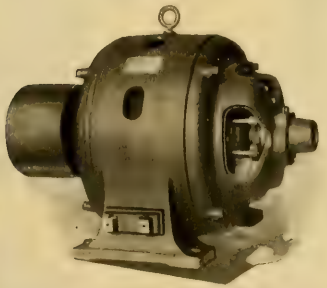
LOOK FOR THE LICENSE LABEL IN THE STEM

LOOK FOR THE LICENSE LABEL IN THE STEM

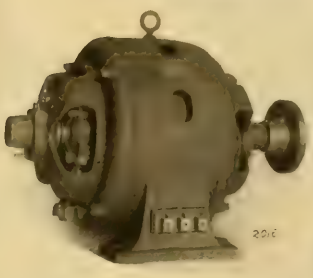
Wagner Electric Manufacturing Co.

GENERAL OFFICE and FACTORY:
ST. LOUIS. MO.

DISTRICT OFFICES IN ALL THE PRINCIPAL CITIES IN UNITED STATES AND CANADA.



Type "BA" Single-Phase. Constant Speed. Can be wound for reversing by external switching if desired.



Type "HS" Single-Phase Elevator and Variable Speed Type.

Write for Bulletins

SINGLE-PHASE MOTORS 68 H

POLYPHASE MOTORS 74 H

TRANSFORMERS 72 H

Showing Construction of Types "M" and "MH" Oil-Filled Lighting and Motor Transformers.

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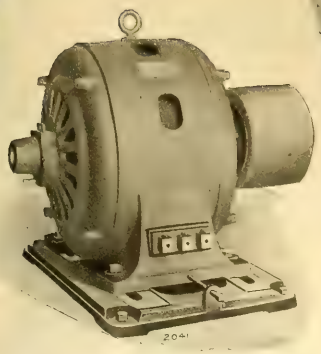
SWITCHBOARD INSTRUMENTS 67 H

PORTABLE INSTRUMENTS 71 H

ELEVATOR MOTORS 70 H

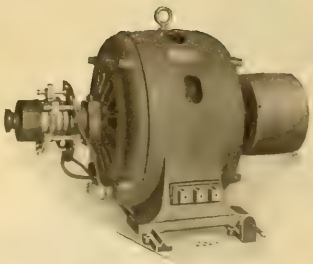


Type "BM" Polyphase, with and without auto-starter.

We Build Transformers of Any Size

Cut shows section of our Standard Transformer, in sizes from 2 K. W. to 50 K. W.

WRITE FOR BULLETINS



Type "BR" Polyphase, with external-resistance starter.

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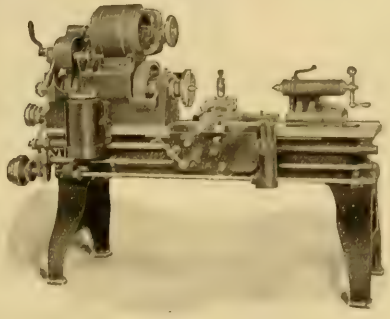
RUBBER COVERED WIRES
and CABLES
PARANITE
Indiana Rubber and Insulated
Wire Co.
JONESBORO, INDIANA

General Electric Company

CR Motor Drive

Neat and Compact. No detached parts. Motor and controller in small space.



A 1 HP Variable Speed Motor Operating a 16-inch Lathe

Easily controlled. 3 to 1 speed variation obtained by field control.

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The Stanley-G. I. Electric Mfg. Co. is a consolidation of the Stanley Electric Mfg. Company of Pittsfield and the General Incandescent Arc Light Company of New York. The Stanley Company's product, marketed under the well-known trade name of the S. K. C. System, comprises Generators, Transformers, Rotary Convertors, Motor Generator Sets, Switchboard Apparatus, Induction Motors, etc. The General Incandescent Arc Light Company has been favorably known as builder of the high-grade G. I. Arc Lamps, Arc Lamp Regulators, Incandescent Lamps, alternating current and direct current Motors, General and Special Electrical Supplies.

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PITTSFIELD MASSACHUSETTS

Light 1906 with the lamp that makes good. The lamp that gives the most light at the least cost. Light the year with

Packard Lamps

The satisfactory service obtained from Packard Lamps stands for three times economy: Economy of TIME and TROUBLE as well as of MONEY.

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MICABOND will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.
CHICAGO MICA CO. VALPARAISO, IND.

YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
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INSURE
RELIABLE
LIGHTING RESULTS
BY ORDERING EDISON LAMPS.

Exclusively used by most discriminating purchasers

All types and varieties
Regular Multiple Lamps
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MAIN LAMP SALES OFFICE
Harrison, N. J.
(487)

MICA Of all Qualities, In any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
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LAFAYETTE ELECTRICAL MFG. CO.
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Booth No. 8. Section C.
Jan'y 15 to 27, 1906

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Works: Boonton, N. J. General Offices: 42 Broadway
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Copley-Senior Carbon Brush
Uniform throughout, a feature lacking in all other brushes
FOR GENERATORS AND MOTORS
Thoroughly and Permanently Self-Lubricating
Will not Cut Will not Spark Carry more Load
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SPEER CARBON CO.
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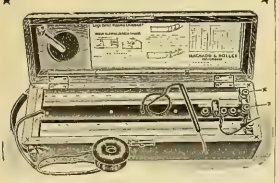
As your ad in the Western Electrician will be read, you will never be blue.

WHITNEY OHMMETERS



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So are all our other meters. Our 13 years of experience has enabled us to develop a line without equal.
Have you seen our guarantee label?
Printed matter pertaining to the complete line sent on application.

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POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
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For all telephone and electrical requirements
LARGE MANUFACTURING CAPACITY
LOW PRICES
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Capacities 0 to 2½ inches. Under test have removed largest amount of metal of any portable drilling device yet devised.
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are the best for soldering Electrical Connections.
LET US SEND YOU our new catalogue and specimens of work, and enter your name for one of the new Bull Dog posters, "The Prize Winner."
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BARE AND INSULATED ELECTRIC WIRE,

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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof
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Prices and Samples on Application.

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WE WILL SHIP ON 20 DAYS TRIAL
ANY NUMBER OF

STOMBAUGH GUY ANCHORS

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IF SATISFACTORY PAY FOR THEM, OTHERWISE, RETURN CHARGES COLLECT
WE PREPAY FREIGHT ON INITIAL ORDERS

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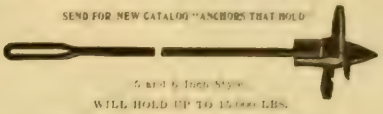

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Castings, Punchings, Materials and Blue Prints for constructing the Brocksmith Dynamo, Motor, Dynamotor, Motor-Generator, Single-Phase Rectifier, A. C. Generator, etc.

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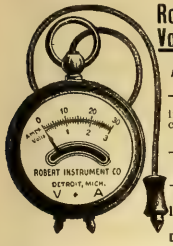

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Accurate, Durable
Guaranteed

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30 Amperes

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Water-Wheel Governors

Our new mechanical governors co-operate with the inertia effect on the water and the momentum of the plant.
They have cut the cost of good government in two. Guaranteed in every particular.

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AKRON, OHIO
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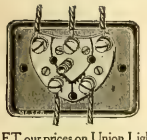

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Northern Apparatus
For Industrial Work

Built for service in industrial plants, to operate in isolated industries, etc. Its simplicity favors Northern Apparatus for this work, and users and those familiar with it favor Northern Apparatus also.

DIRECT CURRENT DYNAMOS AND MOTORS

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BY ALL MEANS

you should be well represented in the advertising columns of the remaining .:. .:. .:.

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issue of January 27th. This number will contain a complete account of the show, illustrations of exhibits etc.

SEND COPY TO-DAY!

Western Electrician
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CHICAGO, ILLINOIS

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Electrician and wireman age, 26, with eight years' electrical, foundry and machine experience desires position with a manufacturing company, estate, department store or theatre. Capable of drawing up estimates and specifications, handling men, designing electrical and mechanical effects and apparatus. Have complete set of tools. Salary $1200. Address Box 566, care of Western Electrician, 510 Marquette Building, Chicago.

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Electrical engineer experienced in circuit breaker design. Excellent opportunity for high-class man. Give experience and salary expected. Address Box 565, care of Western Electrician, 510 Marquette building, Chicago.

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Arc dynamo from 50 to 100 lights 9 6 amp. or 6.8 amp., also M. P. 270 K. W. G. E. generator. THE STANDARD MACHINERY & EQUIPMENT CO. Cleveland, O.

WANTED SALESMAN

First-class salesman to sell new patent Rock Island dry batteries on commission basis. Must have first-class references. Apply at once. Rock Island Battery Co., 23rd and Vine Sts., Cincinnati, Ohio.

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Electric light, heat, power and water works; in county seat in southeast Missouri, first-class in every respect; will stand rigid investigation. Coal $2 per ton; wood $1.50 per cord. Plant five years old. A bargain. Owners' family must change climate. One-half cash. Two excellent deep wells; water unlimited. Address Box 563, care of Western Electrician, 510 Marquette Building, Chicago.

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Illinois and Indiana Towns.

Electric Light and Water			in town of	2,000
"	"	"	"	1,800
"	"	"	"	1,600
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Electric Light			" "	8,000
"	"		" "	5,000

All above plants are offered at bargain price for quick sale, on easy terms of payment.

Long time franchises and liberal city contract at each place.

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We are Headquarters for ELECTRICAL REPAIR WORK We operate the largest repairshops in America and have exceptional facilities for quick work. We repair **all kinds** of electrical apparatus and save our customers **weeks** in time in comparison with sending the work to the manufacturers direct. We have just reduced our prices and ask you to get our quotations on

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Send for our monthly "**Bargain Sheet**," showing net prices on our stock of **second-hand** dynamos, motors, meters, transformers and supplies. Every article a bargain.

GREGORY ELECTRIC CO.
54-62 S. Clinton Street - CHICAGO

RESISTANCE WIRES.

"Advance" *"Climax"*

"Hercules"

FOR BINDING ARMATURES

DRIVER-HARRIS WIRE CO.
HARRISON (NEWARK), N. J.

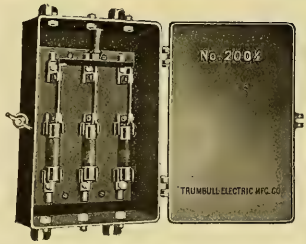
AMERICAN ELECTRICAL SUPPLY CO

ARE YOU SEEKING

Good Material, Good Service, Correct Prices on Electrical Supplies? If you are let us hear from you.

IF ELECTRICAL AND GOOD WE SELL IT

83-85-87 FIFTH AVE CHICAGO



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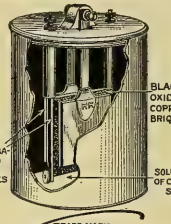
ON LOCAL ACTION IN PRIMARY BATTERIES

The amount of electric current that may be drawn from a primary battery depends, first upon the weight of the zinc electrodes (each ampere hour consumes just 1.2283 grammes), and, second, upon the amount of local action, that is, consumption of zinc without any current in the external circuit. The latter can be prevented by amalgamation, and some makers attempt to prevent it by applying mercury to the outside of the zinc, but in the manufacture of Edison cells a method has been discovered by which 2 per cent of mercury is incorporated in the zinc electrodes as they are cast, insuring that the mercury is just where it is wanted all during the life of the zinc. In a test upon some 300 ampere-hour EDISON cells taken at random from stock, Dr. A. E. Kennelly found that the loss of zinc from local action was only 1-243 part of the total amount consumed.



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Lights.

2 900 Westinghouse, 45 K.W., single phase with switchboard.
1 900 Westinghouse, 45 K.W., two-phase, 1,100 volts.
2 1,200 Westinghouse, 60 K.W., two-phase, 1,100 volts.
1 1,500 General Electric, 75 K.W., three-phase, 2,200 volts.
1 1,500 General Electric, 85 K.W., three-phase, 3,300 volts.
1 1,500 Warren-Medberry, 75 K.W., two-phase, 1,100 or 2,200 volts.
3 1,500 Westinghouse, 75 K.W., single phase, 1,100 or 2,200 volts.
2 1,500 Westinghouse, 75 K.W., two-phase, 1,100 or 2,200 volts.
1 3,000 Warren, 150 K.W., Inductor.
1 4,500 Westinghouse, 225 K.W., two-phase, 1,100 or 2,200 volts.
1 4,500 Westinghouse, 225 K.W., three-phase, 1,100 or 2,200 volts.

125 TO 133 CYCLES

Lights.

1 650 T-H. A. 35, 1,100 volts.
1 1,200 Wstgh., 60 K.W., 1,100 v.
1 1,200 Gen. Elec., A. 60, 1,100 v.
2 1,500 Wood, 75 K.W., 1,100 or 2,200 v.
1 2,400 General Elec., 120 K.W., type A. S., 2,200 volts.
1 3,000 Stanley, inductor type, 150 K.W., two-phase.
1 2,400 General Elec., 120 K.W., type A. 120, 1,100 or 2,200 v.

250 VOLT GENERATORS

K.W.

2 12 Wstgh., M. P., comp.
1 15 Western Elec., M. P., comp.
1 17½ Kester, comp.
1 17½ Eddy, type C, comp.
3 20 Western Elec., M. P., comp.
2 25 Western Elec., M. P., comp.
1 35 Bernard, M. P., comp.
1 45 Am. Eng. Co., M. P., comp.
1 50 C. & C. comp.
1 50 Maine, M. P., comp.
1 55 Fuller, multipolar, comp.
1 75 Westinghouse bipolar with extra armature.
1 75 Siemens & Halske, Churchward type, M. P., brand new, for direct connection.
1 200 Eddy, multipolar, comp.
1 300 Western Electric, M. P., brand new, 8 pole, 3 bearing.

550 VOLT GENERATORS

K.W.

1 75 Westinghouse, M.P.
1 100 Gen. Elec., M. P., 4 comp.
1 100 Siemens & Halske, M. P., comp.
1 110 General Electric, M. P., 6 pole.
1 200 Thompson Ryan, M. P., comp.

ELECTRIC LOCOMOTIVES

Ton.

1 10 Morgan-Gardner, type M. 250 volt, direct current, double motor locomotive, 74 K.W., 42-inch gauge, speed 6 to 10 miles per hour.

125 VOLT GENERATORS

Lights.

1 10 Towle, M. P., comp.
1 25 Sprague-Lundell, shunt.
1 30 Westinghouse, M. P.
2 60 Browning, new.
2 60 Hobart, M. P.
2 65 Browning, M. P., new.
1 75 Phenix, comp., direct connected to No. 4 Case engine.
2 75 Westinghouse, M. P.
3 80 Hobart, M. P., new.
2 100 Hobart, M. P., comp.
1 100 Triumph, M. P., comp.
3 110 New England, M. P., comp
1 110 Akron, M. P., comp.
2 110 Commercial, M. P., comp.
1 150 West. Elec., M. P., type N. 1.
1 160 Bernard, self-oiler.
1 170 Western Elec., M. P.
1 270 Eddy, M. P., comp.
4 340 Western Elec., M. P., comp.
1 350 Edison, 20 K.W.
2 400 Westinghouse, M. P. comp.
1 450 Bullock, M. P., comp.
1 450 Sprague-Lundell, M. P., comp.
1 450 Quaker City, M. P., comp.
1 450 Gen. Elec., M. P., comp.
1 450 West. Elec., M. P., comp.
1 540 Edison, comp., 30 K.W.
1 540 C. & C., M. P., 30 K.W.
3 540 Western Elec., M. P., comp.
1 540 G. E., M. P., comp. 30 K.W.
1 650 Excelsior, M. P., 37½ K.W.
1 650 Westinghouse, M. P.
2 700 Commercial, M. P., comp.
1 700 Card, M. P., comp.
1 700 Crocker-Wheeler, M. P., comp.
2 800 Gen. Elec., M. P., comp.
1 900 Wagner, M. P., comp.
1 1,100 Triumph, M. P., comp.
1 1,300 Card, M. P., comp., 75 K.W.
2 1,300 West. Elec., M. P., 75 K.W.
2 1,350 General Electric, M. P., 75 K.W., 6 pole shunt, direct connected to Ames tandem comp., 11x17x12 automatic engine.
1 1,450 General Electric, M. P., comp, form H, 85 K.W.
1 1,800 Edison, 100 K.W., comp.
1 1,800 Western Electric, M. P., comp., 6 pole, 100 K.W.
1 2,500 Western Electric, M. P., comp., for direct connection, brand new 150 K.W.

ALTERNATING CURRENT MOTORS

SINGLE PHASE, 125-133 CYCLES.

H.P.

1 2 Wagner, 110 volts, auto.
1 3½ Century, 110 volts, auto.

SINGLE PHASE, 60 CYCLE.

H.P.

1 2 Holtzer-Cabot, 208 volts.
1 3 Wagner, 208 volts.
2 1 Century, 104 or 208 volts, auto.
1 2 Century, 104 or 208 volts, auto.
1 3 Century, 104 or 208 volts, auto.
1 5 Wagner, 104 volts, auto.
2 5 Wagner, 208 volts, auto.
1 5 Century, 104 or 208 volts, auto.

THREE-PHASE, 60 CYCLE.

H.P.

2 1 General Electric, 110 volts.
1 2 General Electric, 110 volts.
1 3 General Electric, 110 volts.
1 30 General Electric, 110 volts.
5 10 General Electric, 550 volts.
5 20 General Electric, 550 volts.
1 100 General Electric, 550 volts.
3 150 General Electric, 550 volts.

110 TO 125 VOLT MOTORS

H.P.

1 ⅛ Akron, M. P., back geared with magnetic clutch, motor speed 1,300, speed of shaft.
1 ¼ Crocker-Wheeler.
1 ½ Keystone, M.P.
2 1 Browning, new.
1 1 New England, new.
1 1½ Sprague-Lundell.
1 2 Jenney.
2 3½ Browning, M.P., new.
2 4 Hobart, multipolar, new.
2 4 Browning, M.P., new.
3 5 Hobart, M.P.
1 5 Browning, M.P.
2 7½ New England, M.P., new.
1 7½ Jenney, M.M.
2 7½ Hobart, M.P., new.
1 7½ Commercial, M.P., new.
1 7½ Crocker-Wheeler, M.P.
1 7½ Browning, M.P.
1 9 Bernard.
1 10 Edison, self-oiler.
1 10 Westinghouse, M.P.
1 13 Bernard.
1 15 Edison.
1 18 T.-H., D 15, oil cups.
1 18 King, self-oiler.
1 18 Eddy, M.P., Type G.
1 18 Wagner, M.P.
2 20 Jenney, self-oilers.
1 25 National.
8 25 Western Electric, M.P.
2 30 Commercial, M.P.
1 30 Quaker City, M.P., 6 pole.
1 30 Crocker-Wheeler, M.P.
1 30 General Electric, M.P.
2 30 Westinghouse, M.P.
2 30 Western Electric, M.P.
2 33 Sprague-Lundell, M.P.
1 33 Eddy, M.P.
1 35 Jenney, self-oiler.
1 35 Edison, self-oilers.
1 35 Fisher, M.P.
1 35 C. & C., M.P., enclosed.
1 35 General Electric, M.P.
2 35 Western Elec., M.P.
1 40 Muncie, self-oiler.
3 40 Card, M.P.
1 45 Excelsior, M.P.
2 50 Commercial, M.P.
1 50 Card, M.P.
2 60 Gen. Elec., M.P.
1 65 Wagner, M.P.
1 80 Triumph, M.P.

220 TO 250 VOLT MOTORS

H.P.

1 ¾ Northern, M.P.
1 1 Peerless, enclosed.
4 1 New England, brand new.
1 1 Northern, M.P.
1 1 Western Elec.
1 1 Browning, new.
1 1 Watson, M.P.
4 1½ Sprague-Lundell.
1 2 C. & C.
1 2 Crocker-Wheeler.
1 2 Westinghouse, M.P.
1 2 Bernard, M.P.
1 3 Hartley, M.P.
1 3 Gibbs, multipolar.
2 4 West. Elec., M.P., comp.
1 5 Muncie.
1 5 West. Elec., type G.
1 5 Gen. Elec., M.P., type C.E.
1 5 Browning, M.P., new.
1 5 Belknap, M.P.
2 5 Crocker - Wheeler special printing press motors, direct connected.
2 6 Riker.
1 7½ Eddy, type C.
1 7½ C. & C.
1 7½ Milwaukee, M.P., series, crane type, grease cup.
1 7½ Towle, M.P., new.
1 7½ New England, M. P., new.
1 7½ Towle, M.P., new.
1 8 Holtzer-Cabot.
1 8 Crocker - Wheeler, series crane type.
1 8 Western Electric, M.P., direct connected to Eaton & Prince elevator, complete with controller and drum, very fine, speed 250.
1 10 Eddy, type C.
1 10 Keystone, M.P., enclosed.
1 10 Northern, M.P.
1 10 Westinghouse, M.P.
1 10 Bernard, M.P.
1 15 Keystone, M.P.
1 15 Milwaukee, M.P., [illegible] connected to [illegible]
[illegible]
1 20 [illegible]
1 20 Eddy
1 20 Kester
1 20 Western Electric, M.P.
1 25 Eddy, M.P., type G.
2 25 Western Electric, M.P.
1 30 Western Electric, M.P.
2 40 Bernard, M.P.
1 40 Western Elec., M.P.
1 50 E. & C., multipolar.
1 50 Am. Engine Co., M.P.
1 60 C. & S., self-oiler.
1 60 Maine, M.P.
1 75 Northern, M.P.
1 70 Fuller, multipolar.
1 100 Westinghouse, bipolar.

500 TO 550 VOLT MOTORS

H.P.

2 ½ Browning, new.
¾ Browning, new.
1 1 C. & C.
1 1 Browning, new.
1 1 Towle.
1 1 Holtzer-Cabot.
2 1 New England, new.
1 1½ Northern, M.P.
1 1½ Northern, series.
1 1½ Belknap, self-oiler.
1 2 Watson, self-oiler.
1 2 Browning, new.
2 2 Browning, new.
1 3 T. H., self-oiler.
1 3 Amer. Eng. Co., M.P.
1 3 Westinghouse, M.P.
1 3½ Roth.
1 3½ Roth, M.P.
1 4 Fort Wayne.
1 4 Bernard, M.P.
1 5 Card.
1 5 Browning, M.P.
1 6 Westinghouse, M.P.
1 7½ Roth, self-oiler.
1 7½ Amer. Eng. Co., M.P.
1 7½ Gen. Elec., M.P.
1 7½ Eddy, M.P.
1 10 Eddy, self-oiler, type C.
1 10 Powell, M.P.
2 10 Kester, M.P.
2 10 Belknap, M.P.
1 12 Adams.
2 20 Bernard, M.P.
1 50 Eddy, M.P., type G.
1 75 T. H., type D 62.
1 100 Westinghouse, M.P.
1 125 Siemens & Halske, M.P.

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Quantity.

1 0-50 amp. Weston Standard, portable ammeter, direct current.
1 0-150 volt, Weston Standard portable voltmeter, direct current.
1 0-300 and 0-150 volt Weston Standard No. 4½, portable voltmeter, direct current.
1 0-600 volt Weston Standard, portable voltmeter, brand new, resistance 600 v., coil 69320 ohms, direct.
1 0-60 and 0-120 Weston portable double scale, voltmeter for alt. and direct currents.
1 0-50 and 0-500 double scale Weston standard portable milliammeter, direct current.
1 0-120 volt and 100—0-100 amp. Weston volt-ammeters for automobiles.
1 0-100 amp., Thomson inclined coil, portable ammeter for a. c. or d. c.
1 0-500 volts, Thomson inclined coil, portable voltmeter, for a. c. or d. c.
1 0-150 volts, Queen, portable voltmeter, d. c.
1 0-300 amp., Queen portable ammeter.

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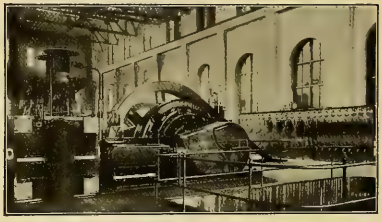

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Write for list of prominent users of Crocker-Wheeler Motors and Generators in and near Chicago.

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THE NEW SEARCH LIGHT REFLECTOR

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YOU CAN CARRY IN STOCK at a very small outlay, a sufficient number of our new X-RAY SECTIONAL TROUGH REFLECTORS to supply all demands immediately, not 10 to 30 days later as formerly. This is only PART of the story.

Our New Pat. Adjustable

WHAT'S YOUR ADDRESS?
We Want To Send Full Information.

National X-RAY Reflector Co.

124-126 Franklin Street, Chicago

Description of switchboard and apparatus displaced by The Columbus Citizens' Telephone Company's automatic equipment, and now offered for sale, in whole or in part.

The switchboard was installed by the Kellogg Switchboard and Supply Company, being completed in April, 1900. It is the full common battery multiple type equipped with fifty-two hundred lines, including fifty-one hundred individual city lines and one hundred rural six-party lines.

There are twenty eight-panel three-position sections. The cabinet work is mahogany. The general appearance is very handsome.

The *instrument equipment* consist of forty hundred and sixty-four wall telephones and twenty two-hundred and thirty-six desk telephones in first-class order.

The *operator's equipment* includes a head telephone with silk cord terminating in a receiver plug, and a switchboard transmitter of latest design suspended from a transmitter arm, adjustable to height and distance. The operator's transmitter battery circuit is opened when plug is removed, preventing waste of current. All necessary induction coils, condensers, etc., are provided and so wired that transmitter current comes from the main exchange battery independent of the cord circuits. The monitor's or chief operator's desk may be connected at will to any operator's circuit.

Keyboard equipment. Each local cord equipment consists of a pair of plugs and cords with a combination listening and ringing key and with two supervisory lamp signals. The plugs are two-conductor, the tip and sleeve insulated by hard rubber bushing. The cords are two-conductor with the best grade of tinsel, well insulated, the whole covered with a double braid, the outer of linen. The keys are of good design, springs of best grade of German silver mounted in a rigid metal frame and insulated with the best quality of hard rubber, all contact points being of platinum.

The supervisory lamp signals consist of twenty-four-volt, one-third-candlepower incandescent lamps, individually mounted on the plug shelf in spring jacks, with good contacts, and easily removed when burned out. Each lamp is under absolute and independent control of the subscriber, into whose jack the corresponding plug is inserted.

Line signals consist of one-hundred-ohm drops. The shuttles are restored by hand.

Answering jacks are of the bridging type. They are in strips of twenty in hard rubber mounting. The springs are of German silver.

The *multiple jacks* are similar in construction to the answering jacks, mounted twenty in a strip. The multiple cabling is neatly arranged in layers so as to facilitate the removal or inspection of jacks and connections.

Two *pilot lamps*, jeweled caps, are provided at each operator's position. The white line pilot lights whenever a subscriber's line lamp is lighted on that position. The red supervisory pilot lights simultaneously with the answering supervisory lamp.

Busy test. When the operator touches the tip of the plug to the ring of the multiple jack when the line is in use, she hears a click in her telephone.

Lighting of switchboard. The front and back of the switchboard are wired for a sufficient number of sixteen-candlepower lamps to thoroughly light the board for operating and making repairs.

Relays. Each supervisory lamp is controlled by a supervisory relay mounted on the back of the corresponding position. The line drop signal for each line is controlled by a line relay mounted in the rear of the board. All relays have German silver springs and platinum contacts and are substantially mounted on steel mounting strips.

Power plant consists of two sets of chloride accumulator storage batteries of four hundred ampere-hour capacity. Each set consists of ten lead-lined tanks of eleven plates each.

Three direct-connected motor generators, manufactured by the Crocker Wheeler Company, are available for charging. The motor is designed to run on a two-hundred-and-twenty-volt direct current circuit. The machines are in first-class order and are complete with starting boxes and field regulators. The ringing machines were made by Roth Brothers & Co. and are in first-class order and complete with starting boxes.

The charging machines are so designed and connected that the batteries may be charged while furnishing current for the exchange, without creating noises in any of the talking circuits.

The power switchboard is of marble, equipped with Weston voltmeters and ammeters and with necessary switches, fuse terminals, circuit breakers, etc., for properly handling all the power apparatus.

Cable terminals. The outside terminals terminate in fifty-nine one-hundred-pair cast-iron terminal heads, made by The Sterling Electric Company. The protection apparatus, heat coils and carbon lightning arrestors are mounted on the side of the castings.

From these terminal heads the line is continued in switchboard cable to a straight cross-connecting rack and from this rack to the switchboard.

The equipment is being dismantled and stored, with all parts arranged for remounting.

Further information furnished prospective purchasers, who should address The Columbus Citizens' Telephone Company, Columbus, Ohio.

Also a nine-position Kellogg toll board designed to work in conjunction with the board described.

One-third the cost of new lamps can be saved by using

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Be up to date. Use them. Write for bulletin giving full particulars.
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Lighting Systems

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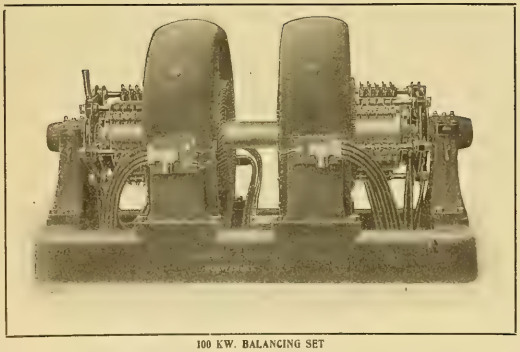
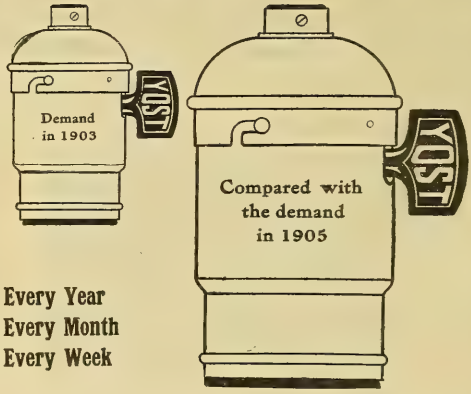


100 KW. BALANCING SET

National Electric Company

Milwaukee



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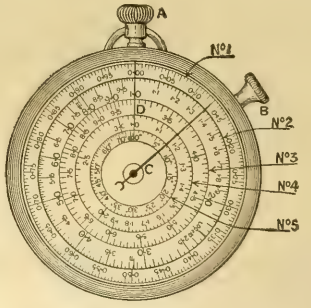

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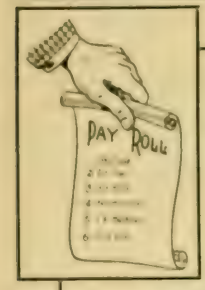

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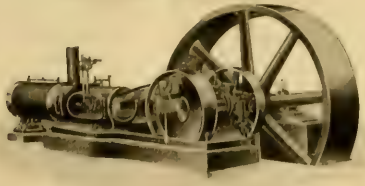

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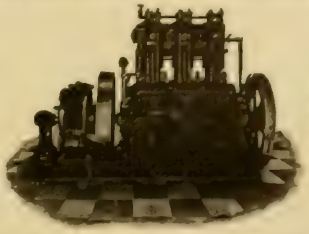

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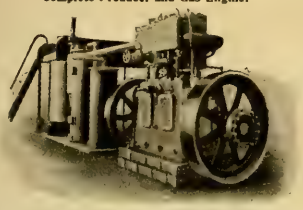

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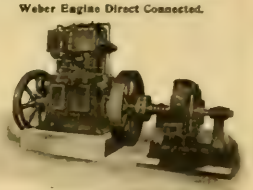

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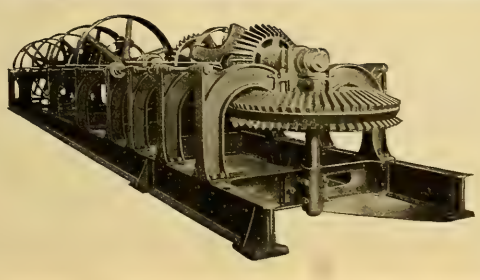

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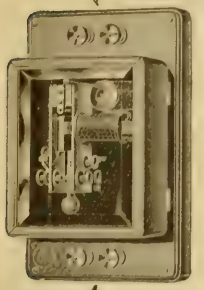

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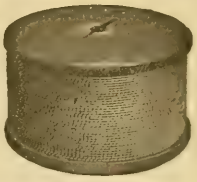

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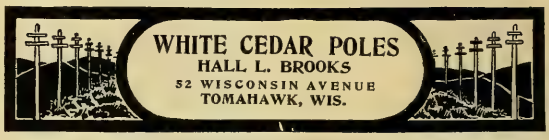

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V	Electromagnets—The Telegraph
VI	Electric Signaling Apparatus
VII	The Relations Between Magnets and Electric Currents
VIII	Induction and Reactive Coils
IX	The Telephone
X	Telephone Accessories
XI	The Mechanical Generation of Electricity
XII	The Dynamo Machine
XIII	Various Types of Dynamo Machines
XIV	Alternators—Polyphase Currents
XV	The Electric Motor
XVI	The Electric Railway
XVII	Polyphase Currents and Motors
XVIII	Electrical Power Transmission
XIX	The Incandescent Light
XX	The Arc Light
XXI	Electrochemistry—Storage Batteries
XXII	Wireless Telegraphy
XXIII	Radiation—X-Rays
XXIV	Recent Theories

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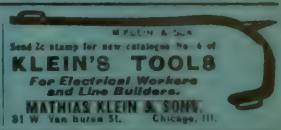

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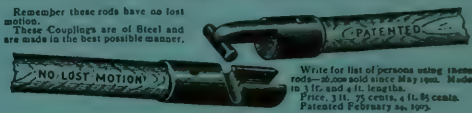

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 8
Alton Machine Co. 4
Allis-Chalmers Company 2
American Battery Co. 13
Amer. Circular Loom Co. 1
American Conduit Co. 22
Amer. District Steam Co. 21
Amer. Elect'l. Supply Co. 18
Amer. El. Telephone Co. 18
American Electrical Works .. 13
Arnold Co., The 10
Automatic Electric Co. 19

Babcock & Wilcox Co. ..... —
Badt, F. B. 10
Bain, Forée & May 13
Baker & Co., Inc. 3
Baker & Co., W. E. 10
Beardslee Chandelier Mfg. Co. 15
Belden Mfg. Co. ..... —
Benton & Son 10
Berthold & Jennings 21
Bissell Co., The F. 4
Bossert Electric Construction Co. 22
Boston Incan. Lamp Co. 4
Bracey-Forse Elec. Cons. Co. 18
Brooks, Hall L. 21
Buckeye Electric Co. ..... —
Buckeye Engine Co. 17
Bull Dog Specialty Co., The 13
Bullock Elec. Mfg. Co. 2
Byllesby & Co., H. M. 10

Carhartt & Co., Hamilton ..... —
Central Electric Co. 5
Century Electric Co. 14
Chicago Edison Co. 4, 14
Chic. Fuse Wire & Mfg. Co. .. 10
Chicago Mica Co. 12
Chicago Pneumatic Tool Co. .. 17
Colonial Sign & Insulator Co. 3
Columbia Incand. Lamp Co. —
Cope, T. J. 1
Copley-Senior Carbon Co. 1
Cornell, T. S. 10
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 5
Crollius & Son, E. R. ..... —
Cutler-Hammer Mfg. Co. 11
Cutter Elec. & Mfg. Company 1

D. & T. Anchor Co. ..... —
D. & W. Fuse Company ..... —
Dearborn Drug & Chem. Wks. 17
Diamond Meter Company 24
Directory of Engineers 10
Dixon Crucible Co., Joseph .. 17
Driver-Harris Wire Co. 3
Duncan Elec. Mfg. Co. 23

Edison Decorative & Miniature Lamp Departm't. 12
Edison Mfg. Company ..... —
Electric Appliance Co. 12
Electric Storage Battery Co.. 3
Elect'l Testing Laboratories. 12
Electrician Pub. Company ... 16

"For Sale" Advertisements .. 14
Ft. Wayne Elec. Works, Inc. .. 23
Fowler & Co., John H. ..... —
Fres-Ko Chemical Co. 15

Galloway Co., J. B. 21
General Electric Co. 11, 12
General Elec. Securities Co. .. 10
General Storage Battery Co. .. 12
Gest, G. M. 22
Gould Storage Battery Co. 6
Gregory Electric Co. 14
Haller Machine Co. ..... —
Hart Mfg. Co. 14
Hartford Steam Boiler Inspection & Insurance Co. .... —
Hazard Manufacturing Co. .... —
Hensel & Co., John A. 8
Highland Park College. 10
Hoffman, G. W. 22
Holmes Fibre-Graph. Co. ..... —
Holophane Glass Co. 9
Humphrey, Henry H. 10
Hunt & Co., Robt. W. 10

Illinois Central Ry. 21
Incandescent Electric Light Manipulator Company ..... —
Indiana Rub. & Ins. W. Co. 1
India Rubber & Gutta Percha Insulating Company ..... —
International Elec. Meter Co. 12
International Tel. Mfg. Co. .. 18

Jackson, D. C. & W. B. 10
Jandus Electric Co. ..... —
Jeffrey Manufacturing Co. 17
Johns-Manville Co., H. W. 4

Kartavert Manufacturing Co. —
Kellogg Switchboard & Supply Company 19, 21
Klein & Sons, Mathias 1
Kohler Brothers 10
Kuhlemeyer, John 24
Kuhlman Electric Co. 14

La Fayette Elect'l Mfg. Co. .—
Leather Preserv. M. Corp. .... —
Leffel & Co., James 17
Lindsley-Bauman Co. 21
Loud's Sons Co., H. M. 20

Machado & Roller ..... —
Maine Hub Mfg. Co. 20
Manhattan El. Supply Co. 1
Marinette Gas Engine Co. 13
Matthews & Bros., W. N. .. 3, 13
McCandless, H. W. & Co. 14
M'Glehan & Co., C. H. 8
McLennan & Company, K. 12
McLeod, Ward & Co. 1
McRoy Clay Works 22
Merriam Co., G. & C. 14
Mica Insulator Company 12
Milwaukee Engineering Co. .. 10
Miscellaneous Advs. 14
Monarch Elec. Mfg. Co 15
Monon R. R. 21
Mott Iron Wks., J. L. 14
Mueller Company, William .. 21
Munsell & Co., Eugene 12

National Battery Co. 8
National Carbon Co. 10
National Electric Co. 11
National India Rubber Co. 1
Nat'l. X Ray Reflector Co. .. 15
New Idea Soldering Paste Co. 14
New York Ins. Wire Co. 18
Northern Elect'l Mfg. Co. 14
Northern Pacific R. R. 20

Okonite Co., The 1
Oneida Community, Ltd. ..... —
Osburn Flex. Conduit Co. 1
Otto Gas Engine Works. 17

Pacific Coast Pole Co. 20
Parsell & Weed ..... —
Patrick Co., R. M. 7
Peru Elec. Mfg. Co. 7
Phillips, Eugene F. 13
Phillips Insulated Wire Co. .. 12
Phoenix Glass Co. ..... —
Phosphor-Bronze S. Co. 17
Pignolet, L. M. 12
Pillsbury-Watkins Co. 20
Pittsburg & L. S. Iron Co. .. 21
Plume & Atwood Mfg. Co. .... —
Porter Cedar Company 20

Rail Joint Co., The 12
Reisinger, Hugo 7
Replogle Governor Works. .. —
Reynolds El. Flasher Mfg. Co. 13
Robbins & Myers Co. 14
Robert Instrument Co., The .—
Robertson & Sons, Jas. L. 14
Rock Island Battery Co 7
Roebling's Sons Co., J. A. 23
Ruebel & Wells 10

Safety Ins. Wire & Cable Co .. 24
St. Marys Incan. Lamp Co. .... —
Samson Cordage Works 13
Sandwich Pole Changer Co. .... —
Sargent & Lundy ..... —
Schott, W. H. 10
Schureman Co., J. L. 13
Simplex Electrical Co., The .. 1
Simplex Elec. Heating Co. 12
Smith Storage Battery Co. .... —
Speer Carbon Co. ..... —
Spon & Chamberlain ..... —
Standard Elect'l. Mfg. Co. .... —
Standard Underg. Cable Co. .... —
Stanley—G. I. Elec. Mfg. Co. —
Star Expansion Bolt Co. 13
Sterling & Son, W. C. 21
Stevens & Co., Milo B. ..... —
Stow Mfg. Company ..... —
Stromberg-Carlson Tel. Mfg. Company 18
Swedish-American Tel. Co. .. 19

Telephone Woodworking Co. 18
Torrey Cedar Company 20
Trumbull Elec. Mfg. Co. 15
Turner Brass Works 13

Underhill, Chas. R. 10
Universal Elec. Stor. Bat. Co. 8

Van Nostrand Co., D. ..... —
Vought-Berger Co. ..... —
Vulcanized Fibre Company .. 24

Wagner Electric Mfg. Co. 24
Wagor Mfg. Co., P. R. ..... —
Weber Gas & Gasoline Engine Co. 17
Wesco Supply Co. 12
Western Electric Company .. 5
Western Lumber & Pole Co. .. 21
Westinghouse Electric & Manufacturing Co. 23
Westinghouse Machine Co. .... —
Weston Electrical Inst. Co. 1
Willard Storage Bat. Co. 8
Willis, G. M. 10
Wilson Co., Jas. L. M. 21
Worcester Company, C. H. 20
Wrigley Co., Thos. ..... —

Yost Electric Mfg. Co. 24

Zeller Geo. A. Book Co. ..... —

For Classified Index of Advertisements See Page 6.

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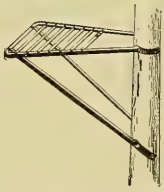

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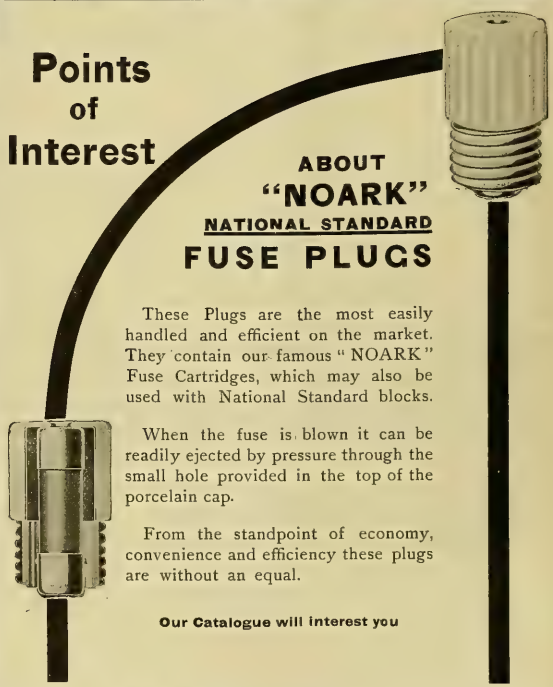

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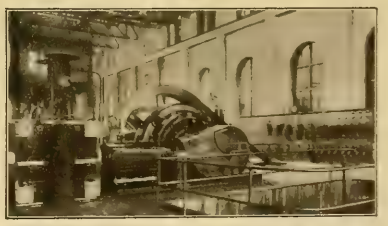

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjustors, Cord.
Incandes. El. Lt. Manip. Co.

Adjusters, Inc. Lamps.
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Anchors (Tel. & Tel.)
D. & T. Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
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Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
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Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works.

Boiler Compounds.
Dearborn Drug & Chem. Wks.

Boilers.
Babcock & Wilcox Co.
Brownell Co., The

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

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Van Nostrand Co., D.
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Brushes.
Central Electric Co.
Copley-Senior Carbon Co.
Holmes Fibre-Graphite Co.
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Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
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Cabling Machinery.
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Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
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Coils and Magnets.
Underhill, Chas. R.
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Commutator Compound.
Crollius & Son, E. R.
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American Circular Loom Co.
American Conduit Company
Central Electric Co.
Electric Appliance Co.
Gest. G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McRoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest. G. M.

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Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Bracey-Foree Elec. Cons. Co.
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Northern Electrical Mfg. Co.
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Controllers.
Cutler-Hammer Mfg. Co.
Schureman, Co., J. L.

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Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Galloway Co., J. B.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
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Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
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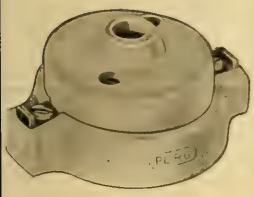

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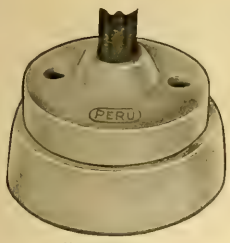

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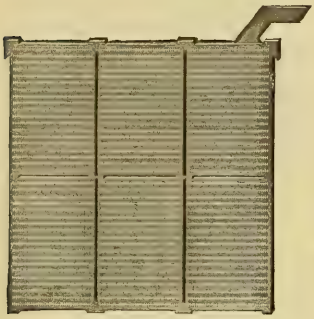

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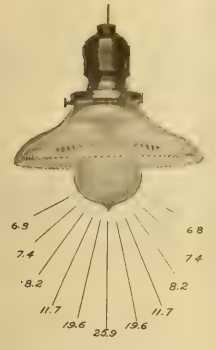

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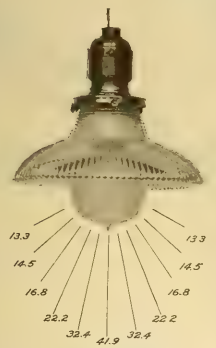

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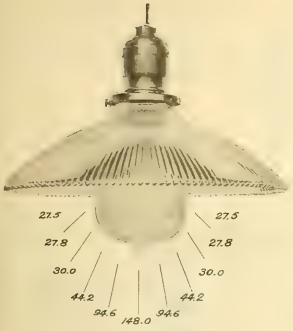

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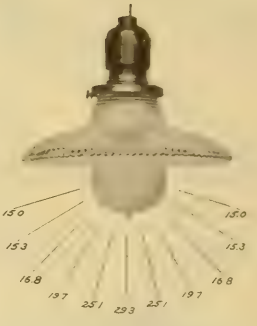

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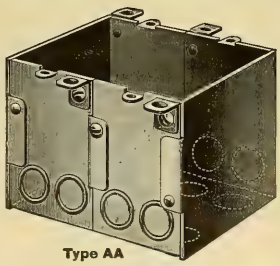
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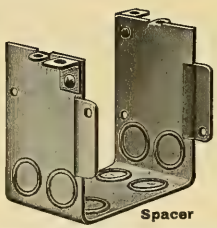
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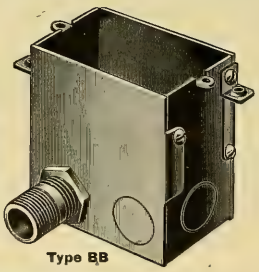
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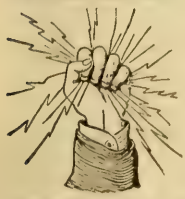

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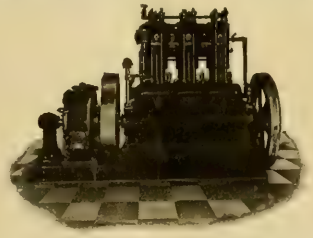

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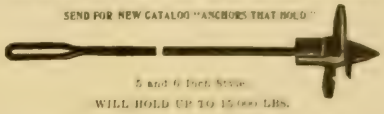

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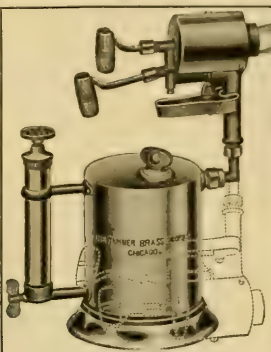

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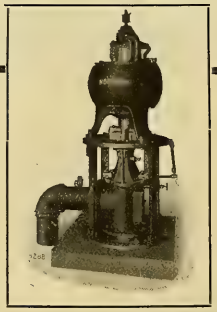

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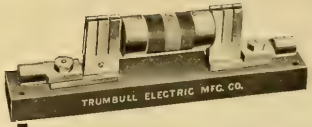

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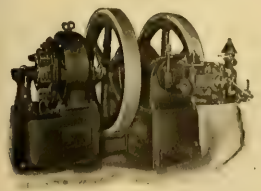

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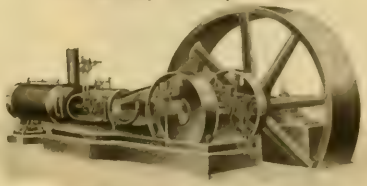

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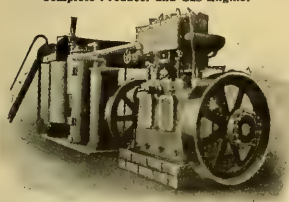

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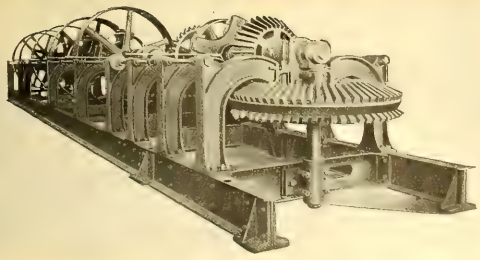

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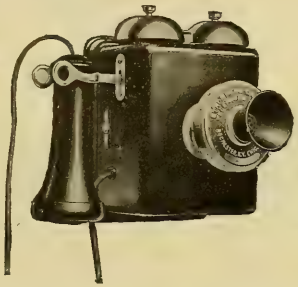

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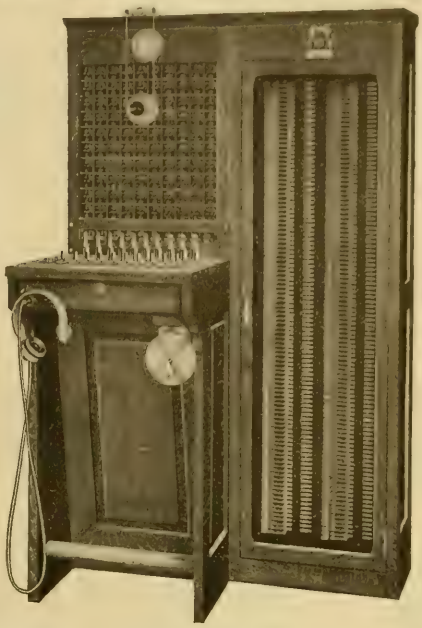

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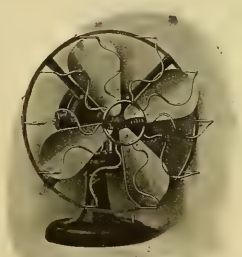

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CONTENTS

CHAPTER
Preface
I The Electric Current
II The Electric Battery
III The Effects of Electric Flow in the Circuit—Heat and Chemical Action
IV The Effects of Electric Flow Outside the Circuit—Magnetism and Induction—The Electrical Units
V Electromagnets—The Telegraph
VI Electric Signaling Apparatus
VII The Relations Between Magnets and Electric Currents
VIII Induction and Reactive Coils
IX The Telephone
X Telephone Accessories
XI The Mechanical Generation of Electricity
XII The Dynamo Machine
XIII Various Types of Dynamo Machines
XIV Alternators—Polyphase Currents
XV The Electric Motor
XVI The Electric Railway
XVII Polyphase Currents and Motors
XVIII Electrical Power Transmission
XIX The Incandescent Light
XX The Arc Light
XXI Electrochemistry—Storage Batteries
XXII Wireless Telegraphy
XXIII Radiation—X-Rays
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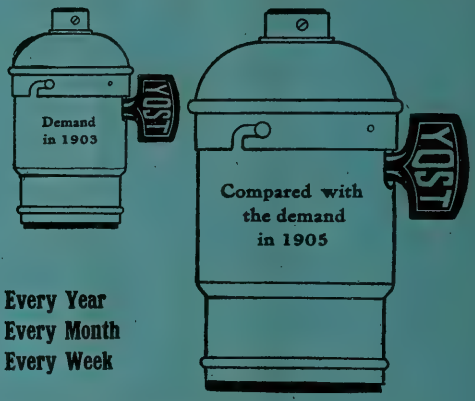

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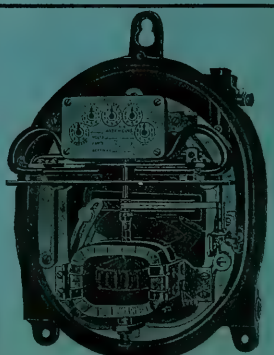

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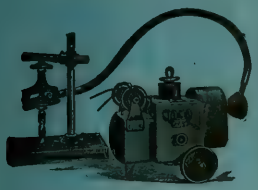

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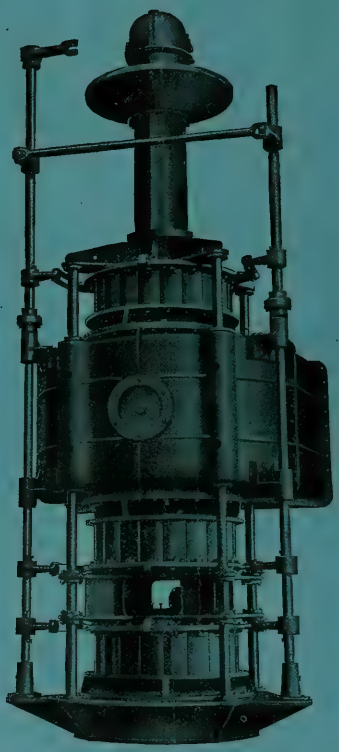

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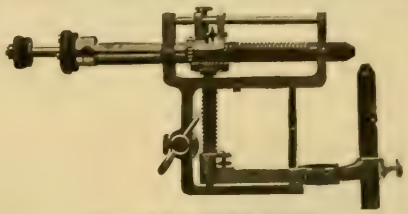

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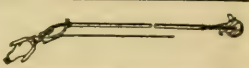

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 24
Alton Machine Co. 4
Allis-Chalmers Company 2
American Battery Co. ..... —
Amer. Circular Loom Co. 1
American Conduit Co. 18
Amer. District Steam Co. 20
Amer. Elect'l. Supply Co. 15
Amer. El. Telephone Co. 19
American Electrical Works .. 13
Arnold Co., The 10
Automatic Electric Co. 18

Babcock & Wilcox Co. 21
Badt, F. B. 10
Bain, Forée & May ..... —
Baker & Co., Inc. 3
Baker & Co., W. E. 10
Beardslee Chandelier Mfg. Co. —
Belden Mfg. Co. 13
Benton & Son ..... —
Berthold & Jennings 20
Bissell Co., The F. 5
Bossert Electric Construction Co. 15
Boston Incan. Lamp Co. ..... —
Bracey-Forse Elec. Cons. Co. —
Brooks, Hall L. 21
Buckeye Electric Co. 17
Buckeye Engine Co. ..... —
Bull Dog Specialty Co., The 14
Bullock Elec. Mfg. Co. 2
Bylesby & Co., H. M. 10

Central Electric Co. 5
Century Electric Co. 13
Chicago Edison Co. 4, 14
Chic. Fuse Wire & Mfg. Co. .. —
Chicago Mica Co. 12
Chicago Pneumatic Tool Co. .. 15
Columbia Incand. Lamp Co. —
Cope, T. J. 19
Copley-Senior Carbon Co. 12
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 8
Crollius & Son, E. R. 13
Cutler-Hammer Mfg. Co. 8
Cutter Elec. & Mfg. Company —

D. & T. Anchor Co. 6
D. & W. Fuse Company ..... —
Dearborn Drug & Chem. Wks. 17
Diamond Meter Company .... —
Directory of Engineers 10
Dixon Crucible Co., Joseph .. 17
Duncan Elec. Mfg. Co. 23

Edison Decorative & Miniature Lamp Departm't. 12
Edison Mfg. Company 14
Electric Appliance Co. 12
Electric Storage Battery Co. . 3
Elect'l Testing Laboratories. 12
Electrician Pub. Company ... 16

"For Sale" Advertisements .. 14
Ft. Wayne Elec. Works, Inc. .23
Fowler & Co., John H. 21
Fox, Arthur W. 3
Fres-Ko Chemical Co. ..... —

Galloway Co., J. B. 20
General Electric Co. 11, 12
General Storage Battery Co. .12
Gest, G. M. 18
Gould Storage Battery Co. .... —
Gregory Electric Co. 14

Haller Machine Co. ..... —
Hart Mfg. Co. 8
Hartford Steam Boiler Inspection & Insurance Co. 14
Hazard Manufacturing Co. ...24
Hensel & Co., John A. ..... —
Highland Park College. 10
Hoffman, G. W. 14
Holmes Fibre-Graph. Co. 20
Holophane Glass Co. 9
Humphrey, Henry H. 10
Hunt & Co., Robt. W. 10

Illinois Central Ry. 21
Incandescent Electric Light Manipulator Company 3
Indiana Rub. & Ins. W. Co. 1
India Rubber & Gutta Percha Insulating Company 7
International Elec. Meter Co. 24
International Tel. Mfg. Co. ...19

Jackson, D. C. & W. B. 10
Jeffrey Manufacturing Co. 17
Johns-Manville Co., H. W. .... —

Kartavert Manufacturing Co. 24
Kellogg Switchboard & Supply Company 19, 21
Klein & Sons, Mathias 13
Kohler Brothers 10
Kuhlemeyer, John 24
Kuhlman Electric Co. 1

La Fayette Elect'l Mfg. Co. ..12
Leather Preserv. M. Corp. 17
Leffel & Co., James 17
Lindsley-Bauman Co. 21
Loud's Sons Co., H. M. 20

Machado & Roller 7
Maine Hub Mfg. Co. ..... —
Manhattan El. Supply Co. 13
Marinette Gas Engine Co. 17
Matthews & Bros., W. N. ...7, 13
McCandless, H. W. & Co. 12
M'Glehan & Co., C. H. 13
McLennan & Company, K. 12
McLeod, Ward & Co. 3
McRoy Clay Works 18
Merriam Co., G. & C. 21
Mica Insulator Company 12
Milwaukee Engineering Co. ..10
Miscellaneous Advs. 14
Monarch Elec. Mfg. Co. ..... —
Monon R. R. ..... —
Mott Iron Wks., J. L. 13
Mueller Company, William .. 21
Munsell & Co., Eugene 12

National Battery Co. 4
National Carbon Co. 12
National Electric Co. 24
National India Rubber Co. .... —
Nat'l. X Ray Reflector Co. ... —
New Idea Soldering Paste Co. 14
New York Ins. Wire Co. 15
Northern Elect'l Mfg. Co. 13

Okonite Co., The 1
Onelda Community, Ltd. 1
Osburn Flex. Conduit Co. 18
Otto Gas Engine Works. ..... —

Pacific Coast Pole Co. 20
Parsell & Weed ..... —
Peru Elec. Mfg. Co. ..... —
Phillips, Eugene F. 13
Phillips Insulated Wire Co. ..13
Phœnix Glass Co. 1
Phosphor-Bronze S. Co. 17
Pignolet, L. M. 12
Pillsbury-Watkins Co. 20
Pittsburg & L. S. Iron Co. 21
Plume & Atwood Mfg. Co. 1
Porter Cedar Company 20

Rail Joint Co., The 3
Reisinger, Hugo ..... —
Replogle Governor Works .. 1
Reynolds El. Flasher Mfg. Co. 3
Robbins & Myers Co. 19
Robert Instrument Co., The. .13
Robertson & Sons, Jas. L. .... —
Rock Island Battery Co. 5
Roebling's Sons Co., J. A. 24
Ruebel & Wells 10

Safety Ins. Wire & Cable Co. . 1
St. Marys Incan. Lamp Co. ....—
Samson Cordage Works. 13
Sandwich Pole Changer Co. .. 18
Sargent & Lundy ..... —
Schott, W. H. 10
Schureman Co., J. L. 12
Simplex Electrical Co., The. . 1
Simplex Elec. Heating Co. 13
Smith Storage Battery Co. . . 4
Speer Carbon Co. 15
Spon & Chamberlain ..... —
Standard Elect'l. Mfg. Co. ..10
Standard Underg. Cable Co. .. 1
Stanley—G. I. Elec. Mfg. Co. 7
Star Expansion Bolt Co. 14
Sterling & Son, W. C. 21
Stow Mfg. Company 1
Stromberg-Carlson Tel. Mfg Company 19

Telephone Woodworking Co. 19
Torrey Cedar Company. . . . 20
Trumbull Elec. Mfg. Co. 8
Turner Brass Works ..... —

Underhill, Chas. R. 10
Universal Elec. Stor. Bat. Co. 4

Van Nostrand Co., D. ..... —
Vought-Berger Co. ..... —
Vulcanized Fibre Company .. 24

Wagner Electric Mfg. Co. ..... —
Wagor Mfg. Co., P. R. 1
Weber Gas & Gasoline Engine Co. 17
Wesco Supply Co. ..... —
Western Electric Company . 10
Western Lumber & Pole Co. . 21
Westinghouse Electric & Manufacturing Co. 22
Westinghouse Machine Co. ...22
Weston Electrical Inst. Co. .. 1
Willard Storage Bat. Co. ..... —
Willis, G. M. 10
Wilson, Co., Jas. I. M. 21
Worcester Company, C. H. ...20
Wrigley Co., Thos. 12

Yost Electric Mfg. Co. 10

Zeller Geo. A. Book Co. ..... —

For Classified Index of Advertisements See Page 6.

Motors,
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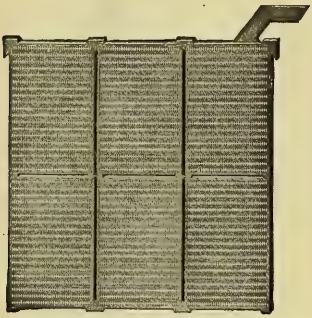

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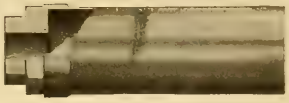

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CLASSIFIED INDEX OF ADVERTISEMENTS.

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Incandes. El. Lt. Manip. Co.

Adjusters, Inc. Lamps.
Inc. El. Lt. Manipulator Co.

Anchors (Tel. & Tel.)
D. & T. Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Arc Lamps, Stereopticon.
Fox, Arthur W.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works.

Boiler Compounds.
Dearborn Drug & Chem. Wks.

Boilers.
Babcock & Wilcox Co.
Brownell Co., The

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Copley-Senior Carbon Co.
Holmes Fibre-Graphite Co.
Western Electric Company.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
National Electric Co.
Parsell & Weed

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clusters.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Underhill, Chas. R.
Western Electric Co.

Commutator Compound.
Crolius & Son, E. R.
Fres-Ko Chemical Co.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduit and Conduits.
American Circular Loom Co.
American Conduit Company
Central Electric Co.
Electric Appliance Co.
Gest, G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McRoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Bracey-Force Elec. Cons. Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman, Co., J. L.

Cord.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Galloway Co., J. B.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Dictionaries.
Merriam Co., G. & L.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.

Dynamos and Motors.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Parsell & Weed.
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Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Byllesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Jackson, D. C. & W. B.
Kohler Brothers.
Milwaukee Engineering Co.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Underhill, Chas. R.
Willis, G. M.

Electrical Instruments.
(Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
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Allis-Chalmers Company.

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Otto Gas Engine Works.
Weber Gas & Gasoline Engine Co.
Westinghouse Machine Co.

Engines, Steam.
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Buckeye Engine Co.
Westinghouse Machine Co.

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Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Plume & Atwood Mfg. Co.

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Kuhlemeyer, John

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Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

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Stow Mfg. Co.

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D. & W. Fuse Company.
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Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
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Holophane Glass Co.
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Phoenix Glass Co.
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Chicago Edison Co.
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Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
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Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
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Westinghouse El. & Mfg. Co.

Iron Castings.
Alton Machine Co.

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Wagor Mfg. Co., P. R.

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Klein & Sons, Mathias.

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(See Wires and Cables.)

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Mica Insulator Co.
Munsell & Co., Eugene.

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(See Cut-outs and Switches.)

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(See Bolts, Toggle.)

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Phillips, Eugene F.
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Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
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Wesco Supply Co.
Western Electric Company.

Woodwork, Telephonic.
Telephone Woodworking Co

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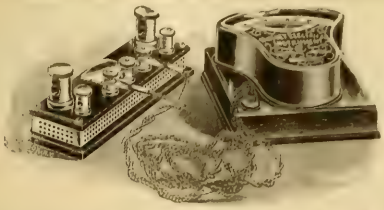

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The Stanley-G. I. Electric Mfg. Co. is a consolidation of the Stanley Electric Mfg. Company of Pittsfield and the General Incandescent Arc Light Company of New York. The Stanley Company's product, marketed under the well-known trade name of the S. K. C. System, comprises Generators, Transformers, Rotary Converters, Motor Generator Sets, Switchboard Apparatus, Induction Motors, etc. The General Incandescent Arc Light Company has been favorably known as builder of the high-grade G. I. Arc Lamps, Arc Lamp Regulators, Incandescent Lamps, alternating current and direct current Motors, General and Special Electrical Supplies.

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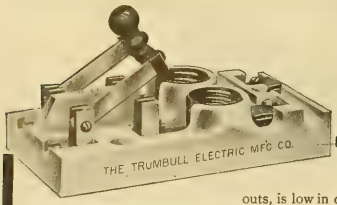

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A distributing board built with Trumbull Panel Cut-outs, is low in cost and neat in appearance.

It occupies less space and costs much less than the panel board, yet, gives exactly the same service.

When rough wiring the circuits are run into the usual distributing box, and when finishing up the Panel Cut-outs are fastened in and connected up.

Carry a few in stock, and the panel board question will never worry you.

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This Trade-Mark guarantees quality.

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we will send you a
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Every lighting man should have one.

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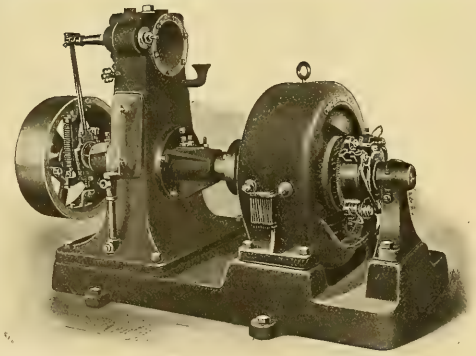

C-W Direct Connected Lighting Set. Capacity, 67 Sixteen-Candlepower Lights.

Supplied from a **C-W GENERATOR** means **ECONOMY** in **LIGHTING.**

Our Generators are simple in design, rugged, reliable and do not require the attention of an electrical expert.

Outputs from 27 sixteen-candlepower lights up.

For complete information send for Bulletin 55 W. E.

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Bulletin 93 gives capacities and prices.

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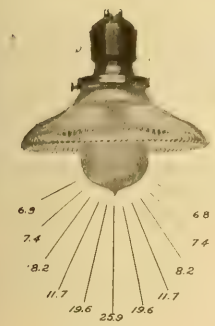
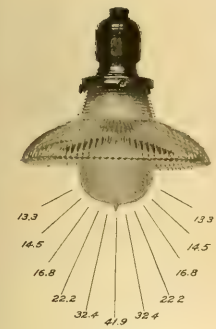


No. 2665
With 8 C. P. Frosted Lamp. Also for use with 10 C. P. Lamp.



No. 2662
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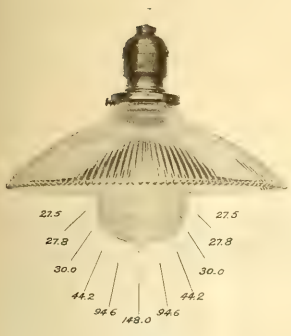

No. 2570
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NEW Pagoda Reflectors

FOR

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Obtain the best results possible from your small size lamps as well as from the large size.

Whether you desire one or the other, the Holophane-Pagoda Reflector, used properly, as shown in these illustrations, will give you the most efficient and altogether best results.

Photometric Tests made by the Electrical Testing Laboratories of New York.

Write for our Discount on Broken and Standard Packages, also our Illustrated Catalog.

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Reflector Number	Height	Width	Dozen in Standard Package	List Price Per Dozen
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2661	5 1/2 "	2 3/8 "	8	9.00
2662	6 1/2 "	2 3/4 "	7	9.00
2664	6 3/4 "	2 1/4 "	7	9.00
2570	9 1/2 "	3 1/4 "	3	18.00
2684	8 1/2 "	2 3/8 "	4	16.00

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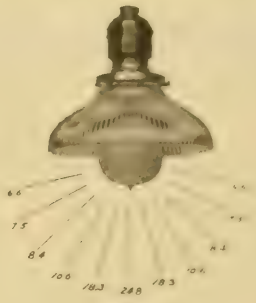

No. 2661
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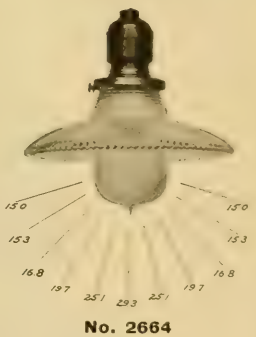

No. 2664
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With 32 C. P. Frosted Lamp.

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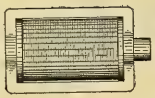

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with carbons tied together
Lamps will not burn out

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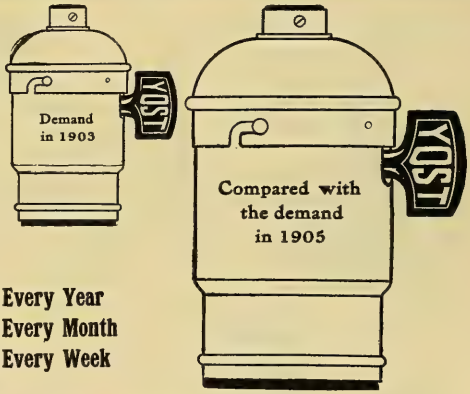

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TOLEDO, OHIO

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STANDARD ELECTRICAL MFG. CO., NILES, O.

General Electric Company

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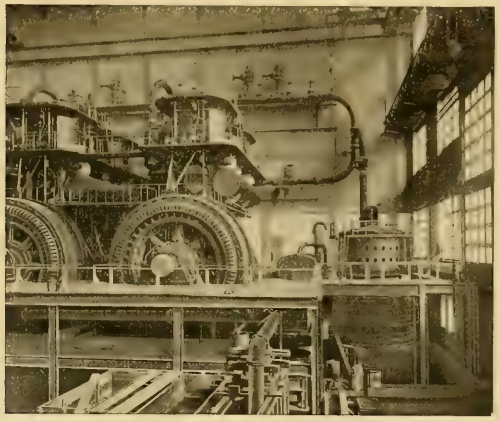
An instructive object lesson on the saving of space in a large installation



5,000 Kw. Curtis Turbine Alternator and 3,500 Kw. Engine-Driven Alternators in the Waterside Station of the New York Edison Company.

At The Left the steam engine driven units have a normal rating of 3,500 kilowatts at 75 revolutions.

At The Right is a Curtis steam turbine driving a 5,000 kilowatt generator at 500 revolutions.

This turbine was put in commercial service in October, 1904, and three more machines of the same capacity are now being installed in this station.

714

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For ornamental fixtures and sign and decorative lighting. Can be used in regular Edison sockets with our candelabra socket adapter.

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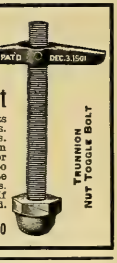

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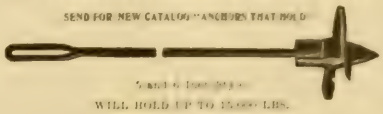

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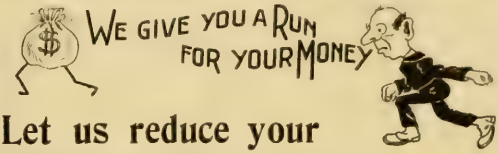

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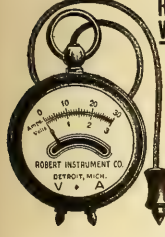

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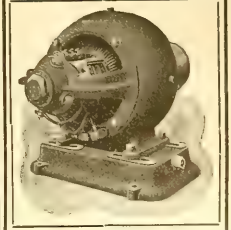

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PREDOMINATES
IN
27 States

"It gives me great pleasure to state, that for 'Giftherecitiveness' your periodical certainly is a winner. As you perhaps are aware, the company I travel for, advertises in all the electrical papers, and it has been a question in my mind whether they reached every central station, as their advertising manager would have our company believe. So, for one year I have kept account of the electrical papers and periodicals subscribed for and received by the manager or superintendent of electric light companies in twenty-seven states, (which has been my territory), and in summing it up, I find that your periodical predominates, three to one. I do not get in many telephone plants, but when I do, I invariably find the 'Western Electrician' staring me in the face."

The letter from which the above is taken, is dated May 8, 1905, and is on file in this office.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

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Electric Light and Water in town of				2,000
"	"	"	"	1,800
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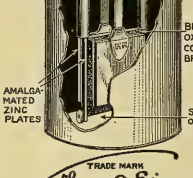

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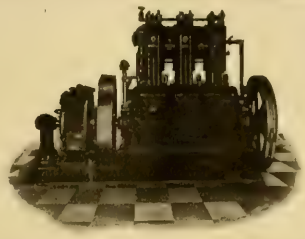

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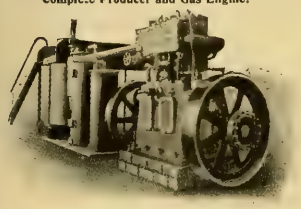

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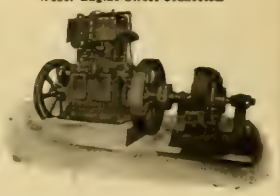

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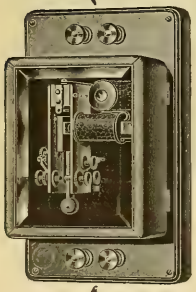

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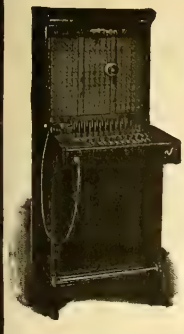

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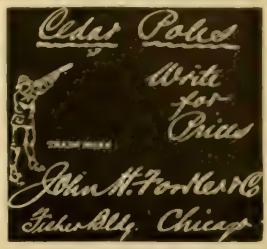

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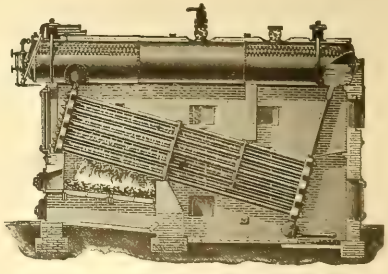

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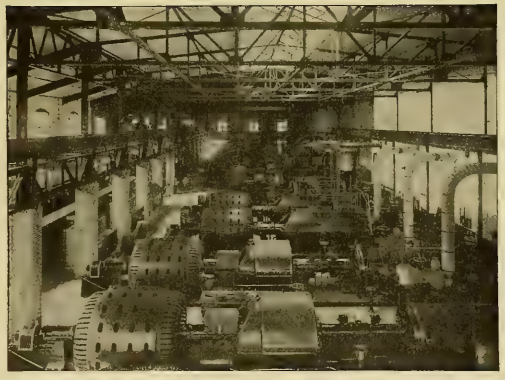

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CONTENTS

CHAPTER
Preface
I The Electric Current
II The Electric Battery
III The Effects of Electric Flow in the Circuit—Heat and Chemical Action
IV The Effects of Electric Flow Outside the Circuit—Magnetism and Induction—The Electrical Units
V Electromagnets—The Telegraph
VI Electric Signaling Apparatus
VII The Relations Between Magnets and Electric Currents
VIII Induction and Reactive Coils
IX The Telephone
X Telephone Accessories
XI The Mechanical Generation of Electricity
XII The Dynamo Machine
XIII Various Types of Dynamo Machines
XIV Alternators—Polyphase Currents
XV The Electric Motor
XVI The Electric Railway
XVII Polyphase Currents and Motors
XVIII Electrical Power Transmission
XIX The Incandescent Light
XX The Arc Light
XXI Electrochemistry—Storage Batteries
XXII Wireless Telegraphy
XXIII Radiation—X-Rays
XXIV Recent Theories

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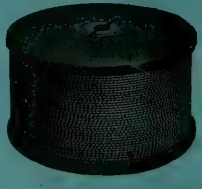

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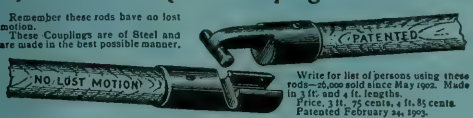

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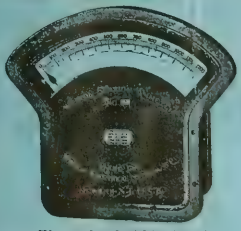

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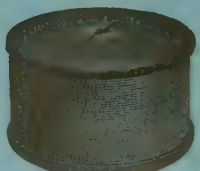

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 8
Aiton Machine Co. 4
Allis-Chalmers Company 2
American Battery Co. 11
Amer. Circular Loom Co. 1
American Conduit Co. 16
American Diesel Engine Co. 15
Amer. District Steam Co. 14
Amer. Elect'l. Supply Co. 7
Amer. El. Telephone Co. 17
American Electrical Works. 11
Arnold Co., The 14
Automatic Electric Co. 16

Babcock & Wilcox Co. ..... —
Badt, F. B. 14
Bain, Forée & May 11
Baker & Co., Inc. 3
Baker & Co., W. E. 14
Beardsley Chandelier Mfg. Co. —
Belden Mfg. Co. ..... —
Benton & Son 13
Berthold & Jennings 18
Bissell Co., The F. 4
Bossert Electric Construction Co. 12
Boston Incan. Lamp Co. ..... —
Bracey-Forse Elec. Cons. Co. 13
Brooks, Hall L. 18
Buckeye Electric Co. ..... —
Buckeye Engine Co. 14
Bull Dog Specialty Co., The —
Bullock Elec. Mfg. Co. 2
Butterfield Construction Co. 14
Byllesby & Co., H. M. 14

Central Electric Co. 5
Century Electric Co. 12
Chicago Edison Co. 4, 12
Chic. Fuse Wire & Mfg. Co. ..11
Chicago Mica Co. 10
Chicago Pneumatic Tool Co. 12
Columbia Incand. Lamp Co. —
Cope, T. J. 1
Copley-Senior Carbon Co. ..13
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 5
Crollius & Son, E. R. ..... —
Cutler-Hammer Mfg. Co. 5
Cutter Elec. & Mfg. Company 1

D. & T. Anchor Co. ..... —
D. & W. Fuse Company ..... —
Dearborn Drug & Chem. Wks. 15
Diamond Meter Company 22
Directory of Engineers 14
Dixon Crucible Co., Joseph. .15
Duncan Elec. Mfg. Co. 21

Edison Decorative & Miniature Lamp Departm't. 10
Edison Mfg. Company ..... —
Electric Appliance Co. 10
Electric Storage Battery Co. 3
Elect'l Testing Laboratories. 10
Electrician Pub. Company ...21

"For Sale" Advertisements. .12
Ft. Wayne Elec. Works, Inc. .21
Fowler & Co., John H. ..... —

Galloway Co., J. B. 19
General Electric Co. 9, 10
General Storage Battery Co. .10
Gest, G. M. 1
Gould Storage Battery Co. 6
Gregory Electric Co. 12

Haller Machine Co. 22
Hart Mfg. Co. 10
Hartford Steam Boiler Inspection & Insurance Co. .... —
Hazard Manufacturing Co. .... —
Hensel & Co., John A. 8
Highland Park College. 14
Hoffman, G. W. 12
Hoffmann, Emil R. 10
Holmes Fibre-Graph Co. ..... —
Holophane Glass Co. 22
Humphrey, Henry H. 14
Hunt & Co., Robt. W. 14

Illinois Central Ry. 19
Incandescent Electric Light Manipulator Company ..... —
Indiana Rub. & Ins. W. Co. 1
India Rubber & Gutta Percha Insulating Company ..... —
International Elec. Meter Co. 7
International Tel. Mfg. Co. ...17

Jackson, D. C. & W. B. 14
Jeffrey Manufacturing Co. 15
Johns-Manville Co., H. W. .... —

Kartavert Manufacturing Co. —
Kellogg Switchboard & Supply Company 17, 18
Klein & Sons, Mathias 10
Kohler Brothers 14
Kuhlemeyer, John 13
Kuhlman Electric Co. 11

La Fayette Elect'l Mfg. Co. —
Leather Preserv. M. Corp. .... —
Leffel & Co., James 15
Lindsley-Bauman Co. 18
Loud's Sons Co., H. M. 19

Machado & Roller ..... —
Maine Hub Mfg. Co. 19
Manhattan El. Supply Co. 11
Marinette Gas Engine Co. 14
Matthews & Bros., W. N. 3
McCandless, H. W. & Co. 12
M'Glehan & Co., C. H. 8
McLennan & Company, K. 10
McLeod, Ward & Co. 7
McRoy Clay Works 10
Mica Insulator Company 10
Milwaukee Engineering Co. ..14
Miscellaneous Advs. 12
Monarch Elec. Mfg. Co 13
Monon R. R. 12
Mott Iron Wks., J. L. 11
Mueller Company, William. .19
Munsell & Co., Eugene 10

National Battery Co. 8
National Carbon Co. 4
National Electric Co. 4
National India Rubber Co. 1
Nat'l. X Ray Reflector Co. .... —
New Idea Soldering Paste Co. 13
New York Ins. Wire Co. 1
Northern Elect'l Mfg. Co. 12

Okonite Co., The 1
Oneida Community, Ltd. ..... —
Osburn Flex. Conduit Co. 16
Otto Gas Engine Works. 15

Pacific Coast Pole Co. 18
Parsell & Weed ..... —
Peru Elec. Mfg. Co. 9
Phillips, Eugene F. 11
Phillips Insulated Wire Co. ..11
Phoenix Glass Co. ..... —
Phosphor-Bronze S. Co. 15
Pignolet, L. M. 10
Pillsbury-Watkins Co. 18
Pittsburg & L. S. Iron Co. 19
Plume & Atwood Mfg. Co. .... —
Porter Cedar Company 18
Prenner, I. S. 12

Rail Joint Co., The 3
Reisinger, Hugo 7
Replogle Governor Works. .. —
Reynolds El. Flasher Mfg. Co. 1
Robbins & Myers Co. 12
Robert Instrument Co., The. —
Robertson & Sons, Jas. L. 12
Rock Island Battery Co ..... —
Roebling's Sons Co., J. A. 1
Ruebel & Wells 14

Safety Ins. Wire & Cable Co. .22
Samson Cordage Works 13
Sandwich Pole Changer Co. —
Sargent & Lundy 14
Schott, W. H. 14
Schureman Co., J. L. 3
Simplex Electrical Co., The. 1
Simplex Elec. Heating Co. 12
Smith Storage Battery Co. .... —
Sorensen, P. 11
Speer Carbon Co. ..... —
Spon & Chamberlain 16
Standard Elect'l. Mfg. Co. .... —
Standard Underg. Cable Co. .... —
Stanley—G. I. Elec. Mfg. Co. —
Star Expansion Bolt Co. 1
Sterling & Son, W. C. 18
Stewart Elec. Co., Frank H. 3
Stow Mfg. Company ..... —
Stromberg-Carlson Tel. Mfg Company 17

Telephone Woodworking Co. 17
Torrey Cedar Company 18
Trumbull Elec. Mfg. Co. 11
Turner Brass Works 9

Underhill, Chas. R. 14
Universal Elec. Stor. Bat. Co. 8

Van Nostrand Co., D. ..... —
Vought-Berger Co. ..... —
Vulcanized Fibre Company. .22

Wagner Electric Mfg. Co. 9
Wagor Mfg. Co., P. R. ..... —
Weber Gas & Gasoline Engine Co. 15
Wesco Supply Co. 10
Western Electric Company ...7
Western Lumber & Pole Co. 18
Westinghouse Electric & Manufacturing Co. 19
Westinghouse Machine Co. ...20
Weston Electrical Inst. Co. ... 1
Willard Storage Bat. Co. 8
Williamson & Co., R. 7
Willis, G. M. 14
Wilson Co., Jas. I. M. 18
Worcester Company, C. H. ...18
Wrigley Co., Thos. ..... —

Yost Electric Mfg. Co 22

Zeller Geo. A. Book Co. ..... —

For Classified Index of Advertisements See Page 6.

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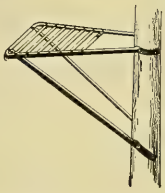

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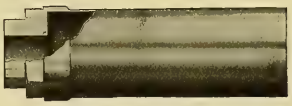

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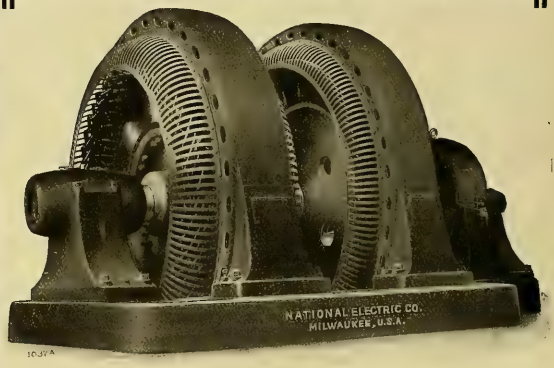

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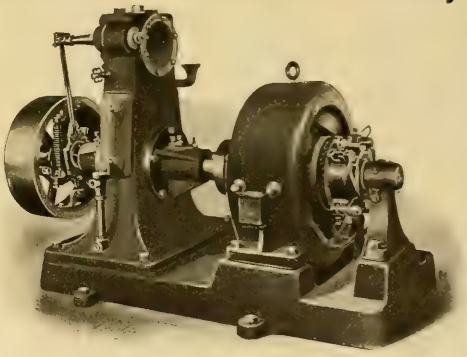

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Adjusters, Inc. Lamps.
Inc. El. Lt. Manipulator Co.

Anchors (Tel. & Tel.)
D. & T. Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

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Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works.

Boiler Compounds.
Dearborn Drug & Chem. Wks.

Boilers.
Babcock & Wilcox Co.
Brownell Co., The

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Copley-Senior Carbon Co.
Holmes Fibre-Graphite Co.
Western Electric Company.

Bushings.
Stewart Elec. Co , Frank H.

Cable Hangers.
Bissell Co., E. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

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National Electric Co.
Parsell & Weed

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Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
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Jeffrey Mfg. Co.

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Allis-Chalmers Company.

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Underhill, Chas. R.
Western Electric Co.

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Crollius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

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American Conduit Company
Central Electric Co.
Electric Appliance Co.
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Wesco Supply Co.

Conduits, Clay.
McRoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest. G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Bracey-Forse Elec. Cons. Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schuyerman, Co., J. L.

Cord.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Galloway Co., J. B.
Maine Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
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Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
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Sorensen, P.
Trumbull Elec. Mfg. Co.
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Allis-Chalmers Company. (Bullock El. Mfg. Co.)
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Bissell Co., The F.
Central Electric Co.
Century Electric Co.
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General Elec. Co.
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Electric Appliance Co.
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Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Bylesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W
Jackson, D. C. & W. B.
Kohler Brothers.
Milwaukee Engineering Co.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Underhill, Chas. R.
Willis, G. M.

Electrical Instruments.
(Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
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Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixture Hanger, Adjustable
Kuhlemeyer, John

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg. Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
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D. & W. Fuse Company.
Electric Appliance Co.
Johns-Manville Co., H. W.
Manhattan Elec. Supply Co.
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Electric Appliance Co.
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Aiton Machine Co.
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Robertson & Sons, Jas. L.

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Aiton Machine Co.

Insulators and Insulating Materials).
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Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
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Okonite Co., The.
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Aiton Machine Co.

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Bissell Co., The F.
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Western Electric Co.
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Lamp Guards.
Wagor Mfg. Co., P. R.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co.
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Monarch Elec. Mfg. Co.
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General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Machinery, Automatic.
M'Glehan & Co., C. H.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus,
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
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Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

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Underhill, Chas. R.

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Switches.
(See Cut-outs and Switches.)

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Elect'l Testing Laboratories.

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Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
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Aiton Machine Co.

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Bissell Co., The F.
Central Electric Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
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National India Rubber Co.
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Okonite Co., The.
Phillips, Eugene F.
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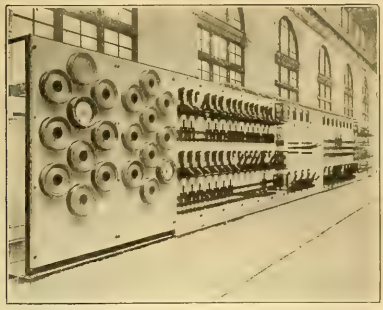

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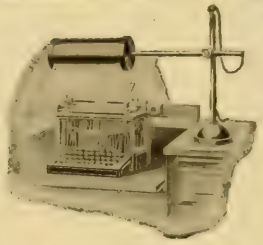

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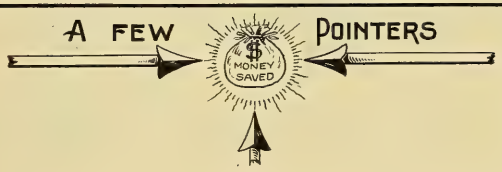

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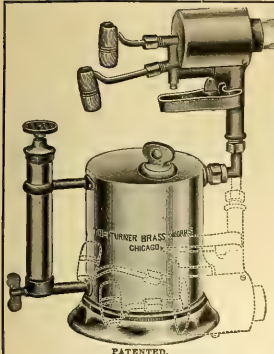

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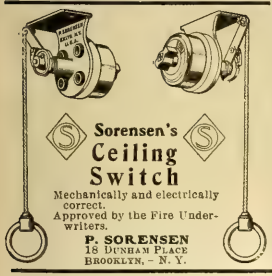

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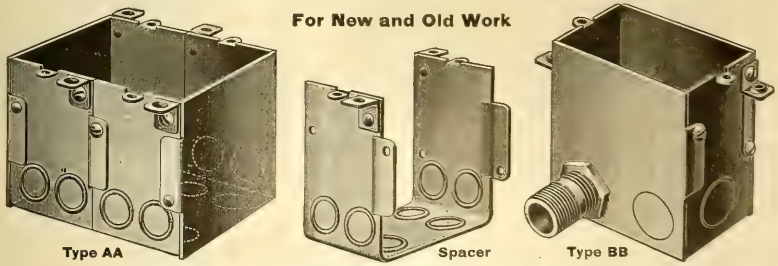

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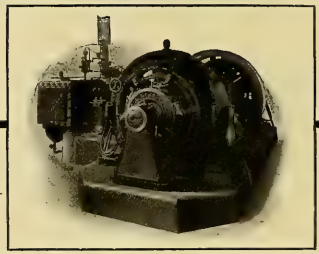

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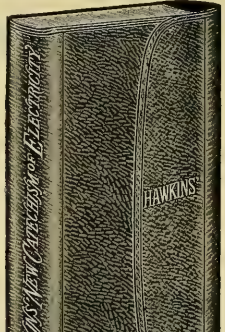

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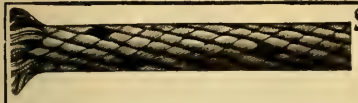

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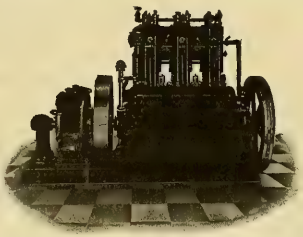
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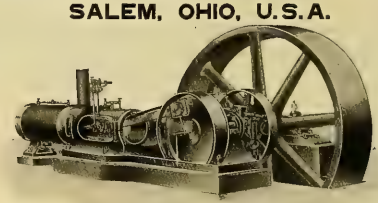
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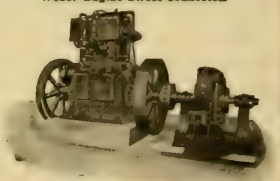

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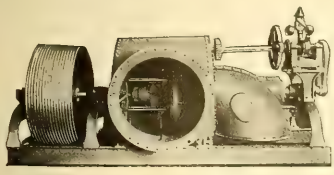

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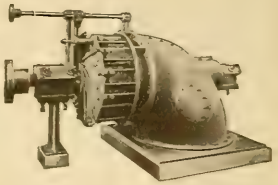

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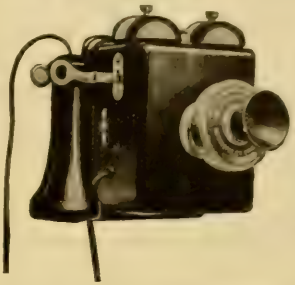

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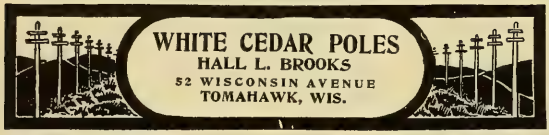

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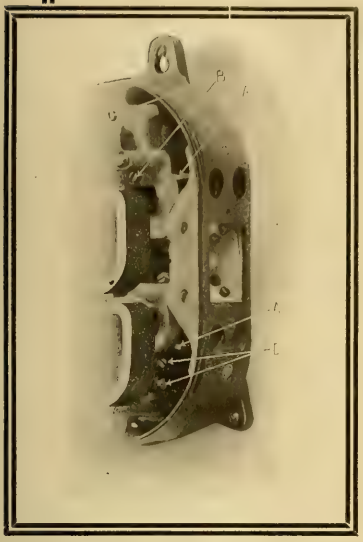

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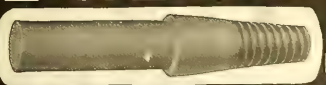

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V Electromagnets—The Telegraph
VI Electric Signaling Apparatus
VII The Relations Between Magnets and Electric Currents
VIII Induction and Reactive Coils
IX The Telephone
X Telephone Accessories
XI The Mechanical Generation of Electricity
XII The Dynamo Machine
XIII Various Types of Dynamo Machines
XIV Alternators—Polyphase Currents
XV The Electric Motor
XVI The Electric Railway
XVII Polyphase Currents and Motors
XVIII Electrical Power Transmission
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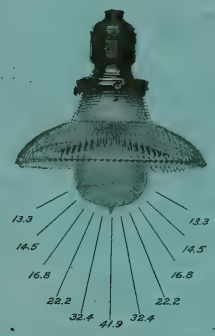

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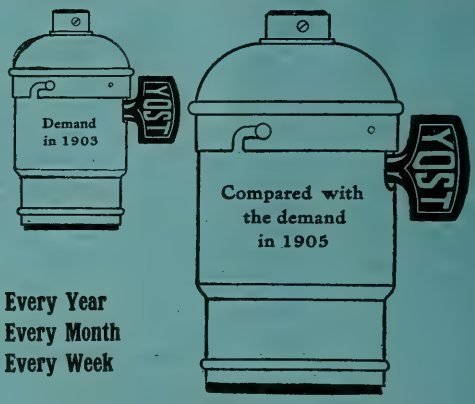

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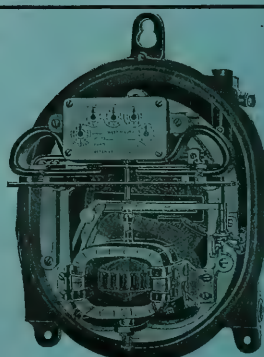
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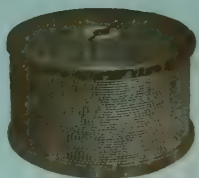

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NOTICE

We have noted an article which has appeared in certain newspapers wherein it is stated that the Westinghouse Machine Company, of Pittsburg, Pa., contracted in 1895 for all rights covering improvements in steam turbines which the Hon. C. A. Parsons and his associates might make during a term of years.

This term expired approximately six years since, and the article mentioned, therefore, is absolutely misleading and is a gross mis-statement of facts. Mr. Parsons gave the Westinghouse Machine Company certain patent rights, but the Allis-Chalmers Company has secured rights under the later patents granted to or acquired by Mr. Parsons, including the rights to all Parsons marine turbine and turbo-compressor patents, and including all improvements and patents relating thereto, which may be later made or granted to him.

The Westinghouse Machine Company, therefore, has not the exclusive rights to Parsons' patents, except the specific detail patents before mentioned; and the particular patent which is involved in the suit which, according to the article referred to, has been instituted by the Westinghouse Machine Company against the Allis-Chalmers Company, relates to a mere detail construction, which the Westinghouse Machine Company does not even attempt to use, nor does the Allis-Chalmers Company use it, or desire to use it.

The Westinghouse Machine Company has no right to use any of Parsons' Marine Turbine or Turbo-Compressor patents or inventions.

The entire article in question was inspired by jealousy and disappointment on account of the fact that the Allis-Chalmers Company has been successful in obtaining rights under Mr. Parsons' later important turbine inventions, particularly those relating to marine turbines and turbo-compressors, and the further fact that Allis-Chalmers Company is entering the field in active competition with the Westinghouse Companies and is securing business that the Westinghouse Companies cannot secure in competition with these and other superior features embodied in the Allis-Chalmers turbine. Allis-Chalmers Company has acquired exclusive rights to certain basic patents which pertain to a modern method of fastening turbine blading at its roots, and for supporting, spacing and tightening the blades at the outer end, in relation to which it has been successful against vigorous interference in the United States Patent Office. These improvements the Westinghouse Machine Company cannot, but would like to, use.

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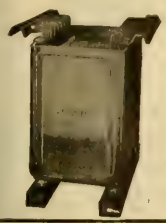

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 22
Alton Machine Co. 4
Allis-Chalmers Company 2
American Battery Co. ..... —
Amer. Circular Loom Co. 1
American Conduit Co. 16
American Diesel Engine Co. — —
Amer. District Steam Co. 14
Amer. Elect'l Supply Co. 11
Amer. El. Telephone Co. 17
American Electrical Works .. 11
Arnold Co., The 14
Automatic Electric Co. 16

Babcock & Wilcox Co. ..... —
Badt, F. B. 14
Bain, Forée & May ..... —
Baker & Co., Inc. 3
Baker & Co., W. E. 14
Beardslee Chandelier Mfg. Co. — —
Belden Mfg. Co. 11
Benton & Son ..... —
Berthold & Jennings 19
Bissell Co., The F. 5
Bossert Electric Construction Co. 20
Boston Incan. Lamp Co. ..... —
Bracey-Forse Elec. Cons. Co. — —
Brooks, Hall L. 18
Buckeye Electric Co. ..... —
Buckeye Engine Co. 15
Bull Dog Specialty Co. 10
Bullock Elec. Mfg. Co. 2
Butterfield Construction Co. —
Bylesby & Co., H. M. 14

Central Electric Co. 5
Century Electric Co. 12
Chicago Edison Co. 4, 12
Chic. Fuse Wire & Mfg. Co. — —
Chicago Mica Co. 10
Chicago Pneumatic Tool Co. 13
Columbia Incand. Lamp Co. — —
Cope, T. J. 17
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 9
Crollius & Son, E. R. ..... —
Cutler-Hammer Mfg. Co. 8
Cutter Elec. & Mfg. Company — —

D. & T. Anchor Co. 6
D. & W. Fuse Company 22
Dearborn Drug & Chem. Wks. 15
Denver & Rio Grande R. R. ..19
Diamond Meter Company .... —
Directory of Engineers 14
Dixon Crucible Co., Joseph .. 15
Duncan Elec. Mfg. Co. 21

Edison Decorative & Miniature Lamp Departm't. 10
Edison Mfg. Company 12
Electric Appliance Co. 10
Electric Storage Battery Co. 3
Elect'l Testing Laboratories. 10
Electrician Pub. Company 19

"For Sale" Advertisements. .12
Ft. Wayne Elec. Works, Inc. .21
Fowler & Co., John H. 19

Galloway Co., J. B. 18
General Electric Co. 9, 10
General Storage Battery Co. .10
Gest, G. M. 17
Gould Storage Battery Co. .... —
Gregory Electric Co. 12

Haller Machine Co. ..... —
Hart Mfg. Co. 11
Hartford Steam Boiler Inspection & Insurance Co. ... 10
Hazard Manufacturing Co. ...22
Hensel & Co., John A. ..... —
Highland Park College. 14
Hoffman, G. W. 13
Hoffmann, Emil R. ..... —
Holmes Fibre-Graph. Co. 12
Holophane Glass Co. 22
Humphrey, Henry H. 14
Hunt & Co., Robt. W. 14

Illinois Central Ry. 18
Incandescent Electric Light Manipulator Company. .... —
Indiana Rub. & Ins. W. Co. 1
India Rubber & Gutta Percha Insulating Company. 8
International Elec. Meter Co. 22
International Tel. Mfg. Co. ... 17

Jackson, D. C. & W. B. 14
Jeffrey Manufacturing Co. 15
Johns-Manville Co., H. W. .... —

Kartavert Manufacturing Co. 22
Kellogg Switchboard & Supply Company 17, 18
Klein & Sons, Mathias. 13
Kohler Brothers. 14
Kuhlemeyer, John. 20
Kuhlman Electric Co. 1

La Fayette Elect'l Mfg. Co. ..10
Leather Preserv. M. Corp. ... 15
Leffel & Co., James. 15
Lindsley-Bauman Co. 19
Loudis Sons Co., H. M. 19

Machado & Roller. 10
Maine Hub Mfg. Co. ..... —
Manhattan El. Supply Co. 1
Marinette Gas Engine Co. .... —
Matthews & Bros., W. N. 3
McCandless, H. W. & Co. 10
M'Glehan & Co., C. H. 11
McLennan & Company, K. ...10
McLeod, Ward & Co. 11
McRoy Clay Works. 16
Mica Insulator Company. 10
Miscellaneous Advs. 12
Missouri Amer. Elec. Co. 7
Monarch Elec. Mfg. Co .... —
Mott Iron Wks., J. L. 13
Mueller Company, William. .19
Munsell & Co., Eugene. 10

National Battery Co. 4
National Carbon Co. 10
National Electric Co. 5
National India Rubber Co. — —
Nat'l. X Ray Reflector Co. — —
New Idea Soldering Paste Co. 10
New York Ins. Wire Co. 14
Northern Elect'l Mfg. Co. ...12
Northern Pacific R. R. 19

Okonite Co., The. 1
Oneida Community, Ltd. 1
Osburn Flex. Conduit Co. 16
Otto Gas Engine Works. — —

Pacific Coast Pole Co. 18
Parsell & Weed. 15
Peru Elec. Mfg. Co. ..... —
Phillips, Eugene F. 11
Phillips Insulated Wire Co. ...11
Phœnix Glass Co. 1
Phosphor-Bronze S. Co. 15
Pignolet, L. M. 10
Pillsbury-Watkins Co. 18
Pittsburg & L. S. Iron Co. 19
Plume & Atwood Mfg. Co. 8
Porter Cedar Company. 19
Prenner, I. S. 13

Rail Joint Co., The. 3
Reisinger, Hugo. ..... —
Replogle Governor Works. .. 1
Reynolds El. Flasher Mfg. Co. 13
Robbins & Myers Co. 12
Robert Instrument Co., The. .11
Robertson & Sons, Jas. L. — —
Rock Island Battery Co. 16
Roebling's Sons Co., J. A. 1
Ruebel & Wells. 14

Safety Ins. Wire & Cable Co. .. 1
Samson Cordage Works. 11
Sandwich Pole Changer Co. ..18
Sargent & Lundy. ..... —
Schott, W. H. 14
Schureman Co., J. L. 3
Simplex Electrical Co., The. . 1
Simplex Elec. Heating Co. 13
Smith Storage Battery Co. 4
Sorensen, P. ..... —
Speer Carbon Co. 13
Spon & Chamberlain. ..... —
Standard Electrl. Mfg. Co. ...20
Standard Underg. Cable Co. 1
Stanley—G. I. Elec. Mfg. Co. 13
Star Expansion Bolt Co. 11
Sterling & Son, W. C. 19
Stewart Elec. Co., Frank H. .. 3
Stow Mfg. Company. 1
Stromberg-Carlson Tel. Mfg Company. 17

Telephone Woodworking Co. 17
Torrey Cedar Company. 18
Trumbull Elec. Mfg. Co. 8
Turner Brass Works. ..... —

Underhill, Chas. R. 14
Universal Elec. Stor. Bat. Co. 4

Van Nostrand Co., D. ..... —
Vought-Berger Co. ..... —
Vulcanized Fibre Company. .22

Wagner Electric Mfg. Co. ..... —
Wagor Mfg. Co., P. R. ..... —
Weber Gas & Gasoline Engine Co. 15
Wesco Supply Co. ..... —
Western Electric Company .. 8
Western Lumber & Pole Co. — —
Westinghouse Electric & Manufacturing Co. 20
Westinghouse Machine Co. — —
Weston Electrical Inst. Co. 1
Willard Storage Bat. Co. ..... —
Williamson & Co., R. 11
Willis, G. M. 14
Wilson, Co., Jas. I. M. 18
Worcester Company, C. H. 18
Wrigley Co., Thos. ..... —

Yost Electric Mfg. Co. 21

Zeller, Geo. A. Book Co. 19

For Classified Index of Advertisements See Page 6.

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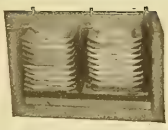

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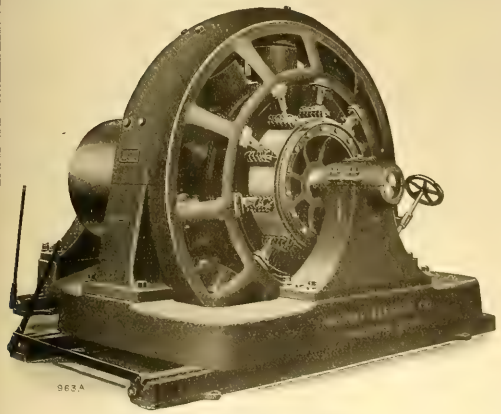

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjustors, Cord.
Incandes. El. Lt. Manfp. Co.

Adjusters, Inc. Lamps.
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Anchors (Tel. & Tel.)
D. & T. Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works.

Boiler Compounds.
Dearborn Drug & Chem. Wks.

Boilers.
Babcock & Wilcox Co.
Brownell Co., The

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre-Graphite Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
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Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
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Electric Appliance Co.
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Reisinger, Hugo.
Speer Carbon Co.
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Castings.
National Electric Co.
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Oneida Community, Ltd.

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Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
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Underhill, Chas. R.
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Croilus & Son, E. R.
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Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduit and Conduits.
American Circular Loom Co.
American Conduit Company
Central Electric Co.
Electric Appliance Co.
Gest. G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McRoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Bracey-Forse Elec. Cons. Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman, Co., J. L.

Cord.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Bertholdt & Jennings.
Central Electric Co.
Electric Appliance Co.
Galloway Co., J. B.
Maine Rub. Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
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Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.

Dynamos and Motors.
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Parsell & Weed.
Robbins & Myers Co.
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Wesco Supply Co.
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For Alphabetical Index of Advertisements See Page 3.

Announcement Extraordinary

An understanding having been arrived at between the General Electric Company, a corporation of New York, the Edison Electric Light Company, a corporation of New York, and the American Electric Company, a corporation of New Jersey, and the Missouri American Electric Company, a corporation of Missouri, relative to the Patent litigation against the Missouri American Electric Company, such arrangement being satisfactory to all the parties in interest, we have pleasure in announcing to users of and dealers in the Incandescent Electric Lamps made and sold by us; that:

All such litigation between the parties has been terminated; and that the American Electric Company of New Jersey and the Missouri American Electric Company of St. Louis, Missouri, have the legal and undisputed right, to the use of all patents on which monopoly is claimed by the National Association of Licensed Manufacturers of Incandescent Lamps; consequently there can be no further interference with dealers in, or users of, our lamps.

Recognizing the fact that irresponsible agents and salesmen of other companies may for the purpose of unprincipled competition, make mis-statements concerning our legal rights, we request of purchasing agents and others interested in incandescent electric lamps to report to us without delay, in definite form any such breach of honorable or decent competition, with the assurance that this company will immediately deal with same in accordance with our rights.

We are entirely and absolutely free from entangling alliances, our claim of independence being fully and unalterably established.

We are the only company in the United States working under our own patented machinery and processes, with the legal right to use all patents under which the National Association of Licensed Manufacturers of Incandescent Lamps are licensed.

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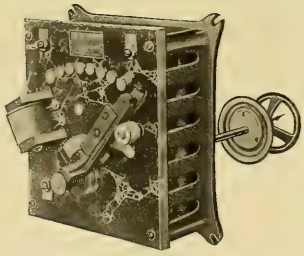

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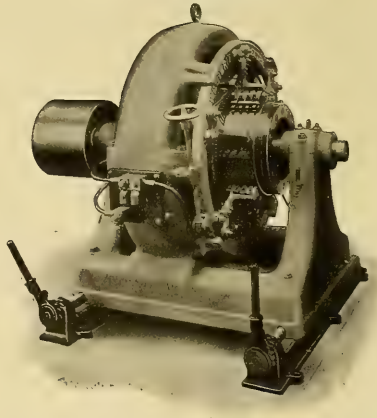

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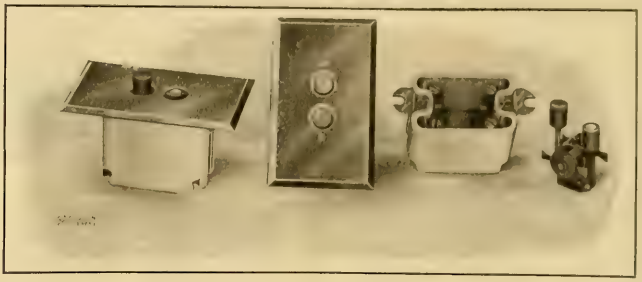

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CHAPTER I

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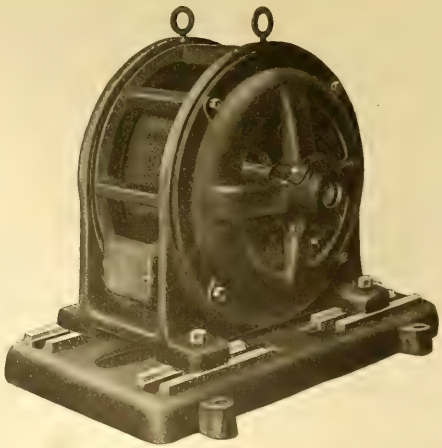

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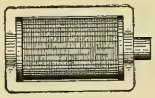

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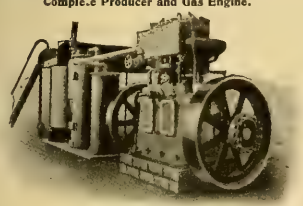

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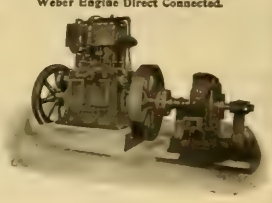

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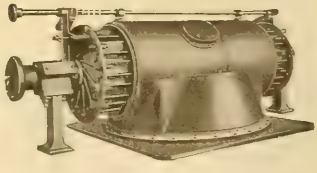

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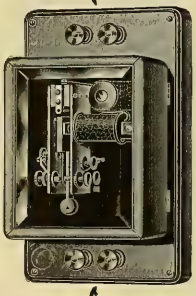

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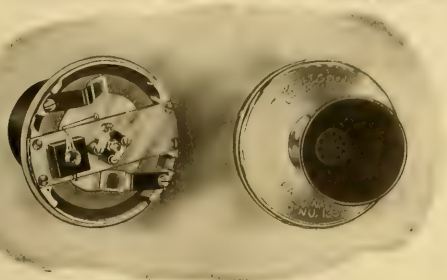

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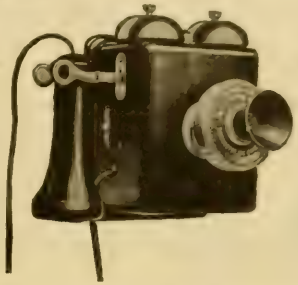

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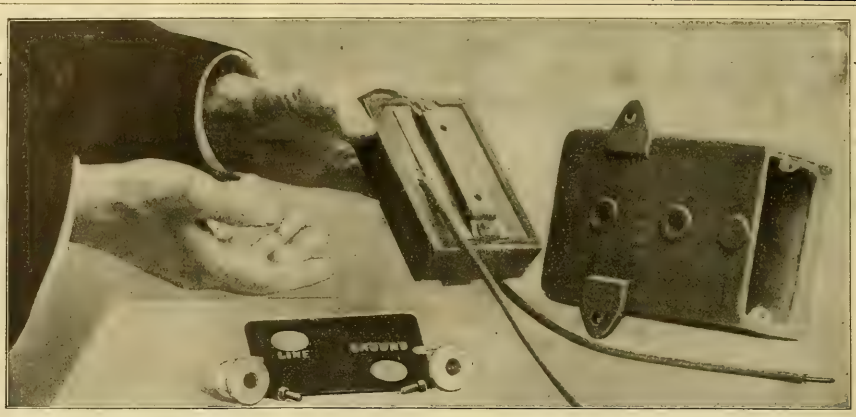

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It is the discharge block and air gap of the Westinghouse M. P. Lightning Arrester fastened compactly together ready for insertion in the containing box. The air gap does not show being on the underside. The block is held rigidly to the box by two screws. After assembling a special gum is poured around the parts to keep out moisture and provide insulation.

In this space, February 3rd last, we showed the complete arrester. In the March 3rd issue we will show the line terminal and button gap as attached to block.

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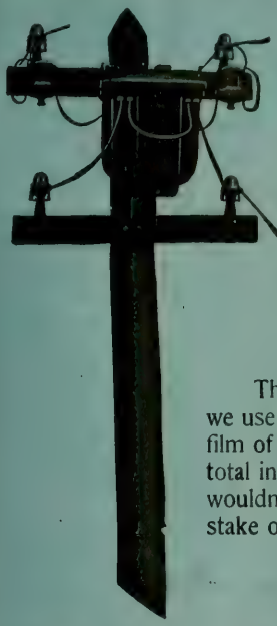

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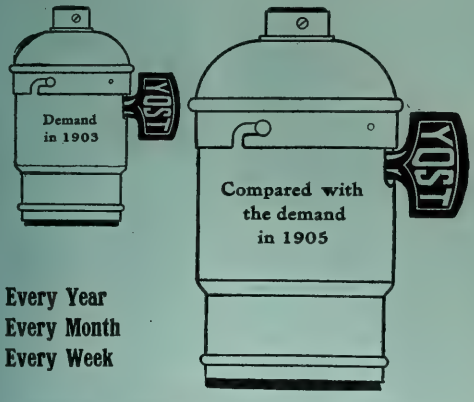

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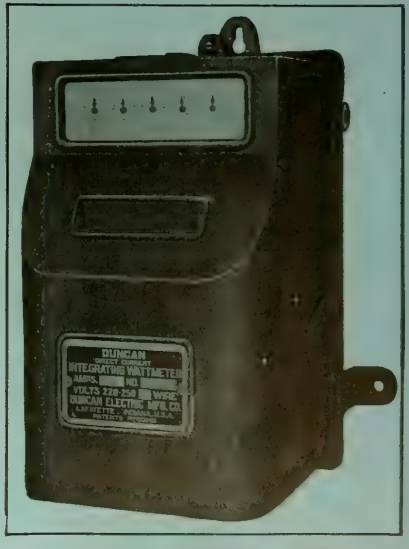

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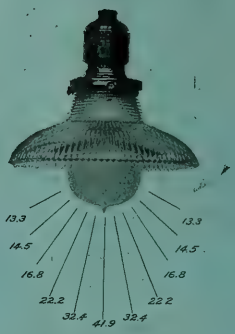

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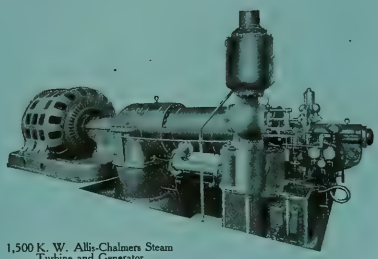

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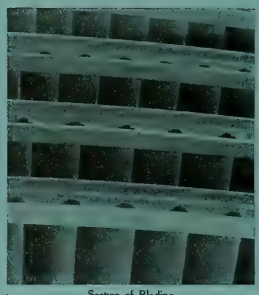

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NOTICE

We have noted an article which has appeared in certain newspapers wherein it is stated that the Westinghouse Machine Company, of Pittsburg, Pa., contracted in 1895 for all rights covering improvements in steam turbines which the Hon. C. A. Parsons and his associates might make during a term of years.

This term expired approximately six years since, and the article mentioned, therefore, is absolutely misleading and is a gross mis-statement of facts. Mr. Parsons gave the Westinghouse Machine Company certain patent rights, but the Allis-Chalmers Company has secured rights under the later patents granted to or acquired by Mr. Parsons, including the rights to all Parsons marine turbine and turbo-compressor patents, and including all improvements and patents relating thereto, which may be later made or granted to him.

The Westinghouse Machine Company, therefore, has not the exclusive rights to Parsons' patents, except the specific detail patents before mentioned; and the particular patent which is involved in the suit which, according to the article referred to, has been instituted by the Westinghouse Machine Company against the Allis-Chalmers Company, relates to a mere detail construction, which the Westinghouse Machine Company does not even attempt to use, nor does the Allis-Chalmers Company use it, or desire to use it.

The Westinghouse Machine Company has no right to use any of Parsons' Marine Turbine or Turbo-Compressor patents or inventions.

The entire article in question was inspired by jealousy and disappointment on account of the fact that the Allis-Chalmers Company has been successful in obtaining rights under Mr. Parsons' later important turbine inventions, particularly those relating to marine turbines and turbo-compressors, and the further fact that Allis-Chalmers Company is entering the field in active competition with the Westinghouse Companies and is securing business that the Westinghouse Companies cannot secure in competition with these and other superior features embodied in the Allis-Chalmers turbine. Allis-Chalmers Company has acquired exclusive rights to certain basic patents which pertain to a modern method of fastening turbine blading at its roots, and for supporting, spacing and tightening the blades at the outer end, in relation to which it has been successful against vigorous interference in the United States Patent Office. These improvements the Westinghouse Machine Company cannot, but would like to, use.

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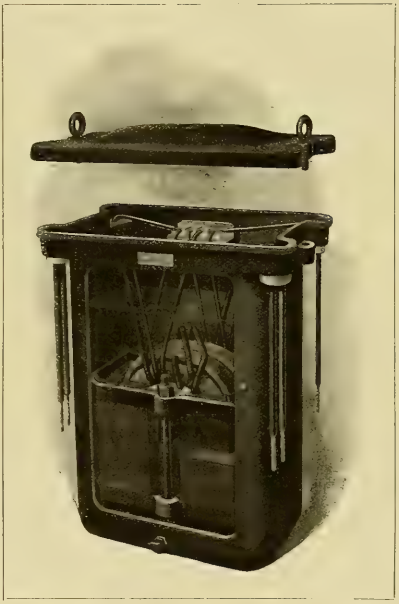

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 20
Alton Machine Co. 4
Allis-Chalmers Company ... 2, 3
American Battery Co. 14
Amer. Circular Loom Co. 1
American Conduit Co. 16
American Diesel Engine Co. —
Amer. District Steam Co. 20
Amer. Elect'l. Supply Co. ..... —
Amer. El. Telephone Co. 17
American Electrical Works .. 13
Arnold Co., The 20
Automatic Electric Co. 16

Babcock & Wilcox Co. ..... —
Badt, F. B. 20
Bain, Force & May 13
Baker & Co., Inc. 5
Baker & Co., W. E. 20
Beardsley Chandelier Mfg. Co. —
Belden Mfg. Co. ..... —
Benton & Son 4
Berthold & Jennings 19
Bissell Co., The F. 1, 9
Bossert Electric Construction Co. 17
Boston Incan. Lamp Co. ..... —
Bracey-Forse Elec. Cons. Co. 16
Brooks, Hall L. 18
Buckeye Electric Co. ..... —
Buckeye Engine Co. 15
Bull Dog Specialty Co., The. —
Bullock Elec. Mfg. Co. 2
Butterfield Construction Co. 20
Bylesby & Co., H. M. 20

Central Electric Co. 7
Century Electric Co. 14
Chicago Edison Co. 4, 14
Chic. Fuse Wire & Mfg. Co. .. 13
Chicago Mica Co. 12
Chicago Pneumatic Tool Co. .. 14
Columbia Incand. Lamp Co. —
Cope, T. J. 1
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 11
Crollius & Son, E. R. ..... —
Cutler-Hammer Mfg. Co. 9
Cutter Elec. & Mfg. Company 1

D. & T. Anchor Co. ..... —
D. & W. Fuse Company ..... —
Davis Electric Mfg. Co. 8
Dearborn Drug & Chem. Wks. 15
Denver & Rio Grande R. R. .. —
Diamond Meter Company 24
Directory of Engineers 20
Dixon Crucible Co., Joseph .. 15
Duncan Elec. Mfg. Co. 23

Edison Decorative & Miniature Lamp Departm't. 12
Edison Mfg. Company ..... —
Electric Appliance Co. 12
Electric Storage Battery Co. . 5
Elect'l Testing Laboratories. —
Electrician Pub. Company ... 10

"For Sale" Advertisements .. 14
Ft. Wayne Elec. Works, Inc. .. 23
Fowler & Co., John H. ..... —
French Battery Co. 7

Galloway Co., J. B. 18
General Electric Co. 11, 12
General Storage Battery Co. 12
Gest, G. M. 1
Gould Storage Battery Co. ... 6
Gregory Electric Co. 14

Haller Machine Co. 13
Hart Mfg. Co. 20
Hartford Steam Boiler Inspection & Insurance Co. —
Hazard Manufacturing Co. —
Hensel & Co., John A. 8
Highland Park College, ... 20
Hoffman, G. W. 14
Hoffmann, Emil R. 14
Holmes Fibre-Graph. Co. ..... —
Holophane Glass Co. 19
Humphrey, Henry H. 20
Hunt & Co., Robt. W. 20

Illinois Central Ry. 18
Incandescent Electric Light Manipulator Company ..... —
Indiana Rub. & Ins. W. Co. .. 1
India Rubber & Gutta Percha Insulating Company ..... —
International Elec. Meter Co 7
International Tel. Mfg. Co. .. 17

Jackson, D. C. & W. B. 20
Jeffrey Manufacturing Co. ... 15

Kartavert Manufacturing Co. —
Kellogg Switchboard & Supply Company 17, 18
Klein & Sons, Mathias 12
Kohler Brothers 20
Kuhlemeyer, John 5
Kuhlman Electric Co. 19

La Fayette Elect'l Mfg. Co. —
Leather Preserv. M. Corp. ... —
Leffel & Co., James 15
Lindsley-Bauman Co. 18
Loud's Sons Co., H. M. 19
Ludlow Valve Co. 15

Machado & Roller ..... —
Maine Hub Mfg. Co. 19
Manhattan El. Supply Co. ... 13
Matthews & Bros., W. N. 5
McCandless, H. W. & Co. 14
M'Glehan & Co., C. H. 14
McLennan & Company, K. ... 12
McLeod, Ward & Co. 12
McRoy Clay Works 16
Mica Insulator Company 12
Miscellaneous Advs. 14
Monarch Elec. Mfg. Co 20
Mott Iron Wks., J. L. 13
Mueller Company, William .. 19
Munsell & Co., Eugene 12

National Battery Co. 8
National Carbon Co. 12
National Electric Co. 24
National India Rubber Co. ... 1
Nat'l. X Ray Reflector Co. .. —
New Idea Soldering Paste Co. 19
New York Ins. Wire Co. 1
Northern Elect'l Mfg. Co. ... 14
Northern Pacific R. R. ..... —

Okonite Co., The 1
Oneida Community, Ltd. ..... —
Osburn Flex. Conduit Co. 16
Otto Gas Engine Works. 15

Pacific Coast Pole Co. 18
Parsell & Weed ..... —
Perrizo & Sons 19
Peru Elec. Mfg. Co. 24
Phillips, Eugene F. 13
Phillips Insulated Wire Co. .. 13
Phoenix Glass Co. ..... —
Phosphor-Bronze S. Co. 15
Pignolet, L. M. 12
Pillsbury-Watkins Co. 18
Pittsburg & L. S. Iron Co. .. 19
Plume & Atwood Mfg. Co. ... —
Porter Cedar Company 18
Prenner, I. S. 13

Rail Joint Co., The 5
Reisinger, Hugo 9
Replogle Governor Works .. —
Reynolds El. Flasher Mfg. Co. 1
Robbins & Myers Co. 12
Robert Instrument Co., The. —
Robertson & Sons, Jas. L. ... 14
Rock Island Battery Co ..... —
Roebling's Sons Co., J. A. ... 19
Ruebel & Wells 20

Safety Ins. Wire & Cable Co. . 24
Samson Cordage Works 16
Sandwich Pole Changer Co. .. —
Sargent & Lundy ..... —
Schott, W. H. 20
Schureman Co., J. L. 5
Simplex Electrical Co., The .. 1
Simplex Elec. Heating Co. ... 14
Smith Storage Battery Co. ... —
Sorensen, P. 13
Speer Carbon Co. ..... —
Spon & Chamberlain 16
Standard Elect'l. Mfg. Co. ... —
Standard Underg. Cable Co. .. —
Stanley—G. I. Elec. Mfg. Co. —
Star Expansion Bolt Co. 1
Sterling & Son, W. C. 19
Stewart Elec. Co., Frank H. . 8
Stow Mfg. Company ..... —
Stromberg-Carlson Tel. Mfg. Company 17
Sturgess Engineering Dept. . 15

Telephone Woodworking Co. 17
Torrey Cedar Company 18
Trumbull Elec. Mfg. Co. 9
Turner Brass Works 9

Underhill, Chas. R. 20
Universal Elec. Stor. Bat. Co. 8

Van Nostrand Co., D. ..... —
Vought-Berger Co. ..... —
Vulcanized Fibre Company .. 24

Wagner Electric Mfg. Co. 4
Wagor Mfg. Co., P. R. ..... —
Weber Gas & Gasoline Engine Co. 15
Wesco Supply Co. 12
Western Electric Company .. 24
Western Lumber & Pole Co. —
Westinghouse Electric & Manufacturing Co. 22
Westinghouse Machine Co. 21, 22
Weston Electrical Inst. Co. .. 1
Willard Storage Bat. Co. 8
Williamson & Co., R. 13
Willis, G. M. 20
Wilson, Co., Jas. L. M. 19
Worcester Company, C. H. 18
Wrigley Co., Thos. ..... —

Yost Electric Mfg. Co. 23

Zeller Geo. A. Book Co. ..... —

For Classified Index of Advertisements See Page 6.

Gould Storage Battery Co.

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WORKS: DEPEW, N. Y.

Bulletins.

CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjustors, Cord.
Incandes. El. Lt. Manip. Co.

Adjusters, Inc. Lamps.
Inc. El. Lt. Manipulator Co.

Anchors (Tel. & Tel.)
D. & T. Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.
Brownell Co., The

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre-Graphite Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
National Electric Co.
Parsell & Weed

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clusters.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Underhill, Chas. R.
Western Electric Co.

Commutator Compound.
Crolius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduit and Conduits.
American Circular Loom Co.
American Conduit Company
Central Electric Co.
Electric Appliance Co.
Gest. G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McRoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest. G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Bracey-Forse Elec. Cons. Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman, Co., J. L.

Cord.
Belden Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Gallowy Co., J. B.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.

Dynamos and Motors.
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Benjamin & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Parsell & Weed.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Byllesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Underhill, Chas. R.
Willis, G. M.

Electrical Instruments.
(Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyers.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Corliss.
Allis-Chalmers Company.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Benton & Son.
Otto Gas Engine Works.
Weber Gas & Gasoline Engine Co.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixture Hanger, Adjustable
Kuhlemeyer, John

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg.Co.
Williamson & Co., R.

Flashes.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

Glassware, Electric.
Addison Glass Co.

Globes, Reflectors and Shades.
Addison Glass Co.
Haller Machine Co.
Holophane Glass Co.
McLeod. Ward & Co.
Nat'l. X Ray Reflector Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Repiogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Incandescent Electric Light Manipulator Co.
Vought-Berger Co.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Iron Castings.
Alton Machine Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Wagor Mfg. Co., P. R.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Standard Electl. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Machinery, Automatic.
M'Glehan & Co., C. H.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.
Preuner, L. S.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Berthold & Jennings.
Brooks Hall L.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley-Bauman Co.
Lond's Sons Co., H. M.
Mueller Company, William.
Pacific Coast Pole Co.
Perrine & Sons.
Pillsbury-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Sierling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Peru Electric Mfg. Co.

Portables,
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Highland Park College.

Searchlights.
Benton & Son.

Second-Hand Machin'y.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Sockets & Receptacles.
Yost Elec. Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Bull Dog Specialty Co., The
Crolius & Son, E. R.
New Idea Soldering Paste Co.
Western Electric Co.

Solenoids.
Schureman Co., J. L.
Underhill, Cnas. R.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co.
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Universal Elec. Stor. Bat. Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co.
Vought-Berger Co
Wesco Supply Co.
Western Electric Co.

Testing, Electrical.
Elect'l Testing Laboratories.

Testing Laboratories,
Elect'l Testing Laboratories.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company. (Bullock El. Mfg. Co.)
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

Woodwork, Telephonic,
Telephone Woodworking Co

For Alphabetical Index of Advertisements See Page 5.

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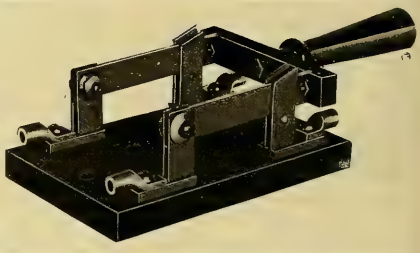

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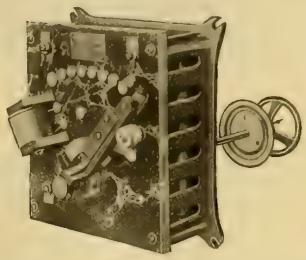

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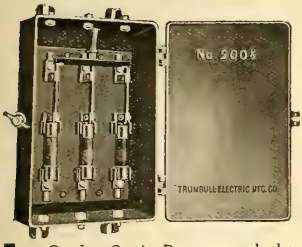

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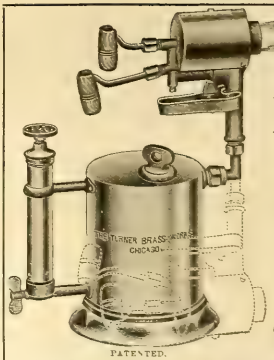

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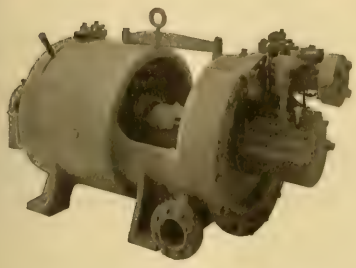

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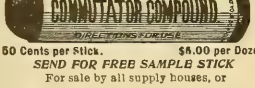

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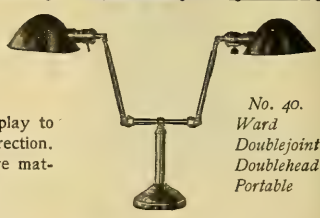

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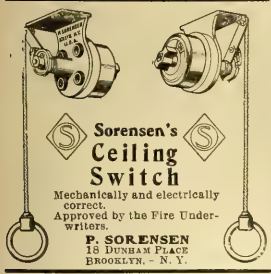

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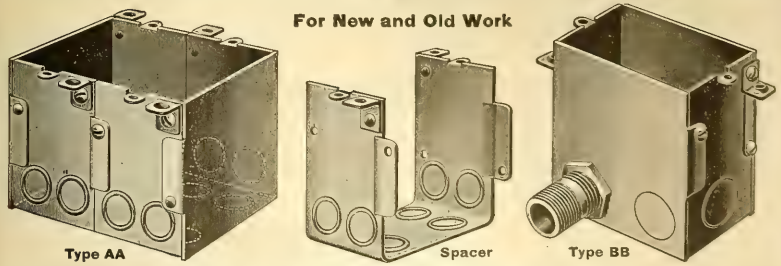

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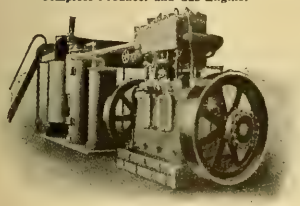

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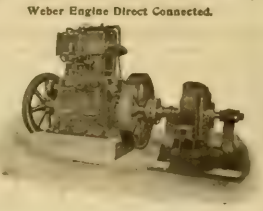

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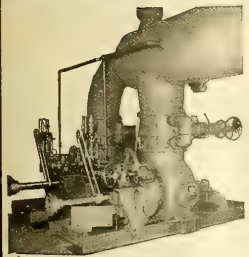

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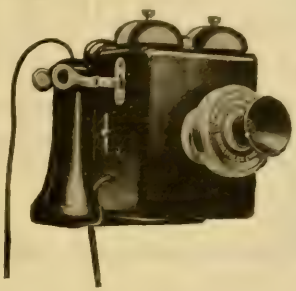

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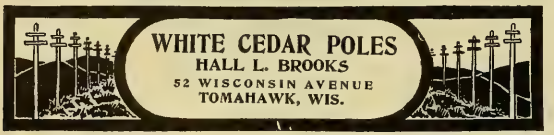

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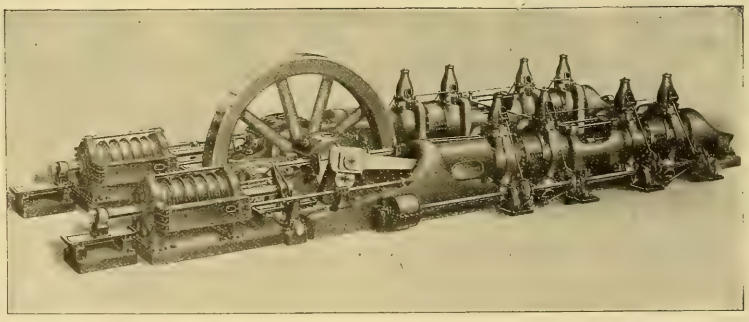

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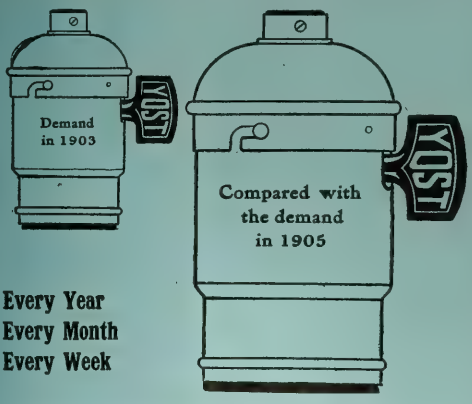

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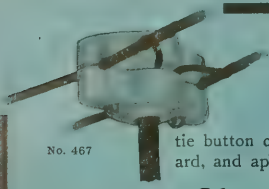
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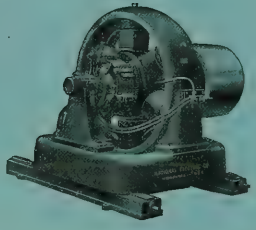

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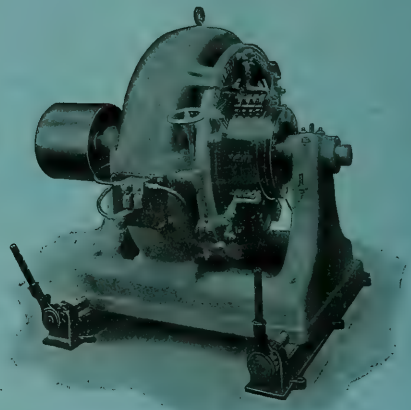

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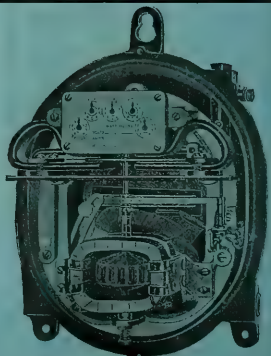
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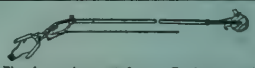

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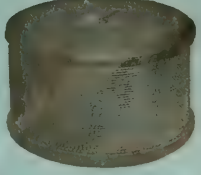

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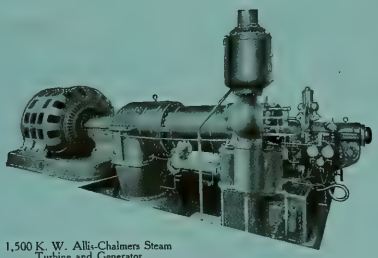

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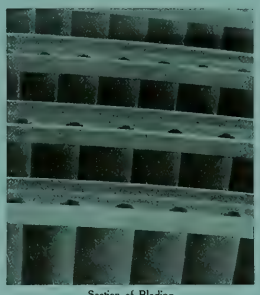

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 10
Aermotor Company 8
Alton Machine Co. 4
Allis-Chalmers Company 2
American Battery Co. —
Amer. Circular Loom Co. 1
American Conduit Co. 16
American Diesel Engine Co. —
Amer. District Steam Co. 13
Amer. Elect'l. Supply Co. —
Amer. El. Telephone Co. 17
American Electrical Works. 11
Arnold Co., The 14
Automatic Electric Co. 16

Babcock & Wilcox Co. 12
Badt, F. B. 14
Bain, Forée & May —
Baker & Co., Inc. 3
Baker & Co., W. E. 14
Beardslee Chandelier Mfg. Co. —
Belden Mfg. Co. 19
Benjamin Elec. Mfg. Co. 11
Benton & Son —
Berthold & Jennings 19
Bissell Co., The F. 5
Bossert Electric Construction Co. 14
Boston Incan. Lamp Co. —
Bracey-Forse Elec. Cons. Co. —
Brooks, Hall L. 18
Bruer, Will F. 19
Buckeye Electric Co. —
Buckeye Engine Co. 15
Bull Dog Specialty Co., The. 10
Bullock Elec. Mfg. Co. 2
Butterfield Construction Co. —
Bylesby & Co., H. M. 14

Central Electric Co. 5
Century Electric Co. 10
Chicago Edison Co. 4, 12
Chic. Fuse Wire & Mfg. Co. —
Chicago Mica Co. 10
Chicago Pneumatic Tool Co. 19
Columbia Incand. Lamp Co. —
Cope, T. J. 11
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 13
Crolius & Son, E. R. 10
Cutler-Hammer Mfg. Co. 7
Cutter Elec. & Mfg. Company —

D. & T. Anchor Co. 5
D. & W. Fuse Company —
Davis Electric Mfg. Co. —
Dearborn Drug & Chem. Wks. 15
Diamond Meter Company —
Directory of Engineers 14
Dixon Crucible Co., Joseph 15
Duncan Elec. Mfg. Co. 21

Edison Decorative & Miniature Lamp Departm't. 10
Edison Mfg. Company 7
Electric Appliance Co. 10
Electric Storage Battery Co. 3
Electrician Pub. Company 20

Faries Mfg. Co. 11
"For Sale" Advertisements. 12
Ft. Wayne Elec. Works, Inc. 21
Fowler & Co., John H. 19
French Battery Co. —

Galloway Co., J. B. 18
General Electric Co. 9, 10
General Storage Battery Co. 10
Gest, G. M. 16
Gould Storage Battery Co. —
Gregory Electric Co. 12

Haller Machine Co. —
Hart Mfg. Co. 14
Hartford Steam Boiler Inspection & Insurance Co. 15
Hazard Manufacturing Co. 22
Hensel & Co., John A. —
Highland Park College. 14
Hoffman, G. W. 19
Hoffmann, Emil R. —
Holmes Fibre-Graph. Co. 22
Holophane Glass Co. 22
Humphrey, Henry H. 14
Hunt & Co., Robt. W. 14

Illinois Central Ry. 18
Incandescent Electric Light Manipulator Company 14
Indiana Rub. & Ins. W. Co. 1
India Rubber & Gutta Percha Insulating Company 6
International Elec. Meter Co. 22
International Tel. Mfg. Co. 17

Jackson, D. C. & W. B. 14
Jeffrey Manufacturing Co. 15

Kartavert Manufacturing Co. 22
Kellogg Switchboard & Supply Company 17, 18
Klein & Sons, Mathias 10
Kohler Brothers 14
Kuhlman Electric Co. 1

La Fayette Elect'l Mfg. Co. 10
Leather Preserv. M. Corp. 11
Leffel & Co., James 15
Lindsley-Bauman Co. 18
Loud's Sons Co., H. M. 19
Ludlow Valve Co. —

Machado & Roller 3
Maine Hub Mfg. Co. —
Manhattan El. Supply Co. 19
Matthews & Bros., W. N. 3
McCandless, H. W. & Co. 10
M'Glehan & Co., C. H. 14
McLennan & Company, K. 10
McLeod, Ward & Co. 5
McRoy Clay Works 16
Mica Insulator Company 10
Miscellaneous Advs. 12
Monarch Elec. Mfg. Co —
Mott Iron Wks., J. L. 1
Mueller Company, William. 19
Munsell & Co., Eugene 10

National Battery Co. 4
National Carbon Co. 10
National Electric Co. 20
National India Rubber Co. —
Nat'l. X Ray Reflector Co. 13
New Idea Soldering Paste Co. 11
New York Ins. Wire Co. 19
Northern Elect'l Mfg. Co. 14

Okonite Co., The 1
Oneida Community, Ltd. 1
Osburn Flex. Conduit Co. 16
Otto Gas Engine Works. —

Pacific Coast Pole Co. 18
Perrizo & Sons 19
Peru Elec. Mfg. Co. —
Phillips, Eugene F. 11
Phillips Insulated Wire Co. 11
Phœnix Glass Co. 1
Phosphor-Bronze S. Co. 15
Pignolet, L. M. 10
Pillsbury-Watkins Co. 18
Pittsburg & L. S. Iron Co. 19
Plume & Atwood Mfg. Co. 14
Porter Cedar Company 18
Prenner, I. S. 11

Rail Joint Co., The 3
Reisinger, Hugo —
Replogle Governor Works. 1
Reynolds El. Flasher Mfg. Co. 22
Robbins & Myers Co. 14
Robert Instrument Co., The. 19
Robertson & Sons, Jas. L. —
Rock Island Battery Co 12
Roebling's Sons Co., J. A. 1
Ruebel & Wells 14
Runzel-Lenz Elec. Mfg. Co. 17

Safety Ins. Wire & Cable Co. 1
Samson Cordage Works. 15
Sandwich Pole Changer Co. 16
Sargent & Lundy —
Schott, W. H. 14
Schureman Co., J. L. 3
Simplex Electrical Co., The. 1
Simplex Elec. Heating Co. 22
Smith Storage Battery Co. 4
Sorensen, P. —
Speer Carbon Co. 12
Spon & Chamberlain —
Standard Elect'l. Mfg. Co. 11
Standard Underg. Cable Co. 1
Stanley—G. I. Elec. Mfg. Co. 8
Star Expansion Bolt Co. 12
Sterling & Son, W. C. 19
Stewart Elec. Co., Frank H. 20
Stow Mfg. Company 1
Stromberg-Carlson Tel. Mfg. Company 17
Sturgess Engineering Dept. —

Telephone Woodworking Co. 17
Torrey Cedar Company 18
Trumbull Elec. Mfg. Co. 5
Turner Brass Works. —

Underhill, Chas. R. 14
Universal Elec. Stor. Bat. Co. 4

Van Nostrand Co., D. —
Vought-Berger Co. —
Vulcanized Fibre Company 22

Wagner Electric Mfg. Co.
Wagor Mfg. Co., P. R. 19
Weber Gas & Gasoline Engine Co. 15
Wesco Supply Co. —
Western Electric Company 13
Western Lumber & Pole Co. —
Westinghouse Electric & Manufacturing Co. 20
Westinghouse Machine Co. —
Weston Electrical Inst. Co. 1
Willard Storage Bat. Co. —
Williamson & Co., R. 11
Willis, G. M. 14
Wilson, Co., Jas. I. M. 19
Worcester Company, C. H. 18
Wrigley Co., Thos. 12

Yost Electric Mfg. Co. 21

Zeller Geo. A. Book Co. —

For Classified Index of Advertisements See Page 6.

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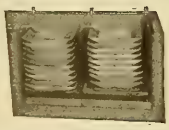

THE ELECTRO-CHEMICAL TRAY BATTERY

Important point— **no "choking" gas.**
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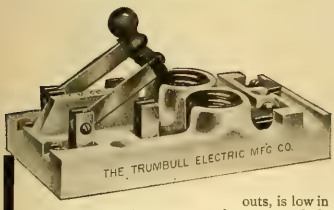

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Every seat is tested to 1,000 pounds and will carry a ton.

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Western Electric Co.
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Schureman, Co., J. L.

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Phillips Insulated Wire Co.
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Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Machinery, Automatic.
M'Gehan & Co., C. H.

Magnet Wires.
(See Wires and Cables.)

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Munsell & Co., Eugene.

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(Bullock El. Mfg. Co.)
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General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine hop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

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Matthews & Bro., W. N.

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Underhill, Chas. R.

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Western Electric Co.

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(See Cut-outs and Switches.)

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Western Electric Co.

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Bissell Co., The F.

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(See Bolts, Toggle.)

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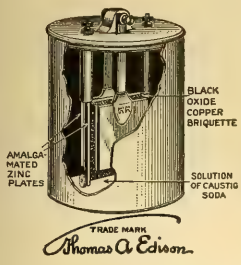
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

Woodwork, Telephonic.
Telephone Woodworking Co

For Alphabetical Index of Advertisements See Page 3.

Primary Battery Design

The sketch herewith shows the manner in which the parts of the Edison Cell are assembled. It will be noted that the elements hang freely from the cover and are not interconnected in any way below the surface of the solution. It will also be observed that the zinc plates are heavily reinforced at the point of connection to the stems. This point is subject to corrosion from the action of dust which, if present, rises to the surface of the solution under the oil and tends to short-circuit the elements of the cell. This is of more importance in those types of cells in which the loose oxide is contained in a perforated copper cylinder than in the Edison, where the oxide is compressed into solid briquettes. Such local action is further guarded against in the Edison Cell by covering the supports of the briquettes with insulating tubes which prevent the dust film from touching the supports. With these precautions the Edison Cell is never troubled by internal short-circuiting nor by eating off of the zinc electrode at the point of attachment.



On the other hand, in some makes of cells in which the oxide is in the shape of loose powder within a perforated container, such troubles are apt to occur, the more so, as the wire leading to the zinc is merely riveted on, while the zinc itself is supported by porcelain brackets attached to the perforated cylinder containing the oxide. These brackets afford convenient resting places for particles of the loose oxide, which in turn serve to short-circuit the two elements of the battery. Such defects are inevitable in cheaply made and poorly designed cells, and it was to overcome them that much time, thought and money were expended on the Edison Cell. The appreciation of battery users, however, is repaying the investment.

Send for the Edison Battery Book "E W."

Edison Manufacturing Co.

2 Lakeside Ave., Orange, N. J.

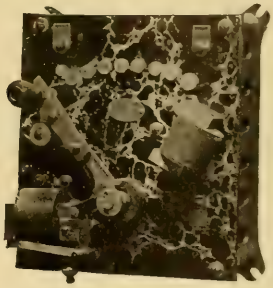
31 Union Square, New York 304 Wabash Ave., Chicago
25 Clerkenwell Road, London

In preparation for moving into larger quarters in the new part of the Marquette Building, which removal will take place April 1st next, we are going through our storage vaults assorting everything therein with a view to carrying into the new place only such things as cannot possibly be dispensed with. In connection with this work we are able to offer for sale cheap a few bound volumes of the WESTERN ELECTRICIAN. These volumes are new and have never been used, and this is an opportunity to obtain a bargain which, for the years they cover, we shall never be able to offer again.

Write us and let us know your needs and we will quote you at once.

WESTERN ELECTRICIAN.

P. S. Kindly take notice that our new suite of rooms will be known as 507 Marquette Building. Our street number, 204 Dearborn Street, and our telephone number, Main 1746, will not change.



C. & H. Overload Motor Starter

This apparatus is similar to our No. 10 type of starter with the exception that it is fitted with an overload release in addition to a no-voltage release. This device besides protecting the motor from overloads, also indicates the amount of current being consumed by the motor, making it convenient for taking readings. The removing of one screw from this attachment will prevent the motor shutting down and enable the attachment to be used as a current indicator only.

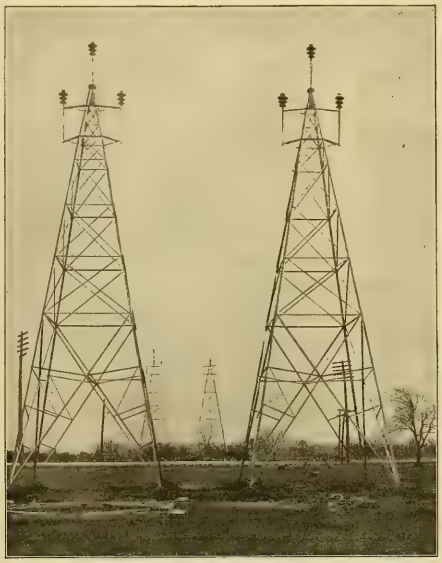
Bulletin 20 gives full description and prices.

THE

Cutler-Hammer Mfg. Co.

Milwaukee

New York Boston Chicago Pittsburg



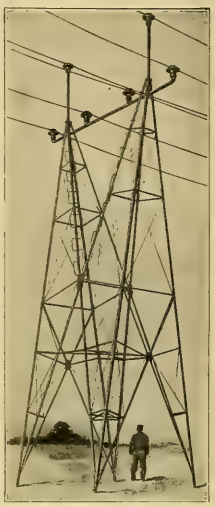
GALVANIZED STEEL
ELECTRIC TRANSMISSION TOWERS

FOR SINGLE, DOUBLE OR TRIPLE CIRCUITS

Aermotor Towers are HEAVILY GALVANIZED after all punching, shearing and machine work is finished. They will withstand corrosion in any climate without expense for maintenance.

THREE-PHASE SINGLE CIRCUIT TOWERS

The view at the left shows the double line of towers designed and built by the Aermotor Company, and erected for one of the power companies at Niagara Falls. These towers are 50 feet high and weigh about 3000 lbs. each. They are guaranteed to withstand a pull of 3500 lbs. at the top of any insulator pin, or a total pull at the top of the tower of 15,000 pounds. They are the most substantial towers yet built for transmission purposes. The price of these towers is very moderate, and the cost of anchorage is greatly reduced by the use of a wide trussed base.



THREE-PHASE DOUBLE CIRCUIT TOWERS

The cut at the right shows the style of tower which the Aermotor Company is now furnishing for a double circuit line which is building in the state of New York. These towers are guaranteed to withstand a strain of 2000 lbs. on any insulator pin, or a total strain of 8000 lbs. in either direction. By the ingenious arrangement of the twin towers these strains are easily met with great economy of material.

The illustrations show only two of the various styles of towers which the Aermotor Company has designed and built. They are prepared to furnish the most economical towers to meet every requirement.

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Stanley - G. I.

The Stanley-G. I. Electric Mfg. Co. is a consolidation of the Stanley Electric Mfg. Company of Pittsfield and the General Incandescent Arc Light Company of New York. The Stanley Company's product, marketed under the well-known trade name of the S. K. C. System, comprises Generators, Transformers, Rotary Converters, Motor Generator Sets, Switchboard Apparatus, Induction Motors, etc. The General Incandescent Arc Light Company has been favorably known as builder of the high-grade G. I. Arc Lamps, Arc Lamp Regulators, Incandescent Lamps, alternating current and direct current Motors, General and Special Electrical Supplies.

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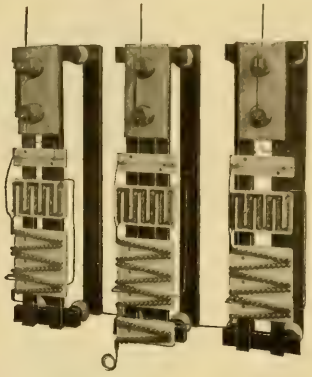
STANLEY-G. I. ELECTRIC MFG. COMPANY
PITTSFIELD MASSACHUSETTS

General Electric Company

1906 Multiplex Lightning Arrester



1906 Multiplex arrester for 13,200 volt Y connected grounded neutral system illustrating shunt resistance and multi-gap features.

Has a low breakdown path
through series gaps for high frequency discharges and through series gaps and a shunt resistance for low frequency discharges.

Has a multiplex discharge path
properly proportioned for abnormal voltage between lines.

Will rupture the dynamic arc
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891

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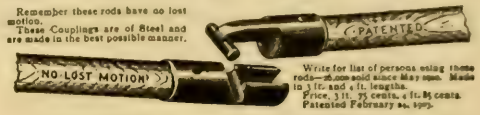
Remember these rods have no lost motion. These Couplings are of Steel and are made in the best possible manner.



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RULES OUT LAMP BREAKAGE

Protects whole Lamp, including tip.

PERMITS FREE LIGHT DISTRIBUTION

Metal formed edgewise radially with Lamps.

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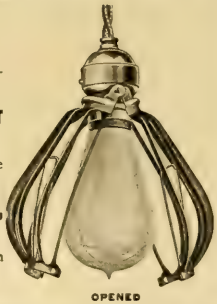
Halves pressed up from sheet steel.



CLOSED — Two parts with hinged joint grip socket tightly.

IT CAN'T BREAK

OPENED — Resilient spring wire supports Lamp centrally—prevents striking.

"Protectalite" Portable Lamp Socket

SOCKET

JET ENAMELED HANDLE

"CAN'T BREAK" LAMP GUARD

Socket Handle permanently attached to cap. Threaded connections unnecessary. Cord cannot come in contact with socket shell. Ample room in cap for tying knot.

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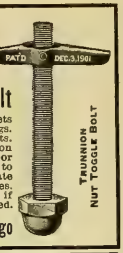

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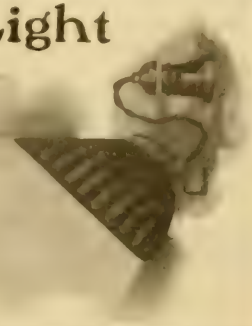

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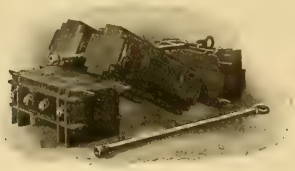

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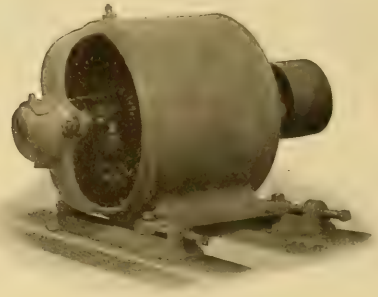

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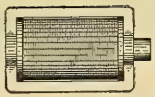

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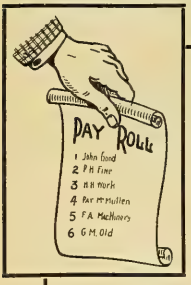

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Built in a wide range of sizes for operation where a vertical shaft is required, enabling operation of machine without the use of bevel gears, etc.
WE SHOW A NORTHERN VERTICAL MOTOR AS APPLIED TO A DEEP WELL PUMP.
Leaflet No. 10126 shows a novel application of the Northern Vertical Motor.
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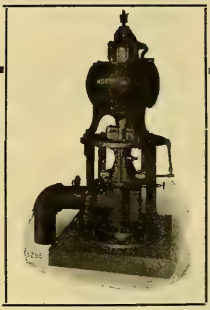

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ARE WELL MADE AND YOU'LL LIKE THEM FOR ALL DIRECT CURRENT CIRCUITS
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Dearborn Water Treatment made to suit the case takes off the scale, keeps it off, stops corrosion and foaming. Send gallon of water for analysis. :: :: ::

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1866 1906

HARTFORD STEAM BOILER INSPECTION & INSURANCE COMPANY

39th ANNUAL STATEMENT

JANUARY 1 1906

CAPITAL	$ 500,000.00
SURPLUS	1,261,459.69
RESERVES	1,926,686.81
ASSETS	3,688,146.50

The **Hartford** is the only company which makes a specialty of, and does exclusively, a steam boiler inspection and insurance business.

The **Hartford** is the only company whose entire talent and energies are applied to the study of steam, to the scientific construction and installation of boilers, and to their periodical inspection by expert mechanics.

The **Hartford** is the only company whose entire assets and resources are held exclusively for the protection of steam users, and the payment of losses occasioned by the explosion of steam boilers, and for no other hazard whatsoever.

The **Hartford** is now doing nearly nine-tenths of the Inspection and Insurance of Steam Boilers in the New England States, and nearly two-thirds of the entire amount done throughout the United States.

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SALEM, OHIO, U.S.A.

STEAM ENGINE BUILDERS.

THE LARGEST LINE OF MODERN ENGINE PATTERNS IN THE WORLD.

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ONE LB. COAL PER HORSE POWER PER HOUR. EVEN WITH COAL AT $5.00 PER TON COSTS LESS THAN ¼ OF ONE CENT PER H. P. PER HOUR OR NOT OVER $7.50 PER YEAR.

Complete Producer and Gas Engine.

BROOKS ELEVATOR CO.

WEBER GAS & GASOLINE ENGINE CO., Minneapolis, Minn., Aug. 10th, 1905. Kansas City, Mo.:

Gentlemen:—The Electric Light Company made a brake test last Saturday night of our Weber Engine and Gas Producer—brakes were set at 100 H. P.

The result of this test was, in a twelve hours' run, the consumption of 1,100 pounds of pea-anthracite coal or 11 of a pound per H. P. per hour.

The ash taken from the run amounted to about 270 pounds.

This should be very satisfactory from your standpoint and the Electric Light Company certainly cannot use it for advertising purposes, in fact do not believe they will ever mention having made this test. yours truly,

BROOKS ELEVATOR COMPANY.

Weber Engine Direct Connected.

Weber Gas & Gasoline Engine Co.

GAS ENGINEERS

Write for Catalogue. P. O. BOX, 381 KANSAS CITY, MO.

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For ARC LAMP and TROLLEY CORD

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Upon request we will send a free sample of

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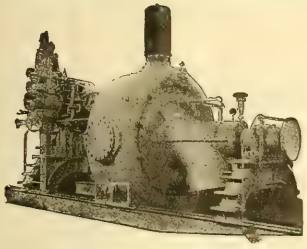
The more money you spend in advertising the more money you have.
The less money you spend in advertising the less money you have.



SAMSON TURBINE

The illustration shows the large NIAGARA design, HORIZONTAL SHAFT TURBINES recently installed by us, for the NIAGARA FALLS HYDRAULIC POWER & MANUFACTURING CO., Niagara Falls, N. Y. Tests conducted by competent engineers, developed as follows:

Head	Gateage	Speed	H. P.	Generator Efficiency	Turbine Efficiency
213 ft.	¼	257 r. p. m.	1750	95 per cent	78.00 per cent
213 ft.	½	257 r. p. m.	3000	95 per cent	85.40 per cent
213 ft.	Full	257 r. p. m.	3800	96 per cent	81.50 per cent

These results have never been equaled by any turbine of the Horizontal Shaft Design, operating under equally HIGH HEADS. The test was made AFTER TURBINES WERE INSTALLED, direct coupled to generators. Francis' weirs and formulæ for discharge were used. The original test reports on file at our offices. These turbines are all fitted with our SAMSON BALANCED GATES. Note especially the UNIFORM SPEED at ALL GATEAGES.

THE JAMES LEFFEL & CO.

307 Lagonda Street, Springfield, Ohio, U. S. A.

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NEW YORK: 277 Broadway CINCINNATI: Union Trust Bldg.

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of all the telephone exchanges (both new and replacements) sold in the United States during the past few years have been

OUR AUTOMATIC SYSTEM

BECAUSE

It improves the service; being perfect, prompt and absolutely private, thus supplying a logical reason for advancing rates which have been too low.

It lowers the expenses; costs 50% less to operate and maintain than a manual exchange.

It makes it possible for the operating companies to pay good dividends on their stock; thus

It enhances and steadies the values of telephone securities, making and keeping them a safe desirable and profitable investment.

Our automatic system adopted in the following cities:

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Portland, Maine.
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Cleburne, Texas.
Columbus, Ga.
South Bend, Ind.
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Miamisburg, Ohio.
Los Angeles, Cal.
Portland, Ore.
Van Wert, Ohio.
Battle Creek, Mich.
Clayton, Mo.
Pentwater, Mich.
Toronto Junction, Canada.
Wilmington, Del.
Albuquerque, N. M.
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Auburn, Maine.
Fall River, Mass.
New Bedford, Mass.
Medford, Wis.
San Diego, Cal.
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Hazleton, Pa.
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Westerly, R. I.
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Princeton, N. J.
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FLEXIBLE CONDUIT

"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

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Bituminized Fibre Conduit

For Underground Construction

COMBINES the **GOOD FEATURES** of other conduits.
ELIMINATES the **BAD FEATURES** existing in many kinds.
HAS VALUABLE FEATURES not found in any other duct.

The American Conduit Company has a corps of experts in underground construction and is prepared to furnish supervision of work if desired. We would prefer to co-operate with contractors in underground construction, but if desired will submit estimates and bids and take contracts for completed underground systems in any part of the United States or Canada.

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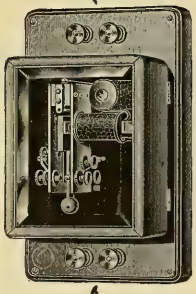

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The most efficient and the only reliable ringer on the market.

Measures only 9x6x5 inches; weighs only 4 lbs. We use no primary battery for the vibrator; actual consumption of current from the main batteries practically unnoticeable. Will ship on 30 days' trial, returnable at our expense if not satisfactory in every respect.

Write **today** for **new** descriptive circular and prices.

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200 Eddy Street
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Our Frequency Pole Changer for Small 4-Party Line Magneto and Common Battery Exchanges will be on the market soon. Come and see it in operation at our Factory.

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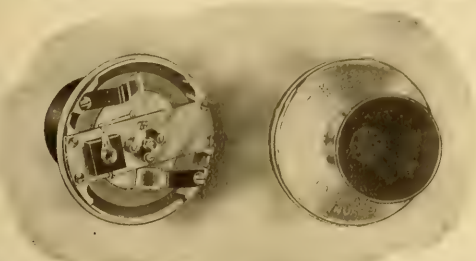
REVERSE TYPE "SOLID BACK"
TRANSMITTER
HAS STOOD THE TEST OF TIME

It was in service five years ago.
It has been in service ever since.
It will be in service forever without change.

A Kellogg Transmitter once installed never needs to be replaced.



BACK VIEW. FRONT VIEW.

Every telephone company has come to know that the Transmitter is the most vital part of the entire system.

If a Transmitter "falls down" and has to be exchanged, it is not the financial loss that counts, but it is the dissatisfaction of the subscribers that hurts the telephone company, and this dissatisfaction of the subscribers cannot be expressed in dollars and cents.

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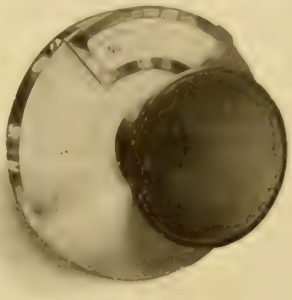
which gives perfect transmission on the longest lines.



You can readily see **why** if you get a copy of our new booklet. Then you can **prove it** by getting a sample Transmitter.

Shall we send you a copy? We mail it free.

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On Sept. 5, 1905, the U. S. Patent Office issued to Oscar M. Leich the dominating patent on Selective Four-party Telephone Ringing Systems covering all present practical forms of **high** and **low frequency** systems, together with all so-called harmonic or different frequency arrangements. We are sole licensees under said patent.

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All shipments are prompt, subject only to car supply.
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The acquisition of this new yard enables us to ship poles by all railroads or by the lake routes, thereby enabling us to give the best delivered prices.
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Also 8 Inch 8 Foot Ties, Going Price, Quick Shipment
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The best protection for the lamp.
Easily put on and will not shake off, or partly off, or shift to one side.
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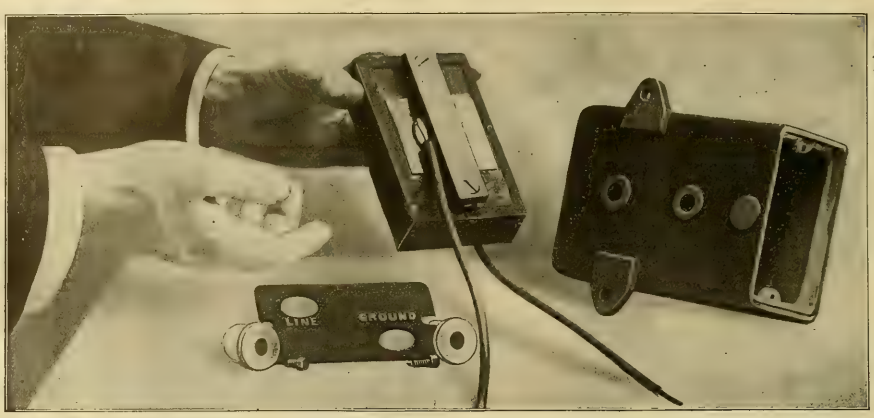

This is the Other Side

of the discharge block of Westinghouse M. P. Lightning Arrester illustrated in our advertisement in the February 17th issue of this publication. It shows the line terminal and button gap, held securely to a bed of mica, placed on the terminal of the discharge block.

In the March 17th issue we will illustrate the discharge block dismantled, and give some details of the M. P. Arrester Button Gap.

Westinghouse Electric & Mfg. Co.

Address nearest district office: **Pittsburg, Pa.**

New York, Atlanta, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Los Angeles, Minneapolis, New Orleans, Philadelphia, Pittsburg, St. Louis, Salt Lake City, San Francisco, Syracuse, Seattle.
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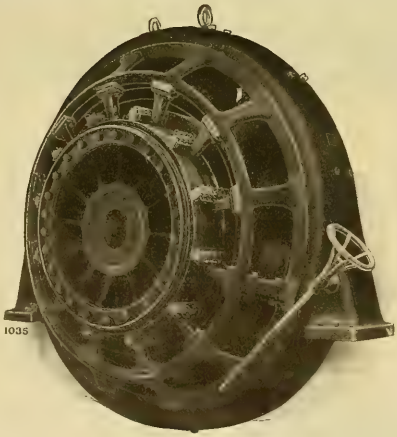
National Engine Type Generators



300 KW. Engine Type Generator

Write for Bulletin No. 62

National Electric Company
MILWAUKEE

NEW YORK PHILADELPHIA CHICAGO SAN FRANCISCO

Keys for the Practical Electrical Worker

By F. J. ROBINSON.

Electric Light, Power, Street Railway, Telephone, Telegraph and the every-day tables explained almost entirely by drawings and diagrams of connections taken from the very latest practice.

Nearly 200 pages. Price $2.00.

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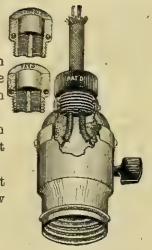
The "KNOSTRAIN" BUSHINGS



are made in two styles: One of them fits ⅜-inch socket caps, and the other is made for rosette or ⅜-inch socket handle.

Why tie knots in cords which increase the dangers of short circuits?

The "Knostrain" Bushings fit either No. 16 or No. 18 lamp or show window cords.

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Are you in any of the above? Our quiet and efficient direct-current generators are of daily use in them all. Might not these machines displace some cumbrous and antiquated appliances in your business?

In Bulletin 1044-E are described

Belt-Driven D. C. Generators

And in Bulletin 1050-E

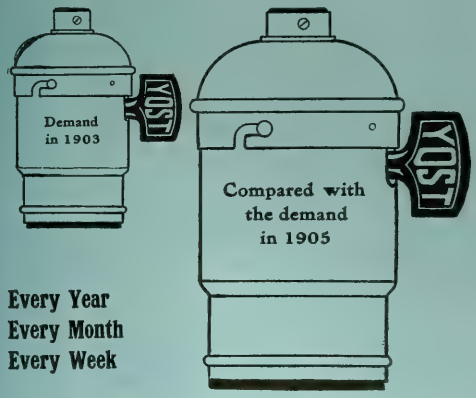
Direct-Connected D. C. Generators

FORT WAYNE ELECTRIC WORKS

"WOOD" SYSTEMS

FORT WAYNE, INDIANA

420



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demonstrating they are of

MORE THAN ORDINARY MERIT

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The Yost Electric Mfg. Co.
TOLEDO, OHIO

RECOGNIZED

BY ALL UNBIASED METER EXPERTS TO BE THE MOST RELIABLE DIRECT CURRENT WATTMETER IN THE WORLD

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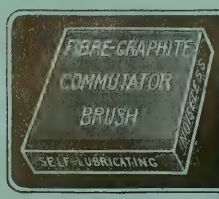

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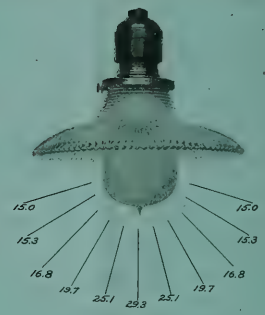

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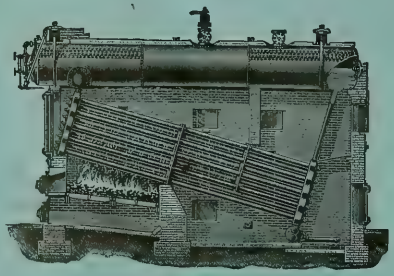

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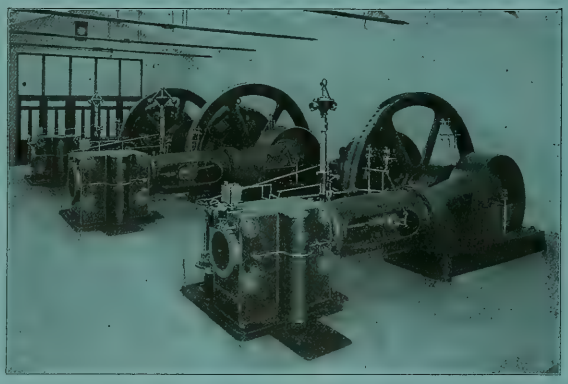

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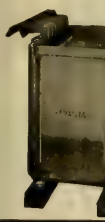

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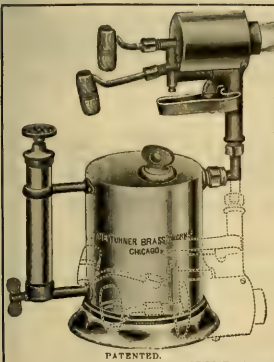

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 16
Aermotor Company ..... —
Alton Machine Co 4
Allis-Chalmers Company 2
American Battery Co. 9
Amer. Circular Loom Co. 4
American Conduit Co. 18
American Diesel Engine Co. 16
Amer. District Steam Co. 16
Amer. Elect'l. Supply Co. ..... —
Amer. El. Telephone Co. 19
American Electrical Works.. 13
Arnold Co., The 16
Automatic Electric Co. 18
Automatic Time Stamp Co.. 4

Babcock & Wilcox Co. ..... —
Badt, F. B. 18
Bain, Forde & May 13
Baker & Co., Inc. 3
Baker & Co., W. E. 16
Beardslee Chandelier Mfg. Co.—
Belden Mfg. Co. ..... —
Benjamin Elec. Mfg. Co. ..... —
Benton & Son 7
Berthold & Jennings 21
Bissell Co., The F. 5 11
Bossert Electric Construction Co. 13
Boston Incan. Lamp Co. ..... —
Bracey-Forse Elec. Cons. Co. 12
Brooks, Hall L. 20
Bruer, Will F. 20
Buckeye Electric Co. ..... —
Buckeye Engine Co. 17
Bull Dog Specialty Co., The.—
Bullock Elec. Mfg. Co. 2
Butterfield Construction Co. 16
Byllesby & Co., H. M. 16

Central Electric Co. 5
Century Electric Co. 12
Chicago Edison Co. 4, 14
Chic. Fuse Wire & Mfg. Co. ..13
Chicago House Wrecking Co. 14
Chicago Mica Co. 12
Chicago Pneumatic Tool Co. .12
Columbia Incand. Lamp Co. .—
Co-Operative Electrical Development Assn. 10
Cope, T. J. 1
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 11
Crolius & Son, E. R. ..... —
Cutler-Hammer Mfg. Co. 7
Cutter Elec. & Mfg. Company 1

D. & T. Anchor Co. 9
D. & W. Fuse Company. ..... —
Davis Electric Mfg. Co 12
Dearborn Drug & Chem. Wks. 17
Diamond Meter Company 5
Directory of Engineers. 16
Dixon Crucible Co., Joseph. .17
Duncan Elec. Mfg. Co. 23

Edison Decorative & Miniature Lamp Departm't. 12
Edison Mfg. Company. ..... —
Electric Appliance Co. 12
Electric Storage Battery Co.. 3
Electrician Pub. Company ..21

Faries Mfg. Co. ..... —
"For Sale" Advertisements. .14
Ft. Wayne Elec. Works, Inc. .23
Fowler & Co., John H. 21
French Battery Co. ..... —

Galloway Co., J. B. 20
General Electric Co. 11, 12
General Storage Battery Co. .12
Gest, G. M. 18
Gleason, John L. 13
Gould Storage Battery Co.... 6
Gregory Electric Co. 14

Haller Machine Co. 15
Hart Mfg. Co. 24
Hartford Steam Boiler Inspection & Insurance Co. ..—
Hazard Manufacturing Co. ..—
Hensel & Co., John A. 8
Highland Park College. ... 16
Hoffman, G. W. 15
Hoffmann, Emil R. 15
Holmes Fibre-Graph. Co. ..... —
Holophane Glass Co. 7
Humphrey, Henry H. 16
Hunt & Co., Robt. W. 16

Illinois Central Ry. 20
Incandescent Electric Light Manipulator Company. ..... —
Indiana Rub. & Ins. W. Co.... 1
India Rubber & Gutta Percha Insulating Company. ..... —
International Elec. Meter Co 5
International Tel. Mfg. Co. ..19

Jackson, D. C. & W. B. 16
Jeffrey Manufacturing Co. ..17

Kartavert Manufacturing Co.—
Kellogg Switchboard & Supply Company. 19, 20
Klein & Sons, Mathias. 12
Kohler Brothers. 16
Kuhlman Electric Co. 12

La Fayette Elect'l Mfg. Co.—
Leather Preserv. M. Corp. ....—
Leffel & Co., James. 17
Lindsley-Bauman Co. 20
Loud's Sons Co., H. M. 21
Ludlow Valve Co. 17

Machado & Roller. ..... —
Maine Hub Mfg. Co. 21
Manhattan El. Supply Co. ..13
Matthews & Bros., W. N. ..3, 9
McCandless, H. W. & Co. 18
M'Glehan & Co., C. H. 13
McLennan & Company, K. ..12
McLeod, Ward & Co. 8
McRoy Clay Works. 18
Mica Insulator Company. 12
Miscellaneous Advs. 14
Monarch Elec. Mfg. Co 7
Mott Iron Wks., J. L. 9
Mueller Company, William. .21
Munsell & Co., Eugene 12

National Battery Co. 8
National Carbon Co. 4
National Electric Co. 24
National India Rubber Co. 1
Nat'l. X Ray Reflector Co. .. —
New Idea Soldering Paste Co. 14
New York Ins. Wire Co. 1
Northern Elect'l Mfg. Co. 14

Okonite Co., The. 1
Oneida Community, Ltd. ..... —
Osburn Flex. Conduit Co. 18
Otto Gas Engine Works. 17

Pacific Coast Pole Co. 20
Perrizo & Sons. 21
Peru Elec. Mfg. Co. 11
Phillips, Eugene F. ..... —
Phillips Insulated Wire Co. ..13
Phœnix Glass Co. ..... —
Phosphor-Bronze S. Co. 17
Pignolet, L. M. 12
Pillsbury-Watkins Co. 20
Pittsburg & L. S. Iron Co. ...21
Plume & Atwood Mfg. Co. .... —
Porter Cedar Company 20

Rail Joint Co., The. 3
Reisinger, Hugo. 7
Replogle Governor Works.. —
Reynolds El. Flasher Mfg. Co. 1
Robbins & Myers Co. 16
Robert Instrument Co., The.—
Robertson & Sons, Jas. L. 14
Rock Island Battery Co .... —
Roebling's Sons Co., J. A. 18
Ruebel & Wells. 16
Runzel-Lenz Elec. Mfg. Co.—

Safety Ins. Wire & Cable Co. .24
Samson Cordage Works. 1
Sandwich Pole Changer Co. .... —
Sargent & Lundy. 16
Schott, W. H. 16
Schureman Co., J. L. 3
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co. 12
Smith Storage Battery Co. .... —
Sorensen, P. 9
Speer Carbon Co. ..... —
Spon & Chamberlain. 15
Standard Elect'l. Mfg. Co. .... —
Standard Underg. Cable Co. .... —
Stanley—G. I. Elec. Mfg. Co.—
Star Expansion Bolt Co. 1
Sterling & Son, W. C. 21
Stewart Elec. Co., Frank H.. 1
Stow Mfg. Company ..... —
Stromberg-Carlson Tel. Mfg Company 19
Sturgess Engineering Dept. 17

Torrey Cedar Company 20
Trumbull Elec. Mfg. Co. 8
Turner Brass Works. 3

Underhill, Chas. R. 16
Universal Elec. Stor. Bat. Co. —

Van Nostrand Co., D. ..... —
Vought-Berger Co. ..... —
Vulcanized Fibre Company.. 24

Wagner Electric Mfg. Co. 24
Wagor Mfg. Co., P. R. ..... —
Weber Gas & Gasoline Engine Co. 17
Wesco Supply Co. 12
Western Electric Company ..24
Western Lumber & Pole Co.—
Westinghouse Electric & Manufacturing Co. 22
Westinghouse Machine Co. ..22
Weston Electrical Inst. Co.... 1
Willard Storage Bat. Co. 8
Williamson & Co., R. 13
Willis, G. M. 16
Wilson, Co., Jas. I. M. 21
Worcester Company, C. H. 20
Wrigley Co., Thos. ..... —

Yost Electric Mfg. Co. 15

Zeller Geo. A. Book Co. .... —

For Classified Index of Advertisements See Page 6.

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> "Upon full consideration, we are of the opinion that the defendant's machine does not infringe Claim 1 of the Hamilton patent, or either Claim 1 or Claim 2 of the Abbott patent."

The decree of the Circuit Court is reversed, and the case is remanded to that court with directions to dismiss the bill, with costs; and the appellant recovers costs of his appeal. We are now ready to supply **Timeometers** and **Duragraphs** for recording **Elapsed Time.**

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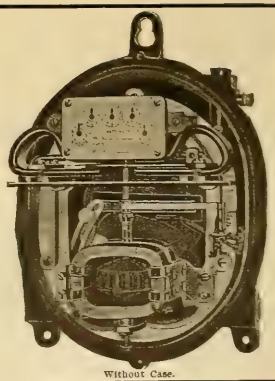

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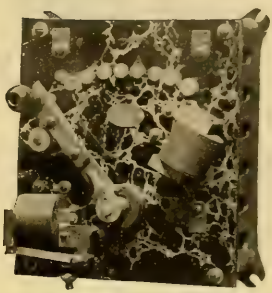

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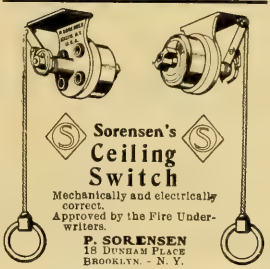

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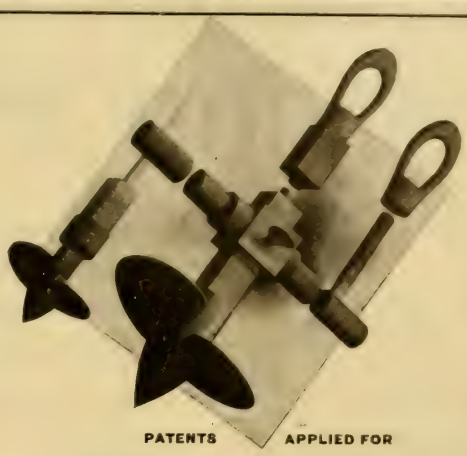

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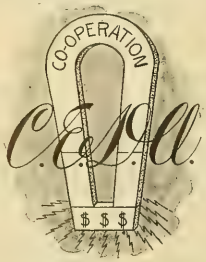

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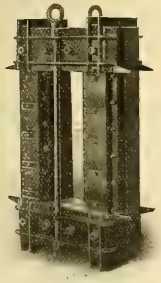

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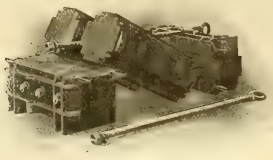

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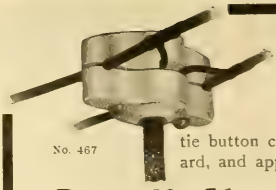

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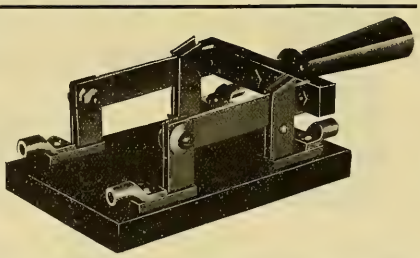

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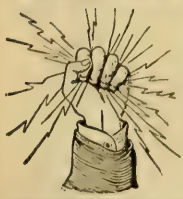

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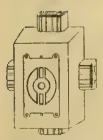

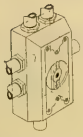

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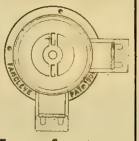

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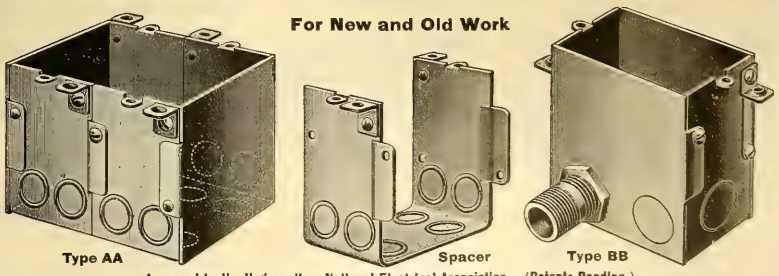

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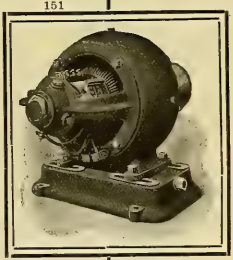

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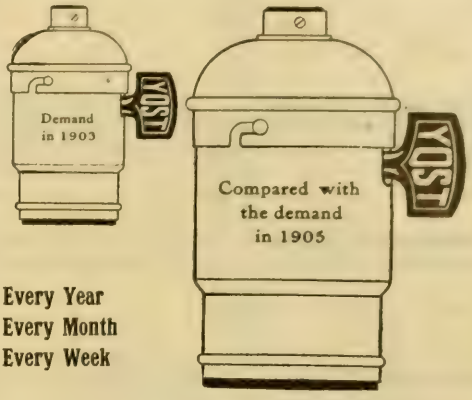

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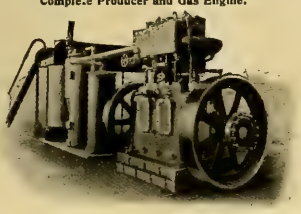

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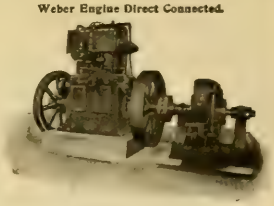

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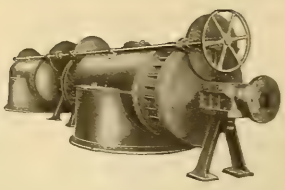

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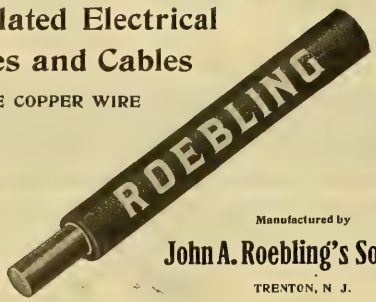

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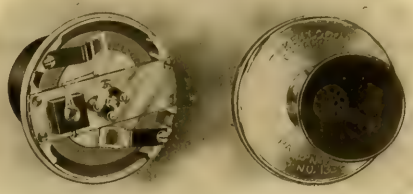

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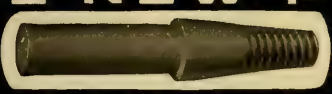
"A Good New Thing"  "A Good New Thing"
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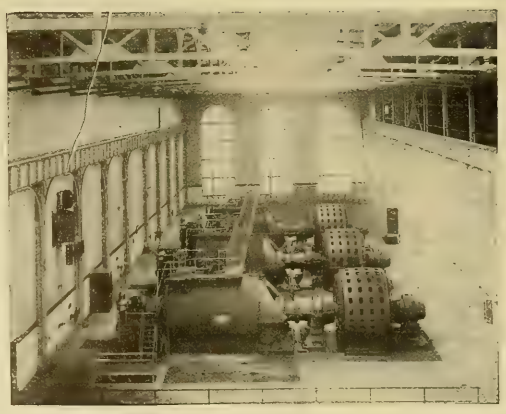

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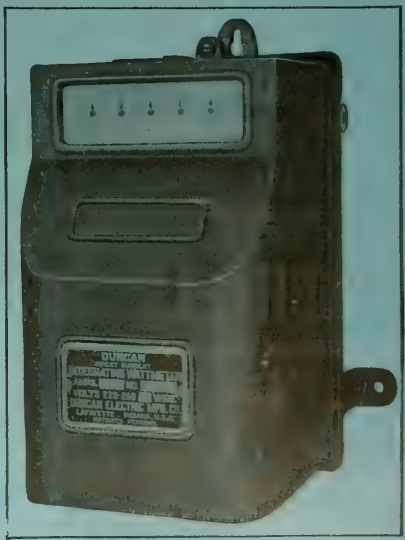

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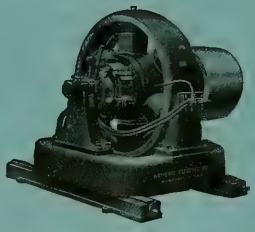

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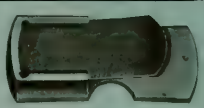
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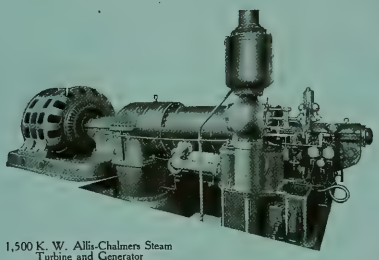

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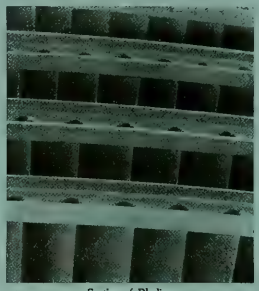

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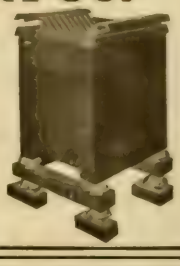

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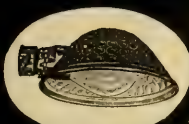

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Grand Prize
Universal Exposition
ST. LOUIS, 1904

ALPHABETICAL INDEX TO ADVERTISEMENTS.

Addison Glass Co. 22
Aermotor Company 8
Alton Machine Co. 4
Allis-Chalmers Company 2
American Battery Co. ..... —
Amer. Circular Loom Co. 1
American Conduit Co. 16
American Diesel Engine Co. —
Amer. District Steam Co. 14
Amer. Elect'l. Supply Co. ..... —
Amer. El. Telephone Co. 17
American Electrical Works .. 11
Arnold Co., The 14
Automatic Electric Co. 16

Babcock & Wilcox Co. ..... —
Badt, F. B. 14
Bain, Forée & May ..... —
Baker & Co., Inc. 3
Baker & Co., W. E. 14
Beardslee Chandelier Mfg. Co. —
Belden Mfg. Co. 11
Benjamin Elec. Mfg. Co. ..... —
Benton & Son ..... —
Berthold & Jennings 18
Bissell Co., The F. 5
Bossert Electric Construction Co. 15
Boston Incan. Lamp Co. ..... —
Bracey-Forse Elec. Cons. Co. —
Brooks, Hall L. 18
Bruer, Will F. 18
Buckeye Electric Co. ..... —
Buckeye Engine Co. 15
Bull Dog Specialty Co., The. —
Bullock Elec. Mfg. Co. 2
Butterfield Construction Co. —
Bylesby & Co., H. M. 14

Central Electric Co. 5
Century Electric Co. 11
Chicago Edison Co. 4, 12
Chic. Fuse Wire & Mfg. Co. —
Chicago House Wrecking Co. 12
Chicago Ins. Wire & Cbl. Co. 5
Chicago Mica Co. 10
Chicago Pneumatic Tool Co. 12
Columbia Incand. Lamp Co. —
Cope, T. J. 16
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co. 9
Crollius & Son, E. R. ..... —
Cutler-Hammer Mfg. Co. 9
Cutter Elec. & Mfg. Company —

D. & T. Anchor Co. 13
D. & W. Fuse Company ..... —
Davis Electric Mfg. Co. ..... —
Dearborn Drug & Chem. Wks. 15
Diamond Meter Company ..... —
Directory of Engineers 14
Dixon Crucible Co., Joseph .. 15
Duncan Elec. Mfg. Co. 21

Edison Decorative & Miniature Lamp Departm't. 10
Edison Mfg. Company 10
Electric Appliance Co. 10
Electric Storage Battery Co. . 3
Electrician Pub. Company ... 21

Faries Mfg. Co. 3
"For Sale" Advertisements. 12
Ft. Wayne Elec. Works, Inc. 21
Fowler & Co., John H. 19
French Battery Co. ..... —

Galloway Co., J. B. 18
General Electric Co. 9, 10
General Storage Battery Co. 10
Gest, G. M. 16
Gleason, John L. ..... —
Gould Storage Battery Co. ..... —
Gregory Electric Co. 12

Haller Machine Co. ..... —
Hart Mfg. Co. 22
Hartford Steam Boiler Inspection & Insurance Co. ... —
Hazard Manufacturing Co. ... 22
Hensel & Co., John A. ..... —
Highland Park College. 14
Hoffman, G. W. 11
Hoffmann, Emil R. ..... —
Holmes Fibre-Graph. Co. 15
Holophane Glass Co. 22
Humphrey, Henry H. 14
Hunt & Co., Robt. W. 14
Hydro-Elec. Development Co 14

Illinois Central Ry. 18
Incandescent Electric Light Manipulator Company ..... —
Indiana Rub. & Ins. W. Co. ... 1
India Rubber & Gutta Percha Insulating Company 6
International Elec. Meter Co 5
International Tel. Mfg. Co. ... 17

Jackson, D. C. & W. B. 14
Jeffrey Manufacturing Co. ... 15

Kartavert Manufacturing Co. 22
Kellogg Switchboard & Supply Company 17, 18
Klein & Sons, Mathias 13
Kohler Brothers 14
Kuhlman Electric Co. 1

La Fayette Elect'l Mfg. Co. . 10
Leather Preserv. M. Corp. ... 13
Leffel & Co., James 15
Lindsley-Bauman Co. 18
Loud's Sons Co., H. M. 19
Ludlow Valve Co. ..... —

Machado & Roller 10
Maine Hub Mfg. Co. ..... —
Manhattan El. Supply Co. ... 1
Marion Ins. Wire & Rub. Co. 11
Matthews & Bros., W. N. ... 3, 11
McCandless, H. W. & Co. ... 11
M'Gehan & Co., C. H. 15
McLennan & Company, K. ... 10
McLeod, Ward & Co. 10
McRoy Clay Works 16
Mica Insulator Company 10
Miscellaneous Advs. 12
Monarch Elec. Mfg. Co ..... —
Mott Iron Wks., J. L. 10
Mueller Company, William .. 19
Munsell & Co., Eugene 10

National Battery Co. 4
National Carbon Co. 5
National Electric Co. 13
National India Rubber Co. ... —
Nat'l. X Ray Reflector Co. .. —
New Idea Soldering Paste Co. 10
New York Ins. Wire Co. 14
Northern Elect'l Mfg. Co. ... 12

Okonite Co., The 1
Onelda Community, Ltd. 1
Osburn Flex. Conduit Co. 16
Otto Gas Engine Works. ..... —

Pacific Coast Pole Co. 18
Perrizo & Sons 19
Pern Elec. Mfg. Co. ..... —
Phillips, Eugene F. 11
Phillips Insulated Wire Co. .. 11
Phœnix Glass Co. 1, 7
Phosphor-Bronze S. Co. 15
Pignolet, L. M. 10
Pillsbury-Watkins Co. 18
Pittsburg & L. S. Iron Co. ... 19
Plume & Atwood Mfg. Co. 1
Porter Cedar Company 18

Rail Joint Co., The 3
Reisinger, Hugo ..... —
Replogle Governor Works .. 1
Reynolds El. Flasher Mfg. Co. 13
Robbins & Myers Co. 20
Robert Instrument Co., The .. 13
Robertson & Sons, Jas. L. .... —
Rock Island Battery Co 13
Roebling's Sons Co., J. A. 22
Ruebel & Wells 14
Runzel-Lenz Elec. Mfg. Co. .. 17

Safety Ins. Wire & Cable Co .. 1
Samson Cordage Works. 14
Sandwich Pole Changer Co. .. 17
Sargent & Lundy ..... —
Schott, W. H. 14
Schureman Co., J. L. 3
Simplex Electrical Co., The .. 1
Simplex Elec. Heating Co. 13
Smith Storage Battery Co. 4
Sorensen, P. ..... —
Speer Carbon Co. 20
Spon & Chamberlain. ..... —
Standard Elect'l. Mfg. Co. 14
Standard Underg. Cable Co. 1
Stanley—G. I. Elec. Mfg. Co. 8
Star Expansion Bolt Co. 11
Sterling & Son, W. C. 19
Stewart Elec. Co., Frank H. .. 2
Stow Mfg. Company 1
Stromberg-Carlson Tel. Mfg. Company 17
Sturgess Engineering Dept. .. —

Torrey Cedar Company. 18
Trumbull Elec. Mfg. Co. 10
Turner Brass Works ..... —

Underhill, Chas. R. 14
Universal Elec. Stor. Bat. Co. 4

Van Nostrand Co., D. ..... —
Vought-Berger Co. ..... —
Vulcanized Fibre Company .. 22

Wagner Electric Mfg. Co. .... —
Wagor Mfg. Co., P. B. ..... —
Weber Gas & Gasoline Engine Co. ..... —
Wesco Supply Co. ..... —
Western Electric Company .. 22
Western Lumber & Pole Co. —
Westinghouse Electric & Manufacturing Co. 20
Westinghouse Machine Co. .... —
Weston Electrical Inst. Co. 1
Willard Storage Bat. Co. .... —
Williamson & Co., R. 11
Willis, G. M. 14
Wilson, Co., Jas. I. M. 19
Worcester Company, C. H. 18
Wrigley Co., Thos. ..... —

Yost Electric Mfg. Co. 11

Zeller, Geo. A. Book Co. 12

For Classified Index of Advertisements See Page 6.

Motors,
Switches,
Arc Lamps,
Circuit Breakers, Etc., Etc.

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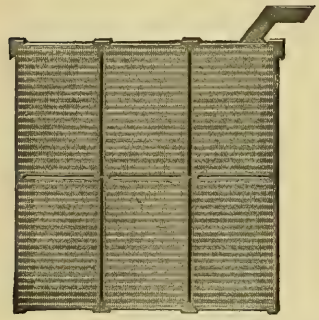

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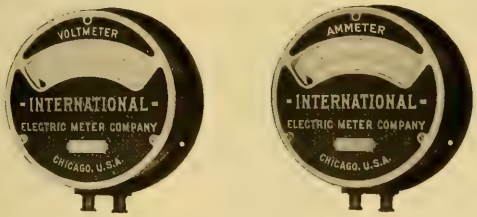

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J. B. OLSON, Manager of Sales

CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjustors, Cord.
Incandes. El. Lt. Manip. Co.

Adjusters, Inc. Lamps.
Inc. El. Lt. Manipulator Co.

Anchors (Tel. & Tel.)
D. & T. Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre-Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Electric Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Metzger Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clusters.
Benjamin Elec. Mfg. Co.
Faries Mfg Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Underhill, Chas. R.
Western Electric Co.

Commutator Compound.
Crollius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduit and Conduits.
American Circular Loom Co.
American Conduit Company
Central Electric Co.
Electric Appliance Co.
Gest. G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McKoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest. G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Bracey-Forse Elec. Cons. Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman, Co., J. L.

Cord.
Belden Mfg. Co.
Rumzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Gallowy Co., B.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.

Dynamos and Motors.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Hadi, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Bylesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Meier Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schout, W. H.
Stanley—G. I. Elec. Mfg. Co.
Underhill, Chas. R.
Willis, G. M.

Electrical Instruments.
(Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators-Conveyers.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Corliss.
Allis-Chalmers Company.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Benton & Son.
Otto Gas Engine Works.
Weber Gas & Gasoline Engine Co.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Faries Mfg. Co.
McLeod, Ward & Co.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg.Co.
Faries Mfg. Co.
Williamson & Co., R

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

Glassware, Electric.
Addison Glass Co.

Globes, Reflectors and Shades.
Addison Glass Co.
Faries Mfg. Co.
Haller Machine Co.
Holophane Glass Co.
McLeod, Ward & Co.
Nat'l X Ray Reflector Co.
Phenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Repiogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Incandescent Electric Light Manipulator Co.
Vought-Berger Co.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indians Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Wagor Mfg. Co., P. R.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Electric Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Machinery, Automatic.
M'Glehan & Co., C. H.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co, Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Berthold & Jennings.
Brooks Hall L.
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley-Bauman Co.
Loud's Sons Co., H. M.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Pittsburg-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Perry Electric Mfg. Co.

Portables.
Faries Mfg.tCo.
McLeod, Ward & Co.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Highland Park College.

Searchlights.
Benton & Son.

Second-Hand Machin'y.
Bissell Co., The F.
Chicago House Wrecking Co.
Gregory Electric Co.
Matthews & Bro., W. N.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Sockets & Receptacles.
Yost Elec. Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Bull Dog Specialty Co., The
Crollius & Son, E. R.
New Idea Soldering Paste Co.
Western Electric Co.

Solenoids.
Schureman Co., J. L.
Underhill, Chas. R.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Universal Elec. Stor. Bat. Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co.
Vought-Berger Co
Wesco Supply Co.
Western Electric Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Towers, Elec. Transmission
Aermotor Company.

Transformers.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Cbl. Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indians Rub. & Ins. Wire Co.
India Rubber & Gutta Perchs Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 3.

INNER GLOBE WISDOM

What makes the city streets so bright,
And the lamps such radiance shed?
"There's a Phœnix Inner in each light,"
The wise Electrician said.

The citizens were filled with pride
As through the streets they sped,
And crooks all sought a place to hide;
"Night's bright as day," they said.

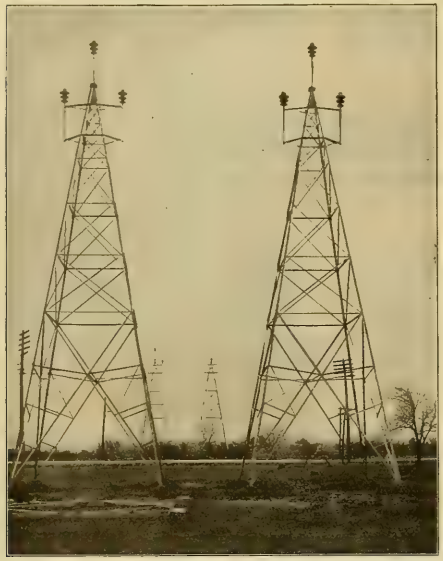
Dealers, too, all wild with glee,
Smiles o'er their faces spread;
When asked why from all care so free,
"Phœnix Inners," all they said.

Now, all "get wise" and join the throng
That only Phœnix Inners use,
And life will be one long, sweet song,
With freedom from the "blues."

Write for Our Inner Globe Proposition
Inner and Outer Globe Catalogues Upon Request

Glassware for All Lighting Systems Our Specialty

THE PHOENIX GLASS CO.
PITTSBURG NEW YORK CHICAGO



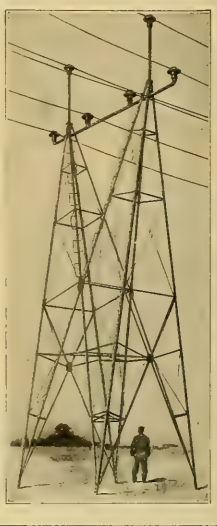
GALVANIZED STEEL
ELECTRIC TRANSMISSION TOWERS

FOR SINGLE, DOUBLE OR TRIPLE CIRCUITS

Aermotor Towers are HEAVILY GALVANIZED after all punching, shearing and machine work is finished. They will withstand corrosion in any climate without expense for maintenance.

THREE-PHASE SINGLE CIRCUIT TOWERS

The view at the left shows the double line of towers designed and built by the Aermotor Company, and erected for one of the power companies at Niagara Falls. These towers are 50 feet high and weigh about 3000 lbs. each. They are guaranteed to withstand a pull of 3500 lbs. at the top of any insulator pin, or a total pull at the top of the tower of 15,000 pounds. They are the most substantial towers yet built for transmission purposes. The price of these towers is very moderate, and the cost of anchorage is greatly reduced by the use of a wide trussed base.



THREE-PHASE DOUBLE CIRCUIT TOWERS

The cut at the right shows the style of tower which the Aermotor Company is now furnishing for a double circuit line which is building in the state of New York. These towers are guaranteed to withstand a strain of 2000 lbs. on any insulator pin, or a total strain of 8000 lbs. in either direction. By the ingenious arrangement of the twin towers these strains are easily met with great economy of material.

The illustrations show only two of the various styles of towers which the Aermotor Company has designed and built. They are prepared to furnish the most economical towers to meet every requirement.

AERMOTOR COMPANY, CHICAGO

Stanley - G. I

The Stanley-G. I. Electric Mfg. Co. is a consolidation of the Stanley Electric Mfg. Company of Pittsfield and the General Incandescent Arc Light Company of New York. The Stanley Company's product, marketed under the well-known trade name of the S. K. C. System, comprises Generators, Transformers, Rotary Converters, Motor Generator Sets, Switchboard Apparatus, Induction Motors, etc. The General Incandescent Arc Light Company has been favorably known as builder of the high-grade G. I. Arc Lamps, Arc Lamp Regulators, Incandescent Lamps, alternating current and direct current Motors, General and Special Electrical Supplies.

FULL STOCK OF MOTORS, TRANSFORMERS AND SUPPLIES CARRIED AT CHICAGO

Chicago Office: 1543-1546 Monadnock Block, **Phone Harrison 5244-5245**

Cincinnati, O., First Nat'l Bank Building St. Louis, Mo., Century Building Minneapolis, Minn., Guaranty Building

Detroit, Chamber of Commerce Cleveland, Citizens Building

STANLEY-G. I. ELECTRIC MFG. COMPANY

PITTSFIELD MASSACHUSETTS

General Electric Company

Electric Heating Devices

Order early and secure prompt shipments

Combination cereal cooker. Sheet aluminum and tinned copper.

Six-pound flat iron for general household use Aluminum bronze or nickel finish.

Electric stove, with three heats.

A profitable summer trade is possible for the central stations which carry a line of General Electric Company's electric heating devices.

The summer is the time and these devices the lever to increase the use of electric current for daily household needs.

912

CHICAGO OFFICE: Monadnock Building

PRINCIPAL OFFICE: Schenectady, N. Y.

Sales Offices in all Large Cities

C-W TRANSFORMERS

CHAPTER III

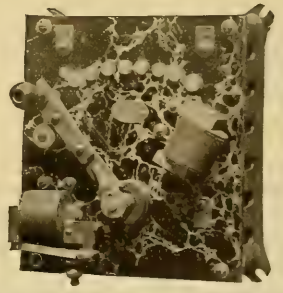
The edgewise wound low tension coil, with its insulating cylinder, is shown in the left hand cut.

At the right is seen the assembled high and low tension windings and insulation ready to go over the core. This is subjected to the vacuum treatment and the compound filling process as a unit; and is not afterwards taken apart or disturbed in anyway. See our Bulletin 65 W. E.

HIGH TENSION COIL

HIGH AND LOW TENSION WINDING

CROCKER-WHEELER COMPANY
Ampere, N. J.



C. & H. Overload Motor Starter

This apparatus is similar to our No. 10 type of starter with the exception that it is fitted with an overload release in addition to a no-voltage release. This device besides protecting the motor from overloads, also indicates the amount of current being consumed by the motor, making it convenient for taking readings. The removing of one screw from this attachment will prevent the motor shutting down and enable the attachment to be used as a current indicator only.

Bulletin 20 gives full description and prices.

THE
Cutler-Hammer Mfg. Co.
Milwaukee

New York Boston Chicago Pittsburg

Telephones

For Exchanges, Hotels, Hospitals, Factories, Office Buildings, Apartment Buildings, and Private lines.

We can guarantee satisfaction and profit to the Exchange, Dealer or Contractor using our apparatus.

ELECTRIC APPLIANCE COMPANY
CHICAGO
Branches: San Francisco, Dallas, New Orleans

MICA Of all Qualities, In any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

LET US HAVE YOUR INQUIRIES WHEN IN NEED OF MICA OF ANY DESCRIPTION—WE CAN GIVE YOU WHAT YOU NEED QUICK AND AT THE RIGHT PRICES.
CHICAGO MICA CO., VALPARAISO, IND.

RELIABILITY
is the feature of
THE EDISON LAMP

4 C.P.—19 watts
3 C.P.—14 watt
2 C.P.—13 or 9 watts

Reliably rated Reliable in brilliancy
Reliably made Reliable in life.
Reliably supplied

LOOK FOR THE LABEL IN THE SOCKET

YOU CAN DEPEND UPON THE EDISON

All Types and Varieties.
Regular Multiple Lamps.
Street Series Lamps.
Miniature Lamps.

GENERAL ELECTRIC COMPANY,
Main Lamp Sales Office,
HARRISON, N. J.

(499)

BIJUR
"HIGH-DUTY"
STORAGE BATTERIES
GENERAL STORAGE BATTERY CO.
42 BROADWAY - - - - NEW YORK

SPARKING *Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .*

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

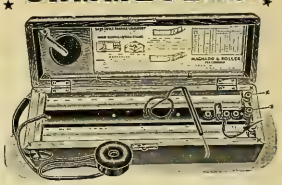
50 Cents per Stick. $5.00 per Dozen.
SEND FOR FREE SAMPLE STICK
For sale by all supply houses, or
K. McLENNAN & CO., Sole Mfrs., Room 411, Inter Ocean Bldg., 130 Dearborn St., Chicago

VOLTMETERS, AMMETERS and VOLT-AMMETERS

For all electrical measurements, testing batteries, electric light circuits etc. Reliable, inexpensive. Portable and switchboard types. Send for Catalog
L. M. PIGNOLET
78-80 Cortlandt Street, NEW YORK

IRON ARC LAMP POLES, BRACKETS, ETC.
THE J. L. MOTT IRON WORKS
84-90 BEEKMAN ST.
NEW YORK

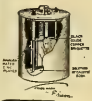
WHITNEY OHMMETERS



ARE ALL RIGHT

So are all our other meters. Our 13 years of experience has enabled us to develop a line without equal.
Have you seen our guarantee label?
Printed matter pertaining to the complete line sent on application.

MACHADO & ROLLER
Monadnock Bldg. Chicago 203 Broadway New York
General Sales Agents
Whitney Electrical Instrument Co.



ECONOMICAL BATTERIES

Edison Primary Batteries furnish most energy for money. Do not waste when idle. Easily and cheaply renewed. Send for Battery Booklet.

Edison Mfg. Co., 7 Lakeside Ave., ORANGE, N. J.
31 Union Sq., N.Y. 304 Wabash Ave., Chicago.
25 Clerkenwell Road, London, E. C.

HORNBERGER TRANSFORMERS
LAFAYETTE ELECTRICAL MFG. CO.
LAFAYETTE, IND.

ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.
"NEW IDEA" SOLDERING PASTE SAMPLE FREE
NEW IDEA SOLDERING PASTE CO., 214 Hibbard Ave., Detroit, Mich.

McLEOD, WARD & CO. McLEOD, WARD & CO. McLEOD, WARD & CO. McLEOD, WARD & CO.

No 30. Ward Doublejoint

OUR LINE OF DESK LAMPS

¶ Popular from the start, but more so now than ever before.
¶ WHY?
¶ Because of our new feature—the "Doublejoint".
¶ Descriptive booklet sent on request.

McLEOD, WARD & COMPANY 27 THAMES STREET
Makers of the "Original Kinsman" NEW YORK CITY

McLEOD, WARD & CO. McLEOD, WARD & CO. McLEOD, WARD & CO. McLEOD, WARD & CO

Iron Clad Service Switch

Cat. No.		Price
1210	110-v. 2-wire	$3.12
1212	250-v. 2 "	3.75
1214	250-v. 3 "	4.50

Discount 50 per cent
Special prices in quantities

This device was designed for use in locations exposed to dampness, corrosive fumes, or mechanical injury.

The case is of cast-iron, having a closely fitting door with spring latch, which can be sealed or pad-locked.

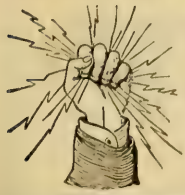
In the box is mounted a 25-ampere combined switch and cut-out on a porcelain base. The three following styles are now furnished:

The Trumbull Electric Mfg. Co.
606 Woodford Ave., Plainville, Conn

FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. E. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

New York Store, W. J. Watson, 26 Cortlandt St.
Chicago Office, F. E. Donohoe, 136 Adams St.
Montreal Branch, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

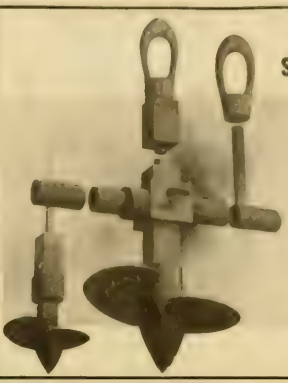
WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 18 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD
2 OUNCE BOX 10 CENTS. SAMPLES SENT FREE.
U.S. METAL POLISH GEO. W. HOFFMAN
POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 205 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD, CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

RICHARD WILLIAMSON, PRESIDENT. CHAS. E. UMMACH, SEC'Y AND TREAS.

R. WILLIAMSON & CO.

MANUFACTURERS OF GAS, ELECTRIC AND COMBINATION FIXTURES
AND DEALERS IN GAS AND ELECTRIC GLOBES MISCELLANEOUS GOODS
ELECTRICAL HOUSE LIGHTING SUPPLIES
88-90-92 W. WASHINGTON STREET, - - CHICAGO

MARION INSULATED WIRE & RUBBER CO.
MANUFACTURERS OF
RUBBER COVERED WIRES AND CABLES
"EAGLE BRAND" ELECTRIC LIGHT AND TELEPHONE WIRES & CABLES
EAGLE BRAND TRADE MARK.
TELEGRAPH, SIGNAL, MINING, MARINE AND SUBMARINE WIRES & CABLES
MAIN OFFICE AND FACTORY, MARION, IND.
CHICAGO OFFICE & WAREHOUSE 141 SO. CLINTON ST.



TYPE B
Stombaugh Guy Anchors

FOR ANCHORING POLES, FENCES, SMOKESTACKS, ETC.

Stombaugh Guy Anchors Are

Send For Handsome, New Illustrated Catalog
W. N. MATTHEWS & BRO.
203 N. 2nd St., St. Louis

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.
Office and Factory: PAWTUCKET, R. I.

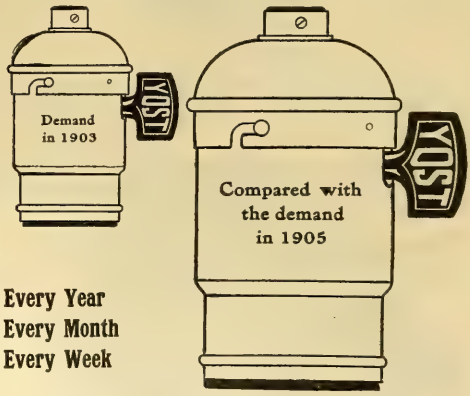
We are the real manufacturers of 75 per cent. of the Enameled Rings used in this country. Try us and see.

STAR EXPANSION BOLT CO.
147-149 CEDAR ST., N. Y. CITY

CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
ST. LOUIS, MO.

MAGNET WIRE
and
ELECTRICAL CORDS
WRITE FOR PRICES
BELDEN MFG. CO.
194 MICHIGAN STREET
CHICAGO

EMPIRE MINIATURE LAMPS
Send for Circular
H. W. McCANDLESS & CO.
Licensed Manufacturers
67 & 69 Park Place
NEW YORK



Every Year
Every Month
Every Week

shows a decided increase in the demand for

Yost Sockets

demonstrating they are of

MORE THAN ORDINARY MERIT

Is there **one good** reason why **you** do not use YOST SOCKETS?

The Yost Electric Mfg. Co.
TOLEDO, OHIO

In 1905

The Western Electrician published 1042 LARGE pages of reading matter and 1575 illustrations. This is 3126 columns or about 3,000,000 words. Equivalent in amount to 23 average $2 technical Books. On the book basis $46 worth given for $3. If you are not a subscriber, send in your order now.

Western Electrician
510 Marquette Building, Chicago

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

WANTED

Draftsmen—We have positions now open for draftsmen. Call or address Western Electric Co., Chicago, Ill.

WANTED.

One No. 8, 65-light, 9.6 ampere, 2,000 C. P. Brush arc dynamo. 65-type No. 31 Brush-Adams, 9.6 ampere, 2,000 C. P., double carbon arc lamps. Describe fully with price. Address Box 582, care Western Electrician, 510 Marquette Building, Chicago, Ill.

WANTED.

A good lineman as foreman. Must be used to live wires. A. C. State experience and salary expected. Address Box 588, care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED

An experienced engineer for night run in a small plant in central Illinois. Must be sober, industrious, and familiar with high speed engines and A. C. generators. Send reference, age, experience and lowest salary in first letter. Address Box No. 585, care of Western Electrician, Chicago.

WANTED

An experienced electrical engineer thoroughly familiar with the electrical and mechanical design of direct current motors and generators; must be a technical graduate. Write fully, giving age, qualification, experience and salary expected. Address Box 586, care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Two second-hand alternators, 60 to 75 K. W. each, 2200 volts, 60 cycles, two phase. Answers must state type of machines, whether they are identical, how long they have been in use, the reasons for sale, and whether price includes switchboards, complete with instruments, rheostats, fuses, switches, etc., and any other apparatus. Answer to ACCUMULATIVE REALTY CO., 309 Broadway, New York City.

WANTED SALESMAN

First-class salesman to sell new patent Rock Island dry batteries on commission basis. Must have first-class references. Apply at once. Rock Island Battery Co., 3rd and Vine Sts., Cincinnati, Ohio.

NOTICE

An American engineer who has resided in various countries of Europe for considerable periods and has an extensive professional acquaintance there, is contemplating a trip of some months abroad and would be glad to attend to important foreign commissions. Address Box 584, care of Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE

Half interest in well paying electric light plant in a Wisconsin town of 6,000. Reason for wishing to dispose of my interest—have other interests in West which need my personal attention. Liberal terms to responsible party. Address Box 587, care of Western Electrician, 510 Marquette Bldg., Chicago, Ill.

FOR SALE

Switchboard and apparatus outgrown and displaced by automatic equipment.

Kellogg switchboard—twenty 8-panel, 3-position, mahogany, equipped for 5200 main lines, ultimate capacity, 6,000 lines.

Kellogg toll board of 9 positions.

Kellogg telephones—4064 wall and 2136 desk.

Sterling terminal rack, with protection.

Power plant, with charging and ringing machines and storage batteries.

Offered for sale in whole or in part.

For particulars, see description in WESTERN ELECTRICIAN of January 20, Electrical Review of January 27, Telephony and Sound Waves for February; or address

The Columbus Citizens' Telephone Company
COLUMBUS, OHIO

Western Electrician
WANT ADS
Bring Results.

FOR SALE

Power Plant at Hannibal, Mo.

1 24-in.x48-in. R. H. Sioux City Corliss engine,
1 26 in.x48 in. L. H. Sioux City Corliss engine.
2 G. E. Thompson-Houston, 120 K. W. single-phase alternators, 1,040 v., 125 cycles complete.
2 60-in.x16-ft. tubular boilers, 50 4-in. tubes.
2 54-in.x15-ft. tubular boilers, 44 4-in. tubes.
1 54-in.x16-ft. tubular boiler, 68 3-in. tubes.
1 Stillwell-Bierce heater.
85 ft. 34 ½-in. double leather belt.
91 ft. 32 ½-in. triple leather belt.
100 ft. 16-in. double leather belt.

To avoid handling and shipment to our warehouses will sell the above complete or any part thereof, f. o. b. Hannibal, at very low price. Write us at once.

WICKES BROTHERS,
SAGINAW, MICH.

REPAIRS

We are Headquarters for ELECTRICAL REPAIR WORK We operate the largest repair shops in America and have exceptional facilities for quick work. We repair **all kinds** of electrical apparatus and save our customers **weeks** in time in comparison with sending the work to the manufacturers direct. We have just reduced our prices and ask you to get our quotations on

Armatures Rewound, Commutators Refilled, Transformers Rewound, Etc.

Send for our monthly **"Bargain Sheet,"** showing net prices on our stock of **second-hand** dynamos, motors, meters, transformers and supplies. Every article a bargain.

GREGORY ELECTRIC CO.
54-62 S. Clinton Street - CHICAGO

The more a man advertises, the greater his business. The greater his business, the more he advertises.

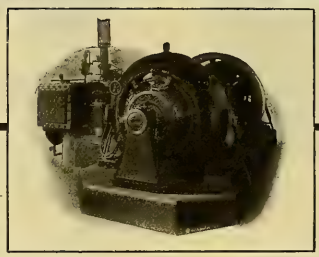
"Little" Giant Storage Batteries

are constructed for all purposes to which storage batteries are adaptable. They retain their charge for long periods. Have greatest output for size and weight. Our Sparking Batteries have hard wood cases, thoroughly acid proof. Every battery guaranteed.

MANUFACTURED BY

Chicago Pneumatic Tool Company

Fisher Building, CHICAGO — 95 Liberty Street, NEW YORK



147

As Good as The Best— "And Then Some."

Ball Compound Engine

Northern Dynamos

Northern Direct Current Apparatus possesses all the characteristics of economical, convenient operation common to excellent electric dynamos and motors and

Many exclusive meritorious features that make it worth your while to get acquainted by reading Bulletin No. 2546

Northern Electrical Mfg. Co. Engineers, Manufacturers, MADISON, WIS., U. S. A.

425 Monadnock Block, Chicago, Ill. — 1236 Wells Bldg., Milwaukee, Wis.
69-75 New Montgomery St., San Francisco, Cal. — 801 Land Title Bldg., Philadelphia, Pa.
21 East Fifth St., St. Paul, Minn. — 29 Broadway, New York

As a Practical Book for Practical Men Spangenberg's Book Ranks First

All the engineering information you should have; all you really need is contained in this book in plain, practical and concise form.

Spangenberg's Steam and Electrical Engineering

Is a complete library covering the subject in all its various branches and contains 672 pages.

The only book ever published containing 1035 questions and answers. Written so you can understand it.

$3.50 is the price, and it is sold with the understanding that it may be returned if not satisfactory, and your money will be refunded immediately. Out of 16,000 books sold only two have been returned. This fact speaks for itself.

CUT OUT AND MAIL TO-DAY

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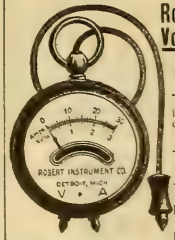

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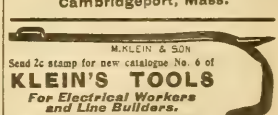

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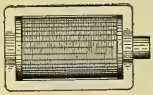

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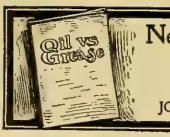

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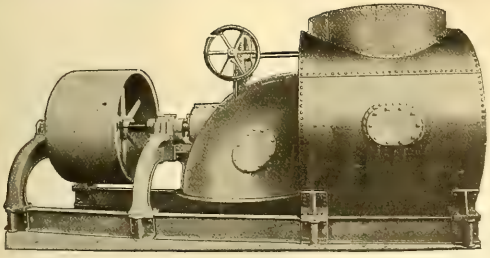

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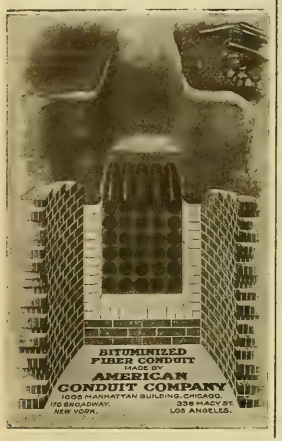

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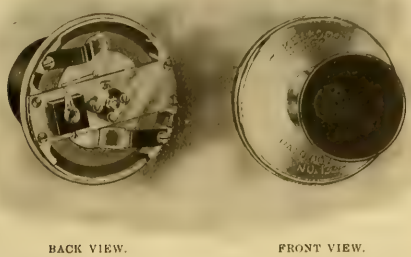

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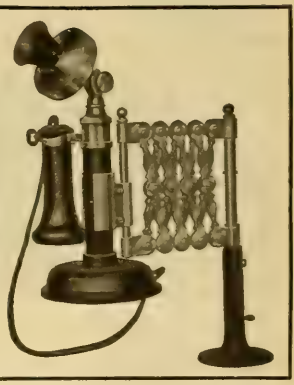

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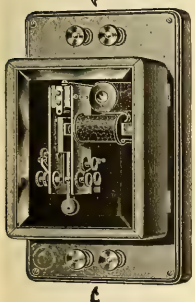

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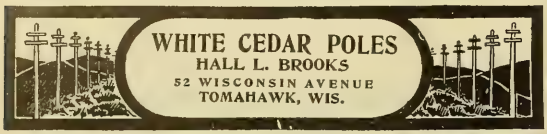

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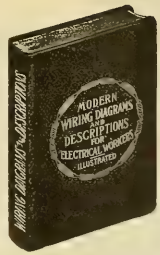

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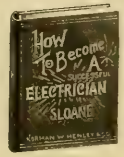

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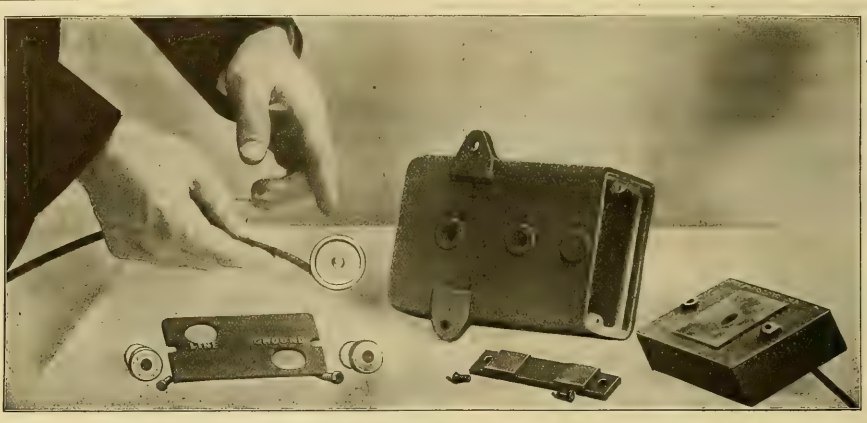

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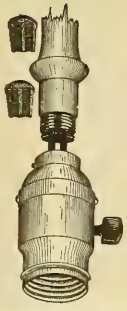

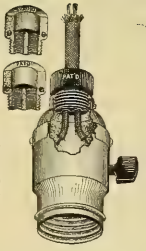

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VI Electric Signaling Apparatus
VII The Relations Between Magnets and Electric Currents
VIII Induction and Reactive Coils
IX The Telephone
X Telephone Accessories
XI The Mechanical Generation of Electricity
XII The Dynamo Machine
XIII Various Types of Dynamo Machines
XIV Alternators—Polyphase Currents
XV The Electric Motor
XVI The Electric Railway
XVII Polyphase Currents and Motors
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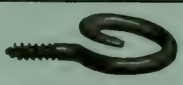

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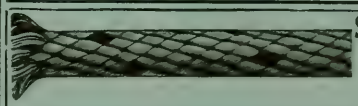

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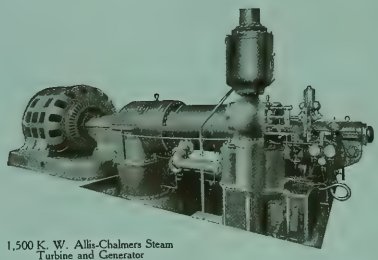

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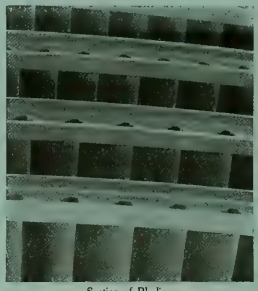

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig....18
Addison Glass Co....14
Aermotor Company....—
Alton Machine Co....4
Allis-Chalmers Company....2
American Battery Co....14
Amer. Circular Loom Co....1
American Conduit Co....16
American Diesel Engine Co.—
Amer. District Steam Co....14
Amer. Elect'l. Supply Co....—
Amer. El. Telephone Co....17
American Electrical Works..11
Arnold Co., The....14
Automatic Electric Co....16

Babcock & Wilcox Co....—
Badt, F. B....14
Bain, Forée & May....11
Baker & Co., Inc....3
Baker & Co., W. E....14
Beardslee Chandelier Mfg.Co.—
Belden Mfg. Co....—
Benjamin Elec. Mfg. Co....—
Benton & Son....4
Berthold & Jennings....18
Bissell Co., The F....1, 9
Bossert Electric Construction Co....12
Boston Incan. Lamp Co....—
Bracey-Forse Elec. Cons. Co.17
Brooks, Hall L....18
Bruer, Will F....18
Buckeye Electric Co....—
Buckeye Engine Co....15
Bull Dog Specialty Co., The.—
Bullock Elec. Mfg. Co....2
Butterfield Construction Co.14
Bylesby & Co., H. M....14

Central Electric Co....5
Century Electric Co....12
Chicago Edison Co....4, 12
Chic. Fuse Wire & Mfg. Co....11
Chicago Ins. Wire & Cbl. Co. 5
Chicago Mica Co....10
Chicago Pneumatic Tool Co..10
Columbia Incand. Lamp Co..7
Cope, T. J....1
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co....5
Crolius & Son, E. R....—
Cutler-Hammer Mfg. Co....—
Cutter Elec. & Mfg. Company 1

D. & T. Anchor Co....13
D. & W. Fuse Company....—
Davis Electric Mfg. Co....—
Dearborn Drug & Chem. Wks.15
Diamond Meter Company....22
Directory of Engineers....14
Dixon Crucible Co., Joseph..15
Doxsee-Barrere Elec. Co....11
Duncan Elec. Mfg. Co....21

Edison Decorative & Miniature Lamp Departm't....10
Edison Mfg. Company....16
Electric Appliance Co....10
Electric Storage Battery Co.. 3
Electrician Pub. Company...21

Faries Mfg. Co....—
"For Sale" Advertisements..12
Ft. Wayne Elec. Works, Inc..21
Fowler & Co., John H....18
French Battery Co....—

Galloway Co., J. B....18
General Electric Co....9, 10
General Storage Battery Co..10
Gest, G. M....16
Gleason, John L....11
Gould Storage Battery Co....6
Gregory Electric Co....12

Haller Machine Co....4
Hart Mfg. Co....4
Hartford Steam Boiler Inspection & Insurance Co....—
Hazard Manufacturing Co....—
Hensel & Co., John A....8
Highland Park College....14
Hoffman, G. W....11
Hoffmann, Emil R....11
Holmes Fibre-Graph. Co....—
Holophane Glass Co....22
Humphrey, Henry H....14
Hunt & Co., Robt. W....14
Hydro-Elec. Developmeat Co14

Illinois Central Ry....12
Incandescent Electric Light Manipulator Company....—
Indiana Rub. & Ins. W. Co.... 1
India Rubber & Gutta Percha Insulating Company....—
International Elec. Meter Co10
International Tel. Mfg. Co....17

Jackson, D. C. & W. B....14
Jeffrey Manufacturing Co....15

Kartavert Manufacturing Co.—
Kellogg Switchboard & Supply Company....17, 18
Klein & Sons, Mathias....16
Kohler Brothers....14
Kuhlman Electric Co....22

La Fayette Elect'l Mfg. Co...—
Leather Preserv. M. Corp....—
Leffel & Co., James....15
Lindsley-Bauman Co....—
Loud's Sons Co., H. M....18
Ludlow Valve Co....15

Machado & Roller....—
Maine Hub Mfg. Co....18
Manhattan El. Supply Co....13
Marion Ins. Wire & Rub. Co.—
Matthews & Bros., W. N....3, 11
McCandless, H. W. & Co....11
M'Glehan & Co., C. H....22
McLennan & Company, K....10
McLeod, Ward & Co....8
McRoy Clay Works....16
Mica Insulator Company....10
Miscellaneous Advs....12
Monarch Elec. Mfg. Co....14
Mott Iron Wks., J. L....14
Mueller Company, William..18
Munsell & Co., Eugene....10

National Battery Co....8
National Carbon Co....5
National Electric Co....4
National India Rubber Co.... 1
Nat'l. X Ray Reflector Co...13
New Idea Soldering Paste Co.22
New York Ins. Wire Co.... 1
Northern Elect'l Mfg. Co....12

Okonite Co., The.... 1
Onelda Community, Ltd....—
Osburn Flex. Conduit Co....16
Otto Gas Engine Works....15

Pacific Coast Pole Co....18
Perrizo & Sons....18
Peru Elec. Mfg. Co....13
Phillips, Eugene F....11
Phillips Insulated Wire Co...11
Phoenix Glass Co....—
Phosphor-Bronze S. Co....15
Pignolet, L. M....10
Pillsbury-Watkins Co....18
Pittsburg & L. S. Iron Co....18
Plume & Atwood Mfg. Co....—
Porter Cedar Company....18

Rail Joint Co., The.... 3
Reisinger, Hugo.... 7
Replogle Governor Works....—
Reynolds El. Flasher Mfg.Co. 1
Robbins & Myers Co....22
Robert Instrument Co., The..—
Robertson & Sons, Jas. L....12
Rock Island Battery Co....—
Roebling's Sons Co., J. A....22
Ruebel & Wells....14
Runzel-Lenz Elec. Mfg. Co.—

Safety Ins. Wire & Cable Co..22
Samson Cordage Works.... 1
Sandwich Pole Changer Co.—
Sargent & Lundy....—
Schott, W. H....14
Schureman Co., J. L.... 3
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co....10
Smith Storage Battery Co....—
Sorensen, P....14
Speer Carbon Co....—
Spon & Chamberlain....15
Standard Elect'l. Mfg. Co....—
Standard Underg. Cable Co....—
Stanley—G. I. Elec. Mfg. Co.—
Star Expansion Bolt Co.... 1
Sterling & Son, W. G....18
Stewart Elec. Co., Frank H..12
Stow Mfg. Company....—
Stromberg-Carlson Tel. Mfg. Company....17
Sturgess Engineering Dept..15

Torrey Cedar Company....18
Trumbull Elec. Mfg. Co.... 8
Turner Brass Works.... 3

Underhill, Chas. R....14
Universal Elec. Stor. Bat. Co. 8

Van Nostrand Co., D....—
Vought-Berger Co....—
Vulcanized Fibre Company..22

Wagner Electric Mfg. Co.... 7
Wagor Mfg. Co., P. R....—
Wesco Supply Co....10
Western Electric Company.. 5
Western Lumber & Pole Co.—
Westinghouse Electric & Manufacturing Co....19
Westinghouse Machine Co....20
Weston Electrical Inst. Co.... 1
Willard Storage Bat. Co.... 8
Williamson & Co., R....11
Willis, G. M....14
Wilson, Co., Jas. I. M....18
Worcester Company, C. H....18
Wrigley Co., Thos....—

Zeller Geo. A. Book Co....—

For Classified Index of Advertisements See Page 6.

Motors, Switches, Arc Lamps, Circuit Breakers, Etc., Etc.

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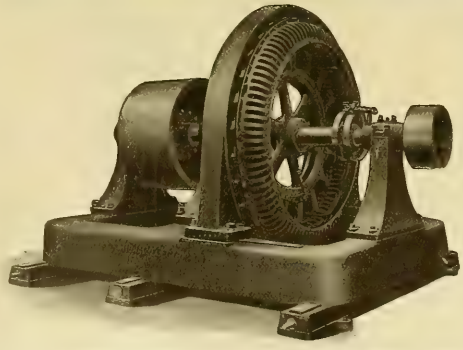

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New York City
Works: Depew, N. Y.

CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjustors, Cord.
Incandes. El. Lt. Manip. Co.

Adjusters, Inc. Lamps.
Inc. El. Lt. Manipulator Co.

Anchors (Tel. & Tel.)
D. & T. Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre-Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., The F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Electric Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clusters.
Benjamin Elec. Mfg. Co.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Underhill, Chas. R.
Western Electric Co.

Commutator Compound.
Crollius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduit and Conduits.
American Circular Loom Co.
American Conduit Company
Central Electric Co.
Electric Appliance Co.
Gest. G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McKoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest. G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Bracey-Rorer Elec. Cons. Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman, Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Galloway Co., J. B.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.

Dynamos and Motors.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Doxsee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. inc.
General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Bylesby & Co., H. M.
Humphrey, Henry H.
Runt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Underhill, Chas. R.
Willis, G. M.

Electrical Instruments.
(Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators-Conveyers.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Corliss.
Allis-Chalmers Company.

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Allis-Chalmers Company.
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Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Faries Mfg. Co.
McLeod, Ward & Co.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg.Co.
Faries Mfg. Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

Glassware, Electric.
Addison Glass Co.

Globes, Reflectors and Shades.
Addison Glass Co.
Faries Mfg. Co.
Haller Machine Co.
Holophane Glass Co.
McLeod, Ward & Co.
Nat'l X Ray Reflector Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Incandescent Electric Light Manipulator Co.
Vought-Berger Co.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Wagor Mfg. Co., P. R.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
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Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

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Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Lineman's Climbers.
Klein & Sons, Mathias.

Machinery, Automatic.
M'Gehan & Co., C. H.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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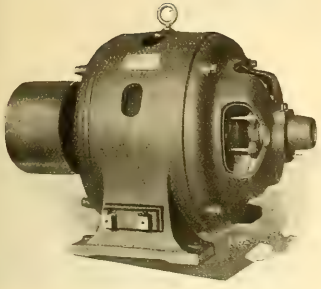

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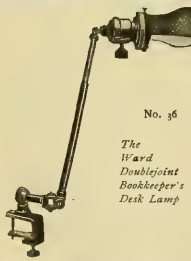

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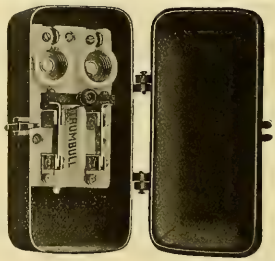

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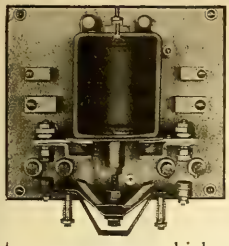

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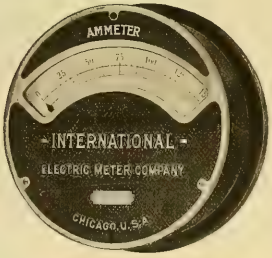

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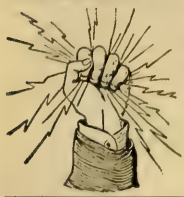

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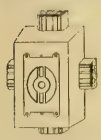

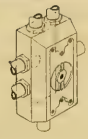

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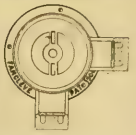

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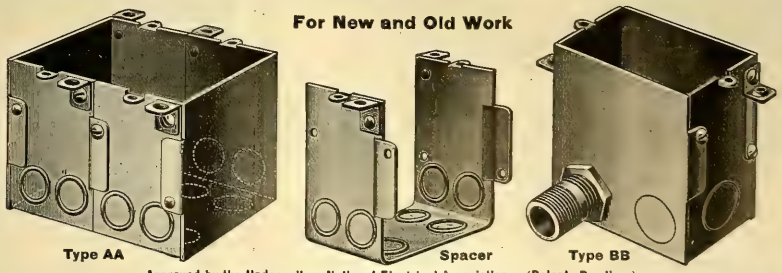

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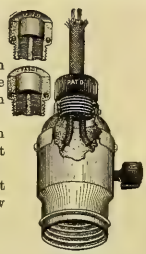

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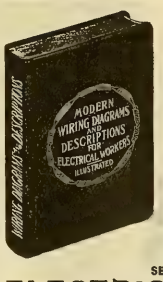

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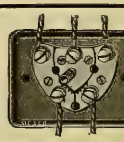

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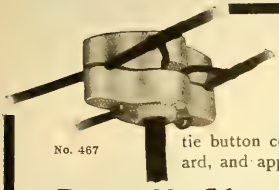

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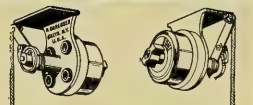

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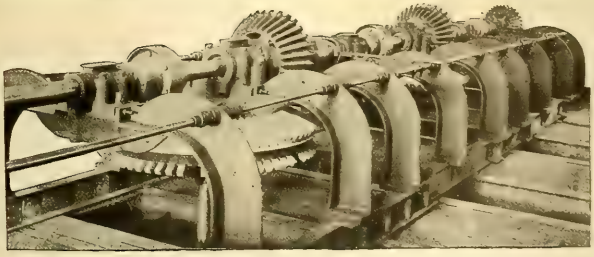

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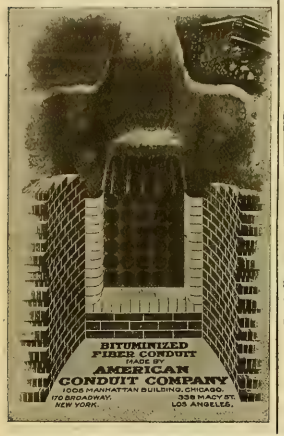

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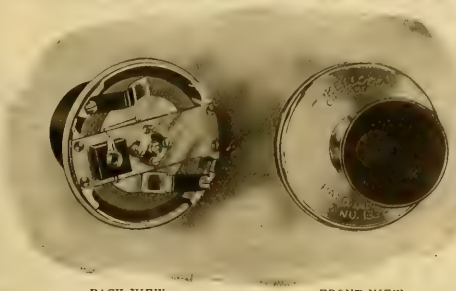

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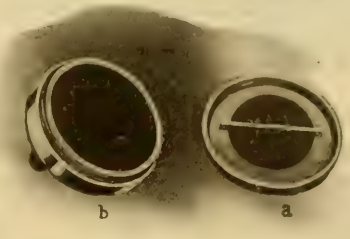

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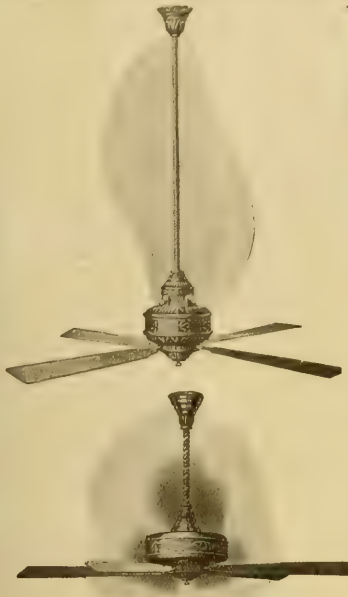

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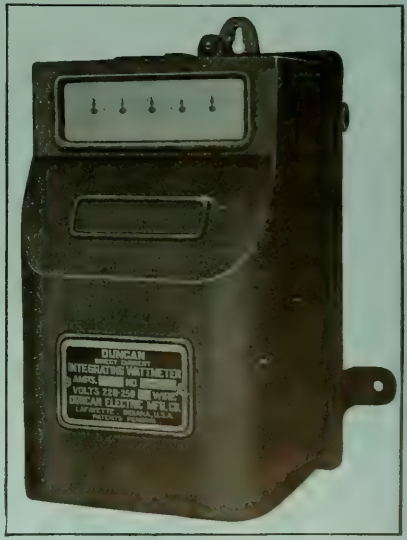

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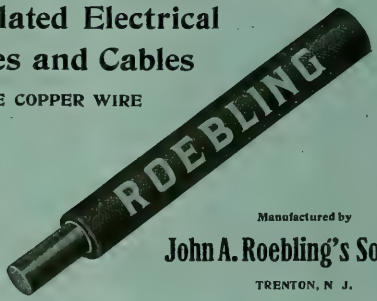

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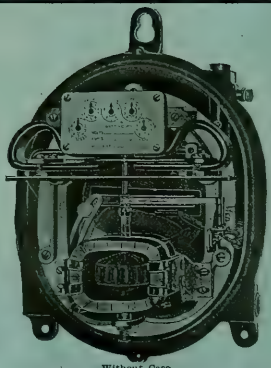

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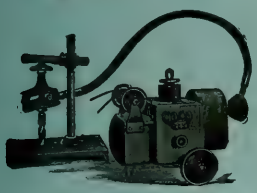

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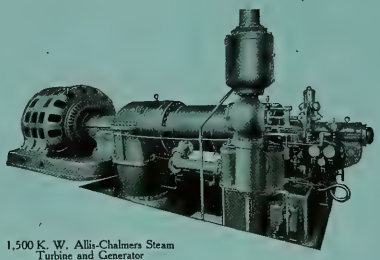

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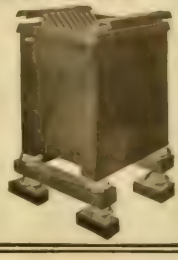

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Abeles & Taussig.....19
Addison Glass Co.....3
Aermotor Company.....18
Alton Machine Co.....4
Allis-Chalmers Company.....2
American Battery Co.....—
Amer. Circular Loom Co.....1
American Conduit Co.....16
American Diesel Engine Co.—
Amer. District Steam Co.....14
Amer. Elect'l. Supply Co.....—
Amer. El. Telephone Co.....17
American Electrical Works..11
Arnold Co., The.....14
Automatic Electric Co.....16

Babcock & Wilcox Co.....—
Badt, F. B.....14
Bain, Forée & May.....—
Baker & Co., Inc.....3
Baker & Co., W. E.....14
Beardslee Chandelier Mfg. Co.—
Belden Mfg. Co.....11
Benjamin Elec. Mfg. Co.....—
Benton & Son.....—
Berthold & Jennings.....19
Bissell Co., The F.....7, 19
Bossert Electric Construction Co.....10
Boston Incan. Lamp Co.....—
Bracey-Forse Elec. Cons. Co.—
Brooks, Hall L.....19
Bruer, Will F.....19
Buckeye Electric Co.....—
Buckeye Engine Co.....15
Bullock Elec. Mfg. Co.....2
Butterfield Construction Co.—
Byllesby & Co., H. M.....14

Central Electric Co.....5
Century Electric Co.....12
Chicago Edison Co.....4, 12
Chic. Fuse Wire & Mfg. Co.—
Chicago Ins. Wire & Mfg. Co. 7
Chicago Mica Co.....10
Chicago Pneumatic Tool Co..12
Columbia Incand. Lamp Co.—
Cope, T. J.....7
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co.....5
Crollius & Son, E. R.....—
Cutler-Hammer Mfg. Co.....9
Cutter Elec. & Mfg. Company—

D. & W. Fuse Company.....—
Davis Electric Mfg. Co.....—
Dearborn Drug & Chem. Wks. 15
Diamond Meter Company.....—
Directory of Engineers.....14
Dixon Crucible Co., Joseph..15
Doxsee-Barrere Elec. Co.....—
Duncan Elec. Mfg. Co.....21

Edison Decorative & Miniature Lamp Departm't.....10
Edison Mfg. Company.....11
Electric Appliance Co.....10
Electric Storage Battery Co.. 3
Electrician Pub. Company... 8

Faries Mfg. Co.....10
"For Sale" Advertisements..13
Ft. Wayne Elec. Works, Inc..21
Fowler & Co., John H.....19
French Battery Co.....—

Galloway Co., J. B.....—
General Electric Co.....9, 10
General Storage Battery Co..10
Gest, G. M.....16
Gleason, John L.....—
Gould Storage Battery Co.....—
Gregory Electric Co.....12

Haller Machine Co.....13
Hart Mfg. Co.....22
Hartford Steam Boiler Inspection & Insurance Co.....—
Hazard Manufacturing Co...32
Helios Mfg. Co.....9
Hensel & Co., John A.....—
Highland Park College.....14
Hoffman, G. W.....11
Hoffmann, Emil R.....—
Holmes Fibre-Graph. Co.....15
Holophane Glass Co.....7
Humphrey, Henry H.....14
Hunt & Co., Robt. W.....14
Hydro-Elec. Development Co14

Illinois Central Ry.....12
Incandescent Electric Light Manipulator Company.....—
Indiana Rub. & Ins. W. Co.... 1
India Rubber & Gutta Percha Insulating Company..... 6
International Elec. Meter Co22
International Tel. Mfg. Co...17

Jackson, D. C. & W. B.....14
Jeffrey Manufacturing Co.....15

Kartavert Manufacturing Co.22
Kellogg Switchboard & Supply Company.....17, 19
Klein & Sons, Mathias.....16
Kohler Brothers.....14
Kuhlman Electric Co.....1

La Fayette Elect'l Mfg. Co..10
Leather Preserv. M. Corp....12
Leffel & Co., James.....15
Lindsley-Bauman Co.....—
Loud's Sons Co., H. M.....19
Ludlow Valve Co.....—

Machado & Roller.....—
Maine Hub Mfg. Co.....—
Manhattan El. Supply Co.... 1
Marion Ins. Wire & Rub. Co.11
Matthews & Bros., W. N...3, 11
McCandless, H. W. & Co.....11
M'Glehan & Co., C. H.....11
McLennan & Company, K.....10
McLeod, Ward & Co.....7
McRoy Clay Works.....16
Mica Insulator Company.....10
Miscellaneous Advs.....12
Monarch Elec. Mfg. Co.....—
Mott Iron Wks., J. L.....11
Mueller Company, William..19
Munsell & Co., Eugene.....10

National Battery Co.....4
National Carbon Co.....5
National Electric Co.....22
National India Rubber Co....—
New Idea Soldering Paste Co.10
New York Ins. Wire Co.....14
Northern Elect'l Mfg. Co....12

Okonite Co., The.....1
Oneida Community, Ltd.....1
Osburn Flex. Conduit Co.....16
Otto Gas Engine Works.....—

Pacific Coast Pole Co.....19
Perrizo & Sons.....19
Peru Elec. Mfg. Co.....—
Phillips, Eugene F.....11
Phillips Insulated Wire Co...11
Phœnix Glass Co.....1
Phosphor-Bronze S. Co.....15
Pignolet, L. M.....10
Pillsbury-Watkins Co.....—
Pittsburg & L. S. Iron Co.....—
Plume & Atwood Mfg. Co.... 1
Porter Cedar Company.....19

Rail Joint Co., The.....3
Reisinger, Hugo.....—
Replogle Governor Works.... 1
Reynolds El. Flasher Mfg. Co.12
Robbins & Myers Co.....7
Robert Instrument Co., The..15
Robertson & Sons, Jas. L.....—
Rock Island Battery Co.....16
Roebling's Sons Co., J. A.....11
Ruebel & Wells.....14
Runzel-Lenz Elec. Mfg. Co...17

Safety Ins. Wire & Cable Co.. 1
Samson Cordage Works.....10
Sandwich Pole Changer Co...17
Sargent & Lundy.....—
Schott, W. H.....14
Schureman Co., J. L.....3
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co.....10
Smith Storage Battery Co.... 4
Sorensen, P.....—
Speer Carbon Co.....13
Spon & Chamberlain.....—
Standard Elect'l. Mfg. Co.... 5
Standard Underg. Cable Co.... 1
Stanley—G. I. Elec. Mfg. Co.13
Star Expansion Bolt Co.....15
Sterling & Son, W. C.....19
Stewart Elec. Co., Frank H..10
Stow Mfg. Company..... 1
Stromberg-Carlson Tel. Mfg Company.....17
Sturgess Engineering Dept...—

Torrey Cedar Company.....19
Trumbull Elec. Mfg. Co.....7
Turner Brass Works.....—

Underhill, Chas. R.....14
Universal Elec. Stor. Bat. Co. 4

Van Nostrand Co., D.....—
Vought-Berger Co.....5
Vulcanized Fibre Company..22

Wagner Electric Mfg. Co.....—
Wagor Mfg. Co., P. R.....—
Wesco Supply Co.....—
Western Electric Company..22
Western Lumber & Pole Co...—
Westinghouse Electric & Manufacturing Co.....20
Westinghouse Machine Co.....—
Weston Electrical Inst. Co... 1
Willard Storage Bat. Co.....—
Williamson & Co., R.....11
Willis, G. M.....14
Wilson, Co., Jas. I. M.....19
Worcester Company, C. H....19
Wrigley Co., Thos.....—

Zeller Geo. A. Book Co.....—

For Classified Index of Advertisements See Page 6.

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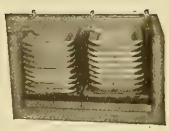

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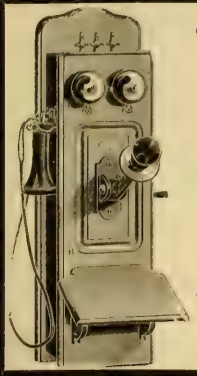

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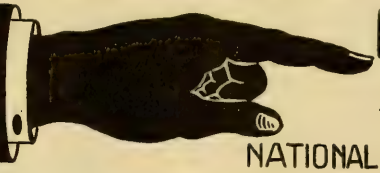

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The edgewise wound low tension coil, with its insulating cylinder, is shown in the left hand cut.

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjustors, Cord.
Incandes. El. Lt. Manip. Co.

Adjusters, Inc. Lamps.
Inc. El. Lt. Manipulator Co.

Anchors (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A., Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre-Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Electric Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clusters.
Benjamin Elec. Mfg. Co.
Faries Mfg Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Underhill, Chas. R.
Western Electric Co.

Commutator Compound.
Crollius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduit and Conduits.
American Circular Loom Co.
American Conduit Company
Central Electric Co.
Electric Appliance Co.
Gest. G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McKoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest. G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Brasey-Forse Elec. Cons. Co
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman, Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Galloway Co., J. R.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.

Dynamos and Motors.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Doxsee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. inc.
General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Byllesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Underhill, Chas. R.
Willis, G. M.

Electrical Instruments.
(Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators-Conveyers.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Corliss.
Allis-Chalmers Company.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Benton & Son.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Faries Mfg. Co.
McLeod, Ward & Co.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg.Co.
Faries Mfg. Co.
Williamson & Co., R

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

Glassware, Electric.
Addison Glass Co.

Globes, Reflectors and Shades.
Addison Glass Co.
Faries Mfg. Co.
Haller Machine Co.
Holophane Glass Co.
McLeod, Ward & Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Incandescent Electric Light Manipulator Co.
Vought-Berger Co.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials.
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Wagor Mfg. Co., P. R.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Machinery, Automatic.
M'Glehan & Co., C. H.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Forse & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co.Ltd.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co , Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Brooks Hall L.
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley-Bauman Co.
Loud's Sons Co., H. M.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Pillsbury-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Perry Electric Mfg. Co.

Portables.
Faries Mfg. Co.
McLeod, Ward & Co.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Highland Park College.

Searchlights.
Benton & Son.

Second-Hand Machin'y.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Crollius & Son, E. R.
New Idea Soldering Paste Co.
Western Electric Co.

Solenoids.
Schureman Co., J. L.
Underhill, Chas. R.

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Electric Appliance Co.
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Weston Electrical Inst. Co.

Stokers.
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Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
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Bissell Co., The F.
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Century Electric Co.
Chicago Edison Co.
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Manhattan Elect'l Supply Co
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Switches.
(See Cut-outs and Switches.)

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American El. Telephone Co
Automatic Electric Co.
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Kellogg Switchb. & Sup. Co.
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Stromberg-Carlson Tel. M.Co.
Vought-Berger Co
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Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Towers, Elec. Transmission
Aermotor Company.

Transformers.
Allis-Chalmers Company.
(Bullock El. Mfg. Co.)
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Turbines, Steam.
Allis-Chalmers Co.
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Turbine Water Wheels.
Allis-Chalmers Co.
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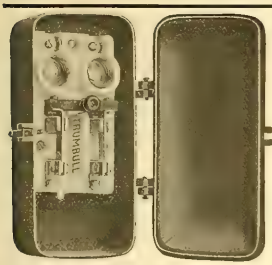

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	List Price	Sale Price
Mechanical Manual, by E. L. Hobson, Philadelphia, Pa..	.50	.20
Secret Letter and Telegraph Code, by Charles Larrabee, New York, 1884	.60	.20
Electricity, Magnetism and Electric Telegraphy, by Thomas D. Lockwood, New York, 1890	2.50	1.00
A Treatise on Electro Metallurgy, by Walter G. McMillan, F. C. S., London, 1890	3.50	1.75
Laboratory Manual of Physics and Applied Electricity, Vols. 1 and 2, by Edward L. Nichols, New York, 1894..	6.25	2.50
Aluminum, Its History and Occurrence, Properties, Metallurgy and Applications, by Joseph W. Richards, M. A., Philadelphia, 1890	6.00	2.75
Electric Light Installations, Vol. 3. Application by Sir David Salomons, M. A., New York, 1890	1.50	.75
Press Working of Metals, by Oberlin Smith, New York, 1896	3.00	1.75
Outlines of Industrial Chemistry, by F. H. Thorp, Ph. D., New York, 1898	3.50	1.75
Evolution of the Electric Incandescent Lamp, by Franklin Leonard Pope, Elizabeth, N. J., 1889	1.00	.50
Power Catechism, New York, 1889	2.00	.75
Electric Light Installations, Vol. 2, Apparatus, by Sir David Salomons, M. A., London, 1894	2.25	1.25
Electricity Simplified, by T. O'Connor Sloane, Ph. D., New York, 1897	1.00	.50
Dynamo Electric Machinery, by Silvanus P. Thompson, D. Sc., American edition, New York, 1902	5.00	2.75
Polyphase Electric Currents and Alternating Current Motors, by Silvanus P. Thompson, New York, 1898	3.50	1.75
How to Run Engines and Boilers, by E. P. Watson, New York, 1901	1.50	.75
Drum Armatures and Commutators, by F. Marten Weymouth, London, 1893	3.00	1.50
The Electrical Transmission of Energy, by Arthur Vaughan Abbott, C. E., New York, 1900	4.50	2.00
Telephone Systems of the Continent of Europe, by A. R. Bennett, London, 1895	4.50	2.00
Motor Power and Gearing for Electrical Machinery, by E. T. Carter, C. E., London, 1896	5.00	2.25
Textbook on Gas, Oil and Air Engines, by Bryan Donkin, London, 1896	7.00	3.25
Practical Application of the Indicator, by Lewis M. Ellison, Chicago, 1897	2.50	1.00
Original Papers on Dynamo Machinery, by John Hopkinson, M. A., New York, 1893	1.00	.50
Patented Telephony, Chicago, 1897	1.50	.60
Derivations of Practical Electrical Units, by Lieut. F. B. Badt and Prof. H. S. Carhart, Chicago, 1890	.75	.35
Electricity as a Motive Power, by Count Th. du Moncel, London, 1883	3.00	1.25
Decorative Electricity, by Mrs. J. E. H. Gordon, London, 1891	2.50	1.00
Electrical Appliances of the Present Day, by Major D. P. Heap, U. S. A., being a report of the Paris Electrical Exhibition of 1881	2.00	.75

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The Indicator and Dynamometer, by Thomas J. Main, M. A., Philadelphia, 1883	1.50	.70
The History and Process of the Electric Telegraph, by Robert Sabine, C. E., London, 1869, cloth	1.25	.50
Paper	.75	.25
Bearings and Lubrication, by A. J. Wallis-Taylor, C. E...	1.50	.75
Electricity in Our Homes and Workshops, by Sidney F. Walker, London, 1889	1.50	.75
The Mathematical Theory of Electricity and Magnetism, by Watson & Burbury, London, 1885. Vol. II, Magnetism and Electrodynamics	2.60	1.25
Electricity, Its Theory, Sources and Application, by John T. Sprague, London, 1892	6.00	1.80
Telegraphy, by W. H. Preece and J. Sivewright, London, 1888	2.00	1.00
Electricity and Magnetism, by Francis Nipher, A. M., St. Louis, 1895	3.25	1.50
Modern American Methods of Copper Smelting, by Edward Dyer Peters, Jr., M. E., New York, 1891	5.00	2.25
Solutions of the Questions in Magnetism and Electricity, set at the Intermediate Science and Preliminary Scientific Pass Examinations of the University of London, 1860 to 1884, by F. W. Levander, London, 1885	1.00	.25
Domestic Electricity for Amateurs, translated from the French of Hospitalier, London, 1889	2.50	.90
Gray's Treatise on Magnetism and Electricity, Vol. I, by Andrew Gray, LL. D., F. R. S., London, 1898	4.50	2.50
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Coil and Current, or the Triumphs of Electricity, by Henry Frith, London, 1897	1.25	.50
A Century of Electricity, by T. C. Mendenhall, Cambridge, 1887	1.25	.50
Magnetism and Electricity, by Arthur William Poyser, M. A., London, 1890	.80	.25
Potential and Its Application Popularly Treated, by Dr. Tumlirz, London, 1889	1.50	.65
Continental Electric Light Central Stations, Killingworth Hedges, London, 1892	6.00	2.85
Theory of Electricity, by Linnaenus Cumming, M. A., London, 1885	2.25	1.00
Electricity Treated Experimentally, by Linnaeus Cumming, M. A., London, 1891	1.50	.75
The Law Relating to Electric Lighting, by G. Spencer Bower, B. A., London, 1889	5.00	1.80
Mathematical Theory of the Steam Engine, by T. Baker, C. E., London, 1890	.75	.25
Elementary Treatise on Natural Philosophy, by A. Privat Deschanel, Part 3, Electricity and Magnetism, New York, 1893	1.50	.80
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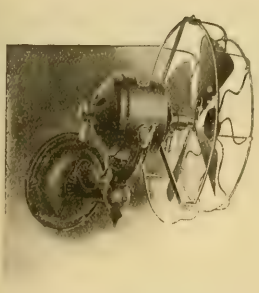

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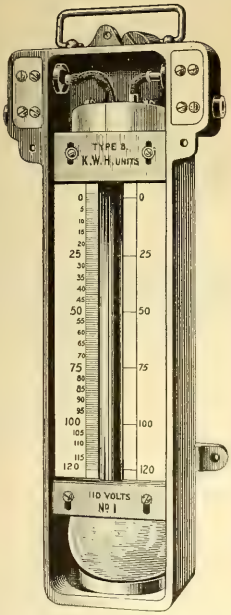

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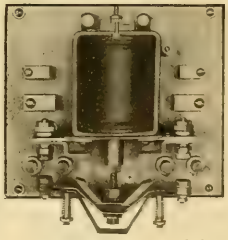

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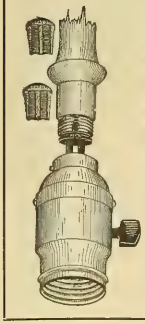

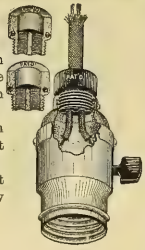

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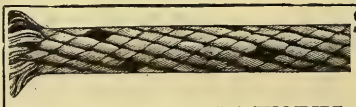

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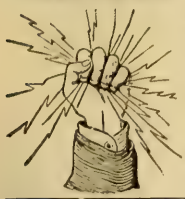

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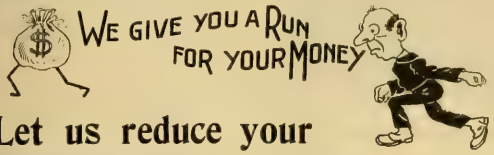

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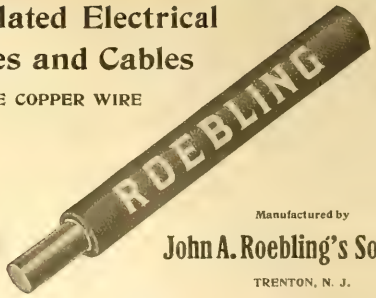

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CONTENTS

CHAPTER
Preface
I The Electric Current
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III The Effects of Electric Flow in the Circuit—Heat and Chemical Action
IV The Effects of Electric Flow Outside the Circuit—Magnetism and Induction—The Electrical Units
V Electromagnets—The Telegraph
VI Electric Signaling Apparatus
VII The Relations Between Magnets and Electric Currents
VIII Induction and Reactive Coils
IX The Telephone
X Telephone Accessories
XI The Mechanical Generation of Electricity
XII The Dynamo Machine
XIII Various Types of Dynamo Machines
XIV Alternators—Polyphase Currents
XV The Electric Motor
XVI The Electric Railway
XVII Polyphase Currents and Motors
XVIII Electrical Power Transmission
XIX The Incandescent Light
XX The Arc Light
XXI Electrochemistry—Storage Batteries
XXII Wireless Telegraphy
XXIII Radiation—X-Rays
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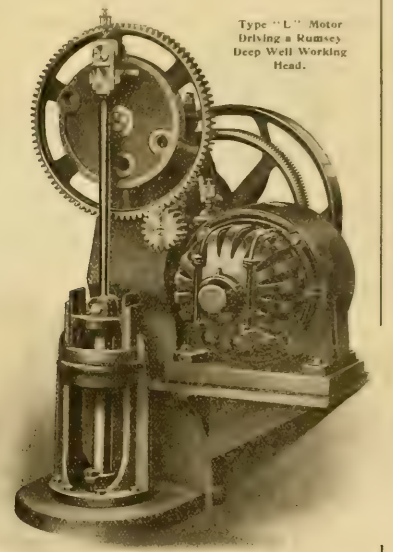

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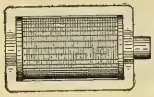

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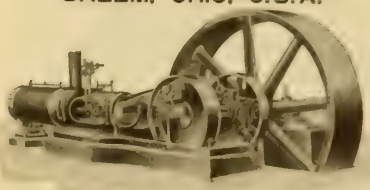

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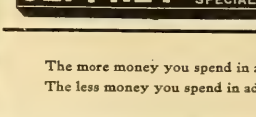

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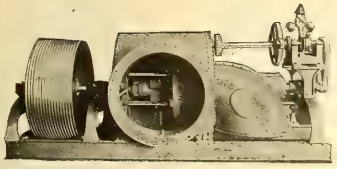

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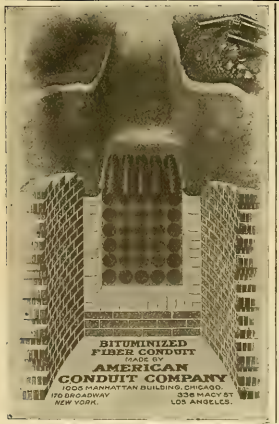

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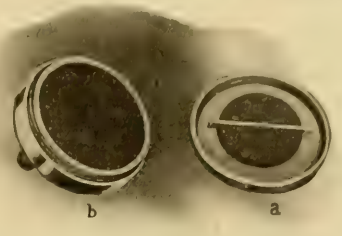

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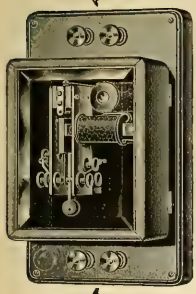

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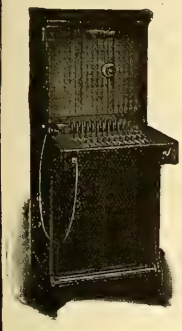

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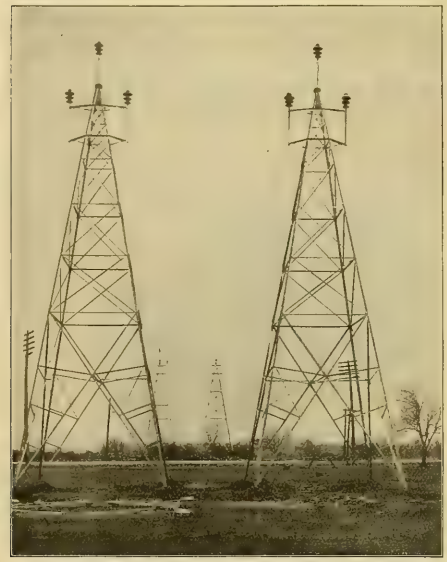

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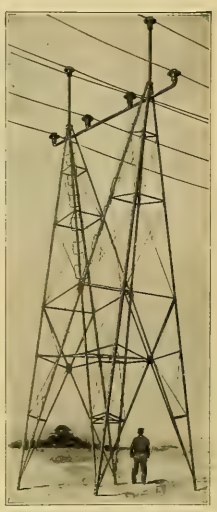

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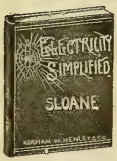

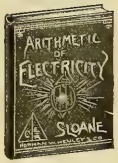

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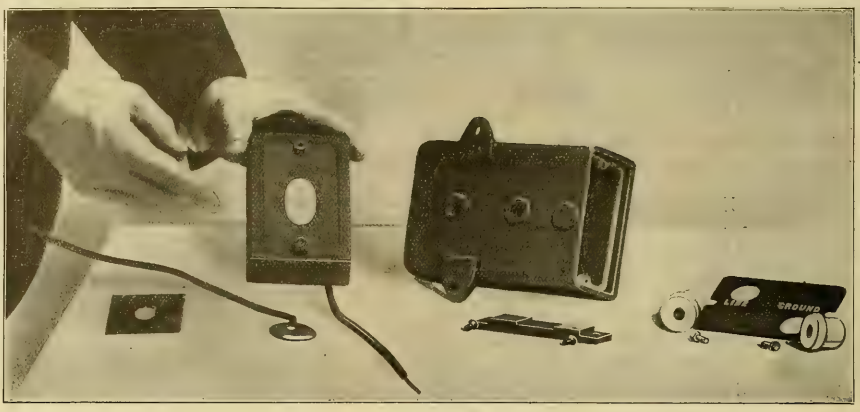

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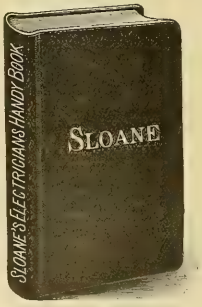

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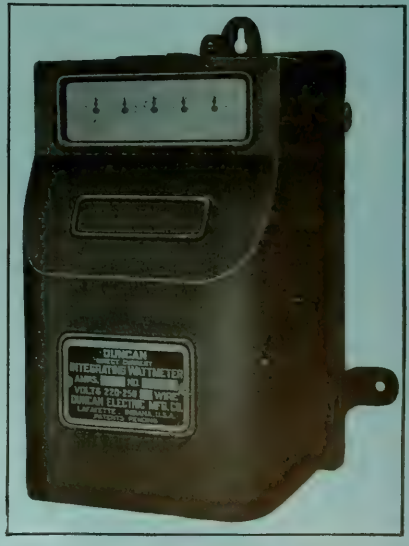

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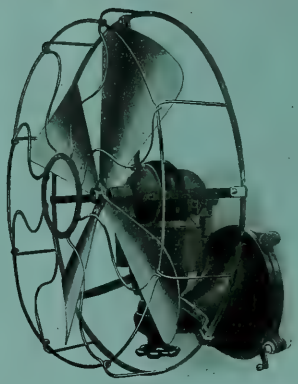

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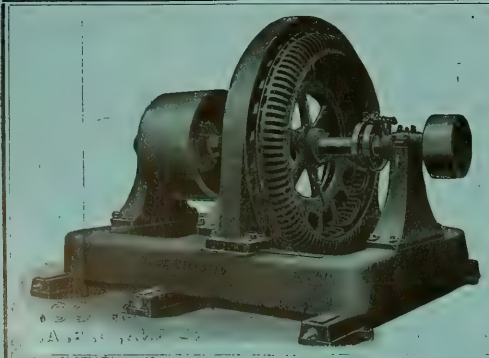

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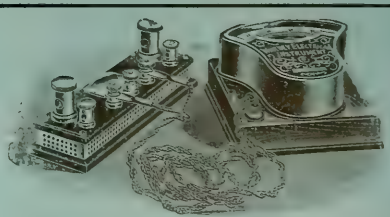
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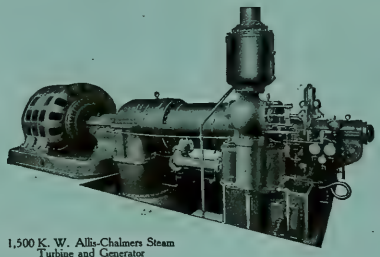
In addition to the Parsons patents referred to, Allis-Chalmers Company has also acquired exclusive rights to certain basic patents covering the Fullager-Sankey method of fastening turbine blading at its roots, and for supporting, spacing and tightening the blades at the outer end, in relation to which it has been successful against vigorous interference in the United States Patent Office.



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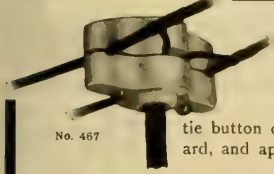

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig....19
Addison Glass Co....7
Aermotor Company....—
Alton Machine Co....4
Allis-Chalmers Company....2
American Battery Co....10
Amer. Circular Loom Co....1
American Conduit Co....16
American Diesel Engine Co.15
Amer. District Steam Co....14
Amer. Elect'l. Supply Co....—
Amer. El. Telephone Co....17
American Electrical Works..11
Arnold Co., The....14
Automatic Electric Co....16

Babcock & Wilcox Co....14
Badt, F. B....14
Bain, Forée & May....11
Baker & Co., Inc....3
Baker & Co., W. E....14
Beardsley Chandelier Mfg.Co.—
Belden Mfg. Co....—
Benjamin Elec. Mfg. Co....—
Benton & Son....4
Berthold & Jennings....19
Bissell Co., The F....5, 19
Bossert Electric Construction Co....9
Boston Incan. Lamp Co....—
Brooks, Hall L....19
Bruer, Will F....19
Buckeye Electric Co....—
Buckeye Engine Co....15
Butterfield Construction Co.14
Byllesby & Co., H. M....14

Central Electric Co....5
Century Electric Co....10
Chicago Edison Co....4, 12
Chic. Fuse Wire & Mfg. Co....—
Chicago Ins. Wire & Mfg. Co.11
Chicago Mica Co....10
Chicago Pneumatic Tool Co..12
Columbia Incand. Lamp Co.—
Cope, T. J....1
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co....7
Crollius & Son, E. R....10
Cutler-Hammer Mfg. Co....5
Cutter Elec. & Mfg. Company 1

D. & W. Fuse Company....—
Davis Electric Mfg. Co....10
Dearborn Drug & Chem. Wks.15
Diamond Meter Company....22
Directory of Engineers....14
Dixon Crucible Co., Joseph..15
Doxsee-Barrere Elec. Co....11
Duncan Elec. Mfg. Co....21

Edison Decorative & Miniature Lamp Departm't....10
Edison Mfg. Company....13
Electric Appliance Co....10
Electric Storage Battery Co.. 3
Electrician Pub. Company...21

Faries Mfg. Co....—
"For Sale" Advertisements..12
Ft. Wayne Elec. Works, Inc..21
Fowler & Co., John H....19
French Battery Co....—

General Electric Co....9, 10
General Storage Battery Co.10
Gest, G. M....16
Gleason, John L....9
Gould Storage Battery Co....6
Gregory Electric Co....12

Haller Machine Co....—
Hart Mfg. Co....9
Hartford Steam Boiler Inspection & Insurance Co....15
Hazard Manufacturing Co....—
Helios Mfg. Co....—
Hensel & Co., John A....8
Highland Park College. 14
Hoffman, G. W....11
Hoffmann, Emil R....13
Holmes Fibre-Graph. Co....—
Holophane Glass Co....22
Humphrey, Henry H....14
Hunt & Co., Robt. W....14
Hydro-Elec. Developmeat Co14

Illinois Central Ry....12
Indiana Rub. & Ins. W. Co....1
India Rubber & Gutta Percha Insulating Company....—
International Elec. Meter Co 4
International Tel. Mfg. Co....17

Jackson, D. C. & W. B....14
Jeffrey Manufacturing Co....15

Kartavert Manufacturing Co.—
Kellogg Switchboard & Supply Company....17, 19
Klein & Sons, Mathias....16
Kohler Brothers....14
Kuhlman Electric Co....13

La Fayette Elect'l Mfg. Co...—
Leather Preserv. M. Corp....—
Leffel & Co., James....15
Lindsley-Bauman Co....—
Loud's Sons Co., H. M....19
Ludlow Valve Co....15

Machado & Roller....1
Maine Hub Mfg. Co....19
Manhattan El. Supply Co....10
Marion Ins. Wire & Rub. Co.—
Matthews & Bros., W. N...3, 11
McCandless, H. W. & Co....11
M'Glehan & Co., C. H....7
McLennan & Company, K....10
McLeod, Ward & Co....8
McRoy Clay Works....16
Mica Insulator Company....10
Miscellaneous Advs....12
Monarch Elec. Mfg. Co....7
Morse, Frank W....10
Mott Iron Wks., J. L....11
Mueller Company, William..19
Munsell & Co., Eugene....10

National Battery Co....8
National Carbon Co....7
National Electric Co....5
National India Rubber Co....1
New Idea Soldering Paste Co.12
New York Ins. Wire Co....1
Northern Elect'l Mfg. Co....12

Okonite Co., The....1
Oneida Community, Ltd....—
Osburn Flex. Conduit Co....16
Otto Gas Engine Works....15

Pacific Coast Pole Co....19
Perrizo & Sons....19
Peru Elec. Mfg. Co....3
Phillips, Eugene F....11
Phillips Insulated Wire Co....11
Phoenix Glass Co....—
Phosphor-Bronze S. Co....15
Pignolet, L. M....10
Pittsburg & L. S. Iron Co....—
Plume & Atwood Mfg. Co....—
Porter Cedar Company....19

Rail Joint Co., The....3
Reisinger, Hugo....7
Replogle Governor Works....—
Reynolds El. Flasher Mfg.Co. 1
Robbins & Myers Co....13
Robert Instrument Co., The.—
Robertson & Sons, Jas. L....—
Rock Island Battery Co....—
Roebling's Sons Co., J. A....9
Ruebel & Wells....14
Runzel-Lenz Elec. Mfg. Co.—

Safety Ins. Wire & Cable Co...11
Samson Cordage Works....1
Sandwich Pole Changer Co.—
Sargent & Lundy....14
Schott, W. H....14
Schureman Co., J. L....3
Simplex Electrical Co., The..1
Simplex Elec. Heating Co....11
Smith Storage Battery Co....—
Sorensen, P....12
Speer Carbon Co....—
Spon & Chamberlain....—
Standard Elect'l Mfg. Co....—
Standard Underg. Cable Co....—
Stanley—G. I. Elec. Mfg. Co.—
Star Expansion Bolt Co....1
Sterling & Son, W. C....19
Stewart Elec. Co., Frank H..22
Stow Mfg. Company....—
Stromberg-Carlson Tel. Mfg Company....17
Sturgess Engineering Dept..15

Torrey Cedar Company....19
Trumbull Elec. Mfg. Co....8
Turner Brass Works....19

Universal Elec. Stor. Bat. Co. 8

Van Nostrand Co., D....—
Vought-Berger Co....—
Vulcanized Fibre Company..22

Wagner Electric Mfg. Co....22
Wesco Supply Co....10
Western Electric Company..4
Western Lumber & Pole Co. 19
Westinghouse Electric & Manufacturing Co....20
Westinghouse Machine Co....20
Weston Electrical Inst. Co...1
Willard Storage Bat. Co....8
Williamson & Co., R....11
Willis, G. M....14
Wilson, Co., Jas. L. M....19
Worcester Company, C. H....19
Wrigley Co., Thos....22

Zeller Geo. A. Book Co....—

For Classified Index of Advertisements See Page 6.

Motors,
Switches,
Arc Lamps,
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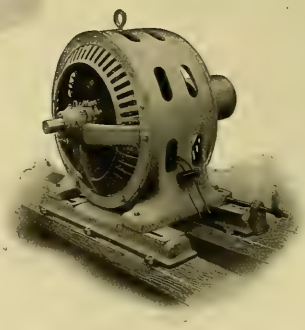

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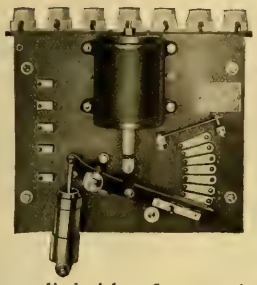

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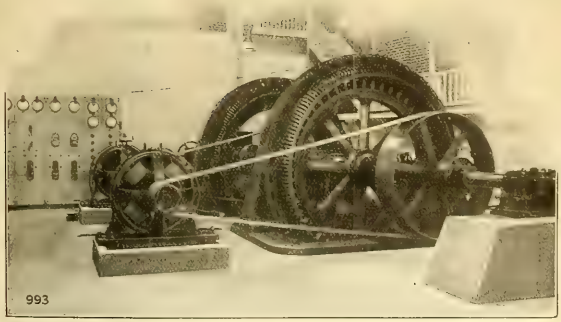

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Anchors, (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
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Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co.: D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre-Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Electric Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutler Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
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Crollus & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduit and Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Electric Appliance Co.
Gest, G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McRoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
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National Electric Co.
Northern Electrical Mfg. Co.
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Schureman Co., J. L.

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Berthold & Jennings.
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Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Trumbull Elec. Mfg. Co.
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Western Electric Co.
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Drills, Electric.
Chicago Pneumatic Tool Co.

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Dynamos and Motors.
Allis-Chalmers Company.
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Central Electric Co.
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Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Byllesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Electric Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
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Pignolet, L. M.
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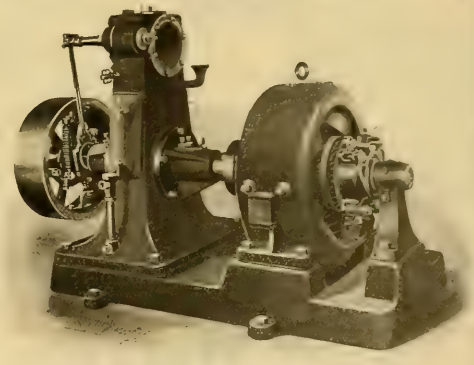

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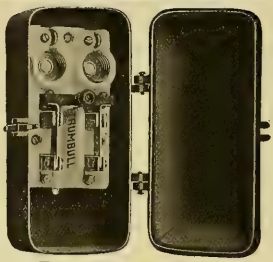

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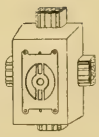

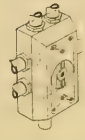

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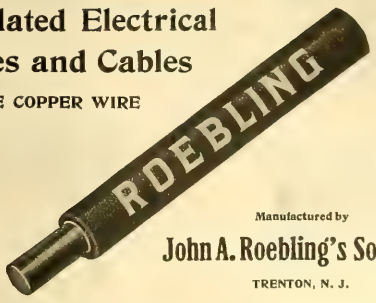

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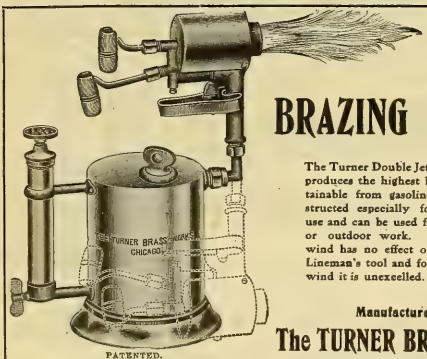

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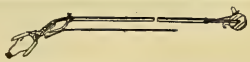

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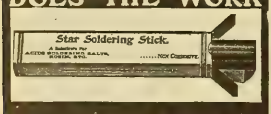

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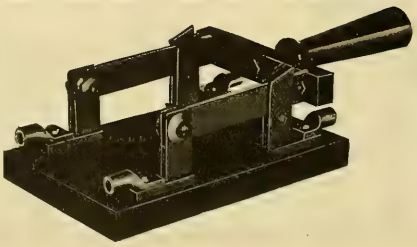

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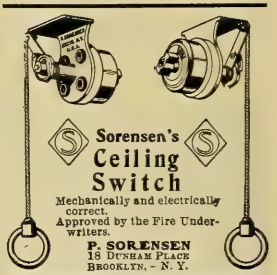

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VI Electric Signaling Apparatus
VII The Relations Between Magnets and Electric Currents
VIII Induction and Reactive Coils
IX The Telephone
X Telephone Accessories
XI The Mechanical Generation of Electricity
XII The Dynamo Machine
XIII Various Types of Dynamo Machines
XIV Alternators—Polyphase Currents
XV The Electric Motor
XVI The Electric Railway
XVII Polyphase Currents and Motors
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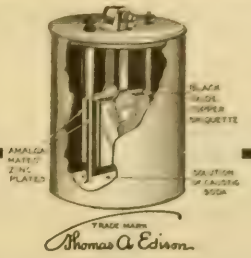

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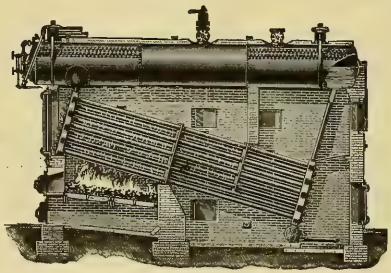

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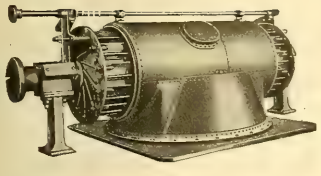

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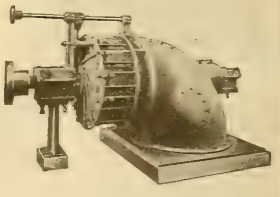

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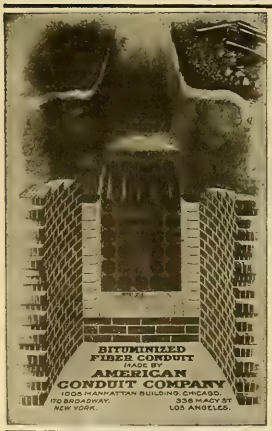

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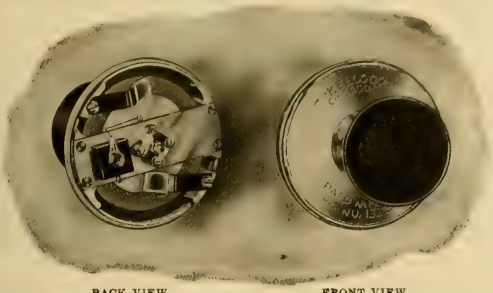

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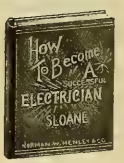

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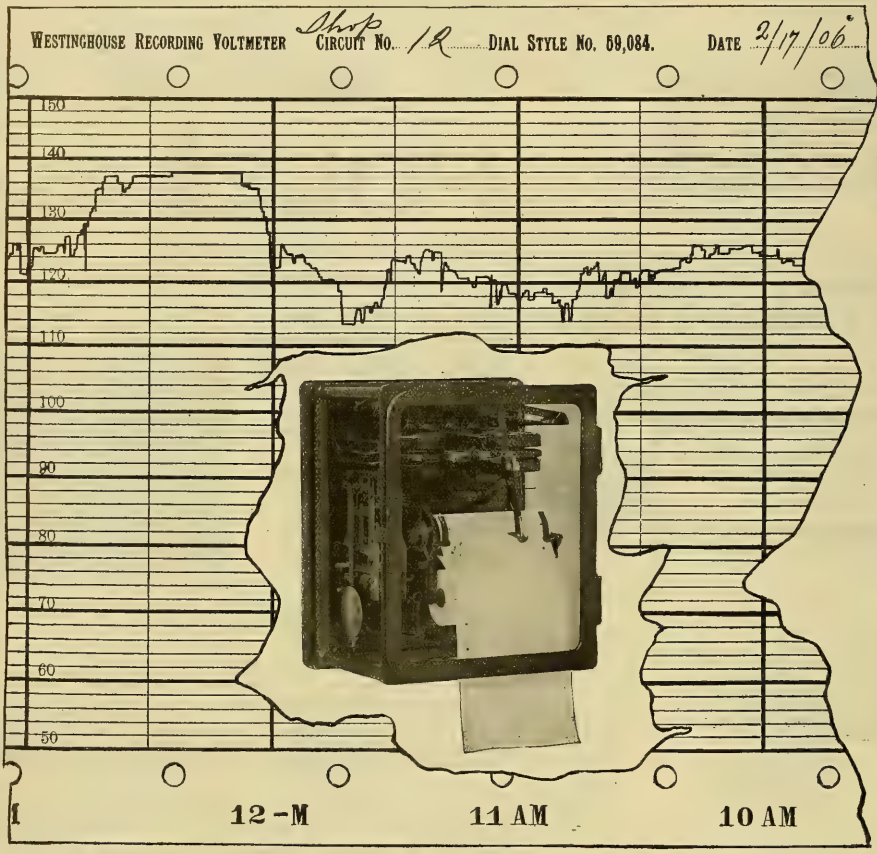

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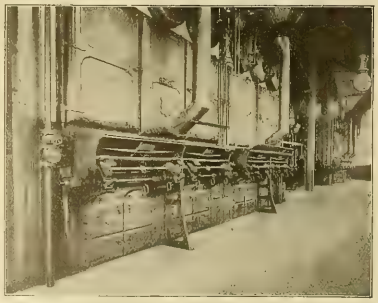

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Form M A B

"K" IS O. K.

Type K Wattmeter

Form S A B

434

Fort Wayne, Indiana

In preparation for moving into larger quarters in the new part of the Marquette Building, which removal will take place April 10th next, we are going through our storage vaults assorting everything therein with a view to carrying into the new place only such things as cannot possibly be dispensed with. In connection with this work we are able to offer for sale cheap a few bound volumes of the WESTERN ELECTRICIAN. These volumes are new and have never been used, and this is an opportunity to obtain a bargain which, for the years they cover, we shall never be able to offer again.

Write us and let us know your needs and we will quote you at once.

WESTERN ELECTRICIAN.

P. S. Kindly take notice that our new suite of rooms will be known as 507 Marquette Building. Our street number, 204 Dearborn Street, and our telephone number, Main 1746, will not change.

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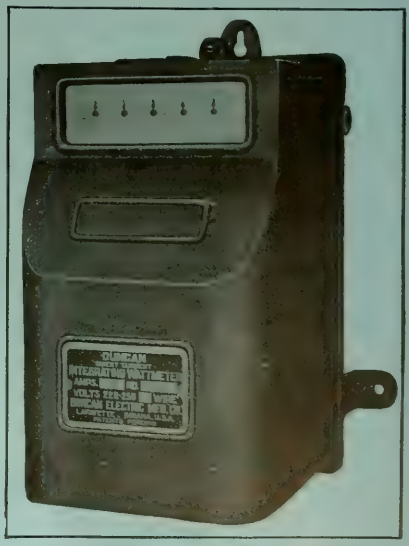
BY ALL UNBIASED METER EXPERTS TO BE THE MOST RELIABLE DIRECT CURRENT WATTMETER IN THE WORLD



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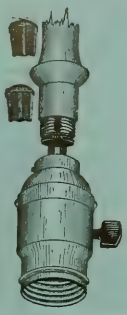
LAFAYETTE INDIANA, U. S. A.

The "KNOSTRAIN" BUSHINGS



are made in two styles: One of them fits ⅜-inch socket caps, and the other is made for rosette or ⅜-inch socket handle.

Why tie knots in cords which increase the dangers of short circuits?

The "Knostrain" Bushings fit either No. 16 or No. 18 lamp or show window cords.

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Wrigley Patented Steel Toggle Bolt

with double flange sides and rigid back for securing brackets and fixtures to hollow tiling, marble slabs and steel ceilings. All other Toggle Bolts pivoted like cuts are infringements. The Trunnion Nut Toggle Bolt has a finished brass cap nut on the end. Hex. for wrench or round for screwdriver, plain or plated, and can be taken off after the bolt has been inserted, to place on the fixture. The bolt screws through the toggle plate the full length. Used for finished work, such as Telephones, Electric Fixtures and Marble Slabs. In ordering, mention if Trunnion Nut with Cap Nut or the plain Toggle Bolt is wanted.

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We are prepared to quote on Variable Speed Motors used in connection with these outfits, both for power work and for fan work, with or without reversible windings. Our bulletin No. 75-H will give full information.

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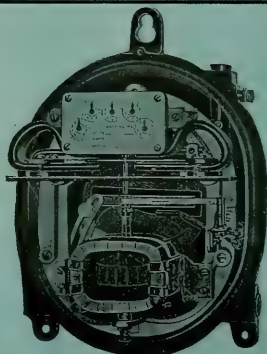

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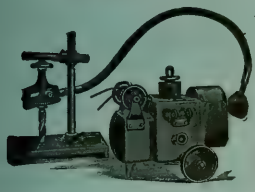

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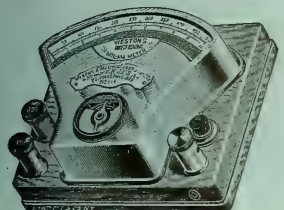

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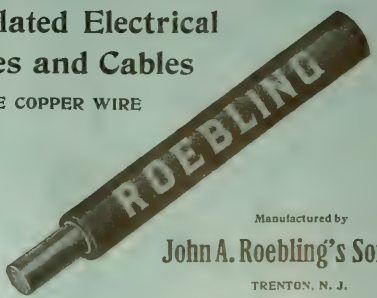

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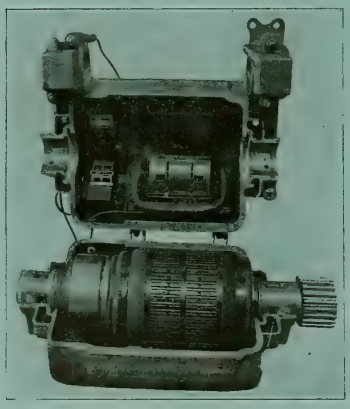

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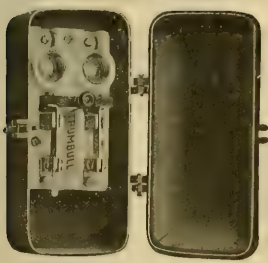

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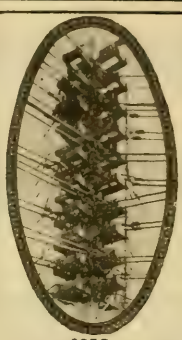

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig 19
Aermotor Company 8
Alton Machine Co 4
Allis-Chalmers Company 2
American Battery Co ..... —
Amer. Circular Loom Co 1
American Conduit Co 16
American Diesel Engine Co. —
Amer. District Steam Co 14
Amer. Elect'l. Supply Co ..... —
Amer. El. Telephone Co 17
American Electrical Works .. 11
Arnold Co., The 14
Automatic Electric Co 16

Babcock & Wilcox Co ..... —
Badt, F. B. 14
Bain, Forée & May ..... —
Baker & Co., Inc. 3
Baker & Co., W. E. 14
Beardslee Chandelier Mfg. Co. —
Belden Mfg. Co. 11
Benjamin Elec. Mfg. Co 7
Benton & Son ..... —
Berthold & Jennings 19
Bissell Co., The F. 5, 19
Bossert Electric Construction Co. 13
Boston Incan. Lamp Co ..... —
Brooks, Hall L. 19
Bruer, Will F. 19
Buckeye Electric Co ..... —
Buckeye Engine Co 15
Butterfield Construction Co. —
Byllesby & Co., H. M. 14

Central Electric Co 5
Century Electric Co 10
Chicago Edison Co 4, 12
Chic. Fuse Wire & Mfg. Co. .. 11
Chicago Ins. Wire & Mfg. Co. 7
Chicago Mica Co 10
Chicago Pneumatic Tool Co. .. 12
Chicago Telephone Co 14
Columbia Incand. Lamp Co. —
Cope, T. J. 12
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co 9
Crolius & Son, E. R. ..... —
Cutler-Hammer Mfg. Co 5
Cutter Elec. & Mfg. Company —

D. & W. Fuse Company ..... —
Davis Electric Mfg. Co ..... —
Dearborn Drug & Chem. Wks. 15
Diamond Meter Company ..... —
Directory of Engineers 14
Dixon Crucible Co., Joseph .. 15
Doxsee-Barrere Elec. Co ..... —
Duncan Elec. Mfg. Co 21

Edison Decorative & Miniature Lamp Departm't 10
Edison Mfg. Company 7
Electric Appliance Co 10
Electric Storage Battery Co. . 3
Electrician Pub. Company ... 21

Faries Mfg. Co 10
"For Sale" Advertisements .. 12
Ft. Wayne Elec. Works, Inc. .21
Fowler & Co., John H. 19
French Battery Co. ..... —

General Electric Co 9, 10
General Storage Battery Co. .10
Gest, G. M. 16
Gleason, John L. ..... —
Gould Storage Battery Co. ..... —
Gregory Electric Co 12

Haller Machine Co 13
Hart Mfg. Co 23
Hartford Steam Boiler Inspection & Insurance Co. ..... —
Hazard Manufacturing Co ... 22
Helios Mfg. Co 22
Hensel & Co., John A ..... —
Highland Park College. 14
Hoffman, G. W. 12
Hoffmann, Emil R. ..... —
Holmes Fibre-Graph. Co. 13
Holophane Glass Co 9
Humphrey, Henry H. 14
Hunt & Co., Robt. W. 14
Hydro-Elec. Development Co 14

Illinois Central Ry. 12
Indiana Rub. & Ins. W. Co. .. 1
India Rubber & Gutta Percha Insulating Company 6
International Elec. Meter Co 10
International Tel. Mfg. Co. ... 17

Jackson, D. C. & W. B. 14
Jeffrey Manufacturing Co. ... 15

Kartavert Manufacturing Co. 22
Kellogg Switchboard & Supply Company 17, 19
Klein & Sons, Mathias 16
Kohler Brothers 14
Kuhlman Electric Co 1

La Fayette Elect'l Mfg. Co. .. 10
Leather Preserv. M. Corp. .. 12
Leffel & Co., James 15
Lindsley-Bauman Co ..... —
Loud's Sons Co., H. M. 19
Ludlow Valve Co ..... —

Machado & Roller ..... —
Maine Hub Mfg. Co ..... —
Manhattan El. Supply Co. ... 1
Marion Ins. Wire & Rub Co. 13
Matthews & Bros., W. N. .. 3, 11
McCandless, H. W. & Co. ... 12
M'Glehan & Co., C. H. 13
McLennan & Company, K. ... 10
McRoy Clay Works 16
Mica Insulator Company 10
Miscellaneous Advs. 12
Monarch Elec. Mfg. Co ..... —
Morse, Frank W. ..... —
Mott Iron Wks., J. L. 7
Mueller Company, William .. 19
Munsell & Co., Eugene 10

National Battery Co. 4
National Carbon Co. 4
National Electric Co. 5
National India Rubber Co. ... —
New Idea Soldering Paste Co. 10
New York Ins. Wire Co 7
Northern Elect'l Mfg. Co. ... 11
Northern Pacific R. R. 12

Okonite Co., The 1
Oneida Community, Ltd. 1
Osburn Flex. Conduit Co. 16
Ostrander & Co., W. R. 7
Otto Gas Engine Works ..... —

Pacific Coast Pole Co. 19
Perrizo & Sons 19
Peru Elec. Mfg. Co ..... —
Phillips, Eugene F. 11
Phillips Insulated Wire Co. .. 11
Phœnix Glass Co. 1
Phosphor-Bronze S. Co. 15
Pignolet, L. M. 10
Pittsburg & L. S. Iron Co. ... —
Plume & Atwood Mfg. Co. ... 22
Porter Cedar Company 19

Rail Joint Co., The 3
Reisinger, Hugo ..... —
Replogle Governor Works ... 7
Reynolds El. Flasher Mfg. Co. 7
Robbins & Myers Co. 4
Robert Instrument Co., The. 11
Robertson & Sons, Jas. L. ... 12
Rock Island Battery Co 16
Roebling's Sons Co., J. A. ... 1
Ruebel & Wells. 14
Runzel-Lenz Elec. Mfg. Co. .. 17

Safety Ins. Wire & Cable Co. . 1
Samson Cordage Works 13
Sandwich Pole Changer Co. .. 17
Sargent & Lundy ..... —
Schott, W. H. 14
Schureman Co., J. L. 3
Simplex Electrical Co., The. . 1
Simplex Elec. Heating Co. ... 12
Smith Storage Battery Co. ... 4
Sorensen, P. ..... —
Speer Carbon Co. 4
Spon & Chamberlain 13
Standard Elect'l. Mfg. Co. .. 7
Standard Underg. Cable Co. .. 1
Stanley—G. I. Elec. Mfg. Co. 8
Star Expansion Bolt Co. ... 11
Sterling & Son, W. C. 19
Stewart Elec. Co., Frank H. . 22
Stow Mfg. Company 1
Stromberg-Carlson Tel. Mfg. Company 17
Sturgess Engineering Dept. .. —

Torrey Cedar Company 19
Trumbull Elec. Mfg. Co. 3
Turner Brass Works ..... —

Van Nostrand Co., D. ..... —
Vought-Berger Co. ..... —
Vulcanized Fibre Company .. 22

Wagner Electric Mfg. Co. ..... —
Wesco Supply Co ..... —
Western Electric Company .. 22
Western Lumber & Pole Co. .. 19
Westinghouse Electric & Manufacturing Co. 20
Westinghouse Machine Co. ... —
Weston Electrical Inst. Co. ... 1
Willard Storage Bat. Co. ..... —
Williamson & Co., R. 11
Willis, G. M. 14
Wilson, Co., Jas. I. M. 19
Worcester Company, C. H. ... 19
Wrigley Co., Thos. ..... —

Yonkers Specialty Co. 1

Zeller, Geo. A. Book Co. ..... —

For Classified Index of Advertisements See Page 6.

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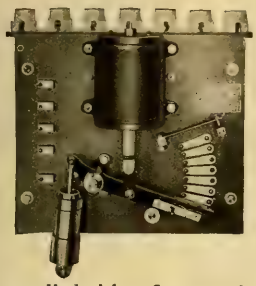

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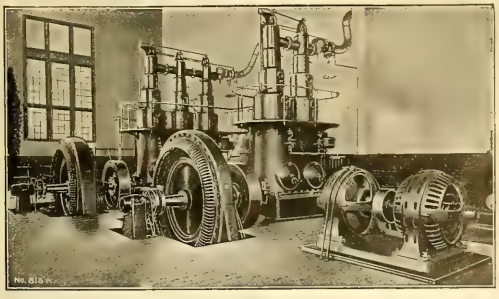

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Osburn Flexible Conduit Co.
Wesco Supply Co.

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Cope, T. J.

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Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

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Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
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Wesco Supply Co.
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Bossert Elec. Const. Co.
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Benton & Son.
Bissell Co., The F.
Central Electric Co.
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Electric Appliance Co.
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Badt, F. B.
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Runt & Co., Robt. W.
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Jackson, D. C. & W. B.
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Sargent & Lundy.
Schott, W. H.
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Stanley—G. I. Elec. Mfg. Co.
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Williamson & Co., R

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

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Stow Mfg. Co.

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Electric Appliance Co.
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Vought-Berger Co.

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Allis-Chalmers Company.

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Robertson & Sons, Jas. L.

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Magnet Wires.
(See Wires and Cables.)

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(See Bolts, Toggle.)

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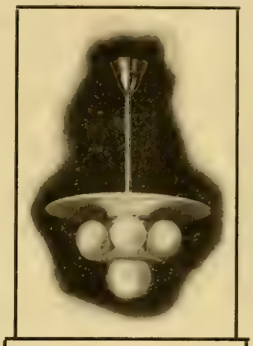

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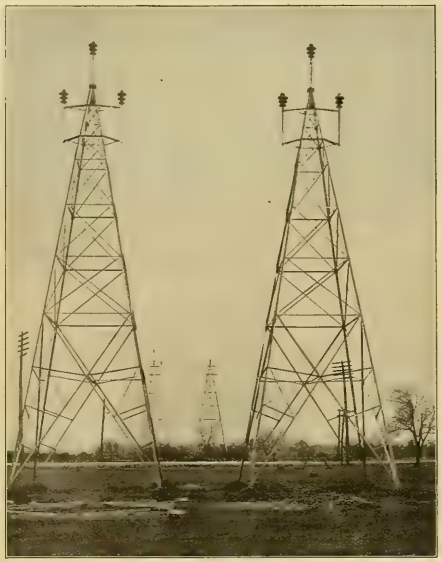

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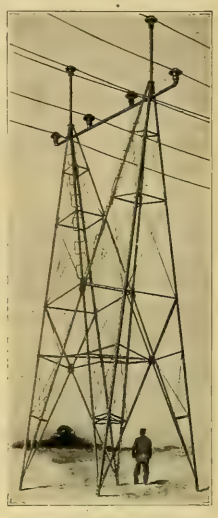

THREE-PHASE DOUBLE CIRCUIT TOWERS

The cut at the right shows the style of tower which the Aermotor Company is now furnishing for a double circuit line which is building in the state of New York. These towers are guaranteed to withstand a strain of 2000 lbs. on any insulator pin, or a total strain of 8000 lbs. in either direction. By the ingenious arrangement of the twin towers these strains are easily met with great economy of material.

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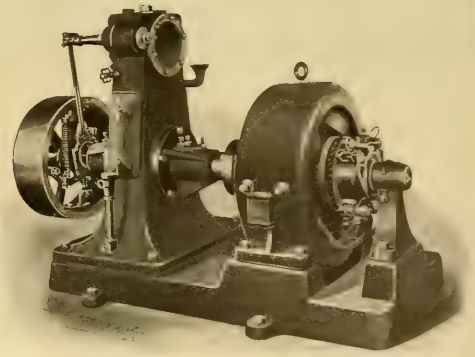

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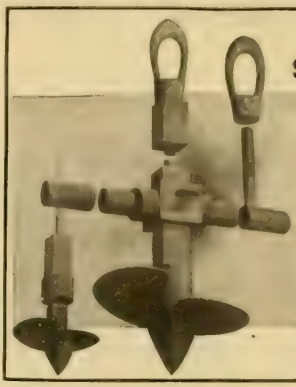

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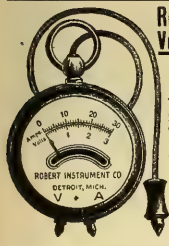

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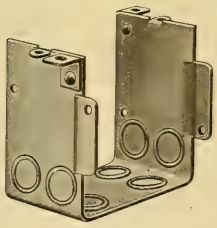
NEW  **NEW**

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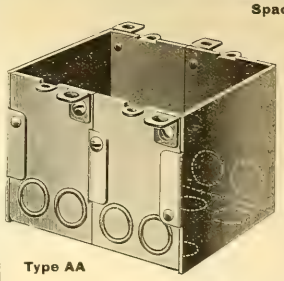

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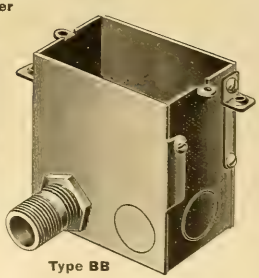

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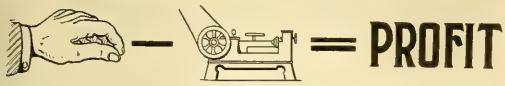

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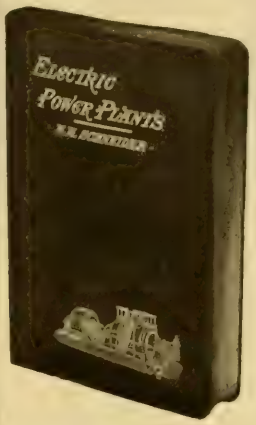

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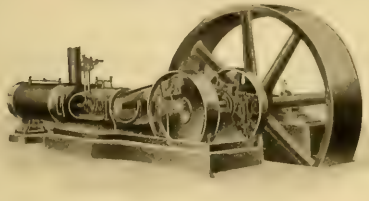

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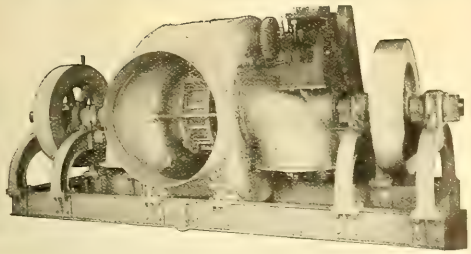

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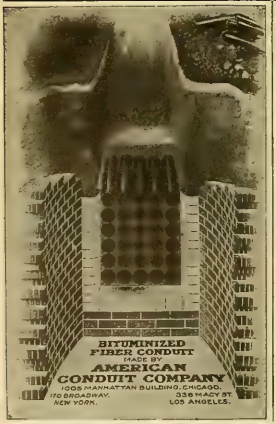

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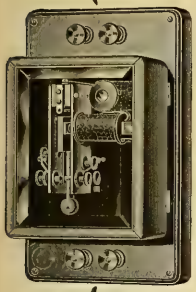

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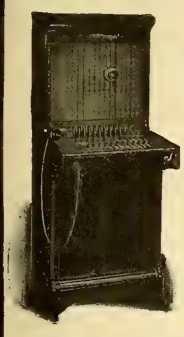

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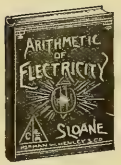

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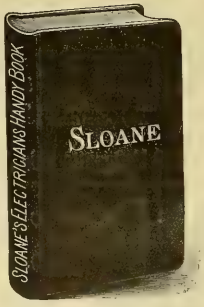

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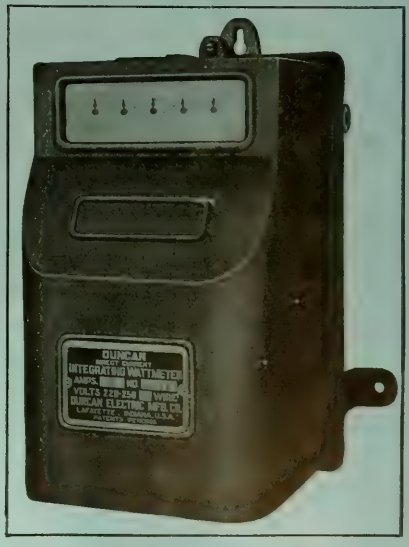

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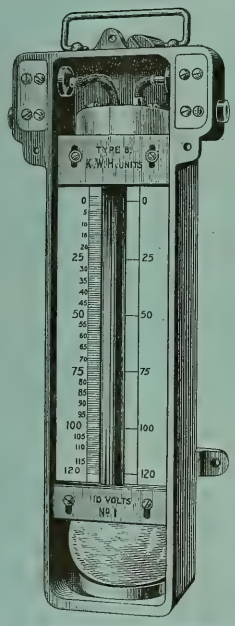

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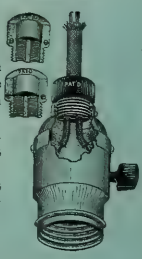

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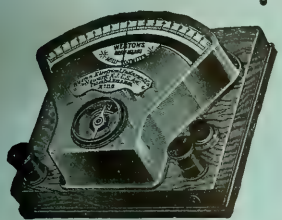
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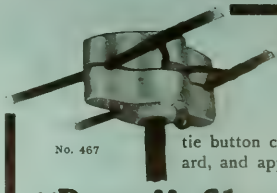
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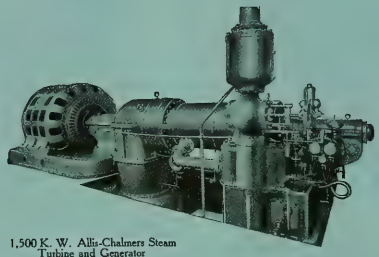

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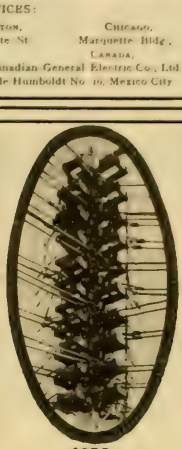

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig....18
Aermotor Company....—
Aiton Machine Co....4
Allis-Chalmers Company....2
Amber Electric Co....12
American Battery Co....15
Amer. Circular Loom Co....1
American Conduit Co....16
American Diesel Engine Co.—
Amer. District Steam Co....14
Amer. Elect'l. Supply Co....—
Amer. El. Telephone Co....17
American Electrical Works..11
Arnold Co., The....14
Automatic Electric Co....16

Babcock & Wilcox Co....—
Badt, F. B....14
Bain, Forée & May....10
Baker & Co., Inc....3
Baker & Co., W. E....14
Beardsley Chandelier Mfg. Co.—
Belden Mfg. Co....—
Benjamin Elec. Mfg. Co....—
Benton & Son....7
Berthold & Jennings....18
Bissell Co., The F....9, 18
Bossert Electric Construction Co....12
Boston Incan. Lamp Co....—
Brooks, Hall L....18
Bruer, Will F....18
Buckeye Electric Co....—
Buckeye Engine Co....15
Butterfield Construction Co.14
Bylesby & Co., H. M....14

Central Electric Co....5
Century Electric Co....10
Chicago Edison Co....4, 12
Chic. Fuse Wire & Mfg. Co....—
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Chicago Pneumatic Tool Co..12
Chicago Telephone Co....16
Columbia Incand. Lamp Co..—
Cope, T. J....1
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co....22
Crolius & Son, E. R....—
Cutler-Hammer Mfg. Co....9
Cutter Elec. & Mfg. Company 1

D. & W. Fuse Company....22
Davis Electric Mfg. Co....—
Dearborn Drug & Chem. Wks.15
Diamond Meter Company....5
Directory of Engineers....14
Dixon Crucible Co., Joseph..15
Doxsee-Barrere Elec. Co....12
Duncan Elec. Mfg. Co....21

Edison Decorative & Miniature Lamp Departm't....10
Edison Mfg. Company....16
Electric Appliance Co....10
Electric Storage Battery Co.. 3
Electrician Pub. Company....21

Faries Mfg. Co....—
"For Sale" Advertisements..12
Ft. Wayne Elec. Works, Inc..21
Fowler & Co., John H....18
French Battery Co....—

General Electric Co....9, 10
General Storage Battery Co..10
Gest, G. M....16
Gleason, John L....22
Gould Storage Battery Co....5
Gregory Electric Co....12

Haller Machine Co....—
Hart Mfg. Co....3
Hartford Steam Boiler Inspection & Insurance Co....—
Hazard Manufacturing Co....—
Helios Mfg. Co....—
Hensel & Co., John A....5
Highland Park College....14
Hoffman, G. W....12
Hoffmann, Emil R....10
Holmes Fibre-Graph. Co....—
Holophane Glass Co....6
Humphrey, Henry H....14
Hunt & Co., Robt. W....14
Hydro-Elec. Developmeat Co14

Illinois Central Ry....12
Indiana Rub. & Ins. W. Co....1
India Rubber & Gutta Percha Insulating Company....—
International Elec. Meter Co 4
International Tel. Mfg. Co....17

Jackson, D. C. & W. B....14
Jeffrey Manufacturing Co....15

Kartavert Manufacturing Co.—
Kellogg Switchboard & Supply Company....17, 18
Klein & Sons, Mathias....16
Kohler Brothers....14
Kuhlman Electric Co....12

La Fayette Elect'l Mfg. Co...—
Leather Preserv. M. Corp....—
Leffel & Co., James....15
Loud's Sons Co., H. M....18
Ludlow Valve Co....15

Machado & Roller....10
Maine Hub Mfg. Co....18
Manhattan El. Supply Co....12
Manross, F. N....11
Marion Ins. Wire & Rub. Co.—
Matthews & Bros., W. N...3, 11
McCandless, H. W. & Co....11
M'Glehan & Co., C. H....14
McLennan & Company, K....10
McRoy Clay Works....16
Mica Insulator Company....10
Miscellaneous Advs....12
Monarch Elec. Mfg. Co....7
Morse, Frank W....—
Mott Iron Wks., J. L....11
Mueller Company, William..18
Munsell & Co., Eugene....10

National Battery Co....5
National Carbon Co....4
National Electric Co....11
National India Rubber Co....1
New Idea Soldering Paste Co.16
New York Ins. Wire Co....1
Northern Elect'l Mfg. Co....15

Okonite Co., The....1
Oneida Community, Ltd....—
Osburn Flex. Conduit Co....16
Ostrander & Co., W. R....10
Otto Gas Engine Works....15

Pacific Coast Pole Co....18
Penn. R. R....13
Perrizo & Sons....18
Peru Elec. Mfg. Co....1
Phillips, Eugene F....11
Phillips Insulated Wire Co...11
Phœnix Glass Co....8
Phosphor-Bronze S. Co....15
Pignolet, L. M....10
Plume & Atwood Mfg. Co....—
Porter Cedar Company....18

Rail Joint Co., The....3
Reisinger, Hugo....7
Replogle Governor Works....—
Reynolds El. Flasher Mfg. Co. 1
Robbins & Myers Co....22
Robert Instruments Co., The..—
Robertson & Sons, Jas. L....—
Rock Island Battery Co....—
Roebling's Sons Co., J. A....14
Ruebel & Wells....14
Runzel-Lenz Elec. Mfg. Co...—

Safety Ins. Wire & Cable Co ..22
Samson Cordage Works....1
Sandwich Pole Changer Co....—
Sargent & Lundy....—
Schott, W. H....14
Schureman Co., J. L....3
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co....15
Smith Storage Battery Co....—
Sorensen, P....16
Speer Carbon Co....—
Spon & Chamberlain....—
Standard Elect'l. Mfg. Co...—
Standard Underg. Cable Co...—
Stanley—G. I. Elec. Mfg. Co.—
Star Expansion Bolt Co....12
Sterling & Son, W. C....18
Stewart Elec. Co., Frank H —
Stow Mfg. Company....—
Stromberg-Carlson Tel. Mfg Company....17
Sturgess Engineering Dept. 15

Torrey Cedar Company....18
Trumbull Elec. Mfg. Co....7
Turner Brass Works....7

Van Nostrand Co., D....—
Vought-Berger Co....11
Vulcanized Fibre Company. 22

Wagner Electric Mfg. Co....7
Wesco Supply Co....10
Western Electric Company..22
Western Lumber & Pole Co 18
Westinghouse Electric & Manufacturing Co....19
Westinghouse Machine Co....20
Weston Electrical Inst. Co... 1
Willard Storage Bat. Co....5
Williamson & Co., R....11
Willis, G. M....14
Wilson, Co., Jas. I. M....18
Worcester Company, C. H....18
Wrigley Co., Thos....—

Yonkers Specialty Co....1

Zeller, Geo. A. Book Co....15

For Classified Index of Advertisements See Page 6.

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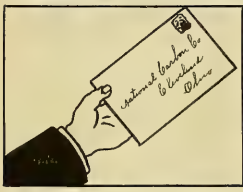

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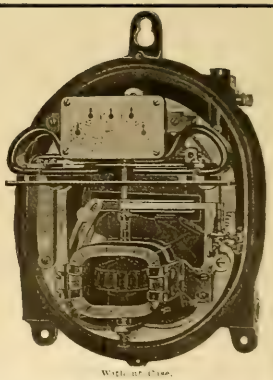

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1 West 34th Street,
New York City
Works: Depew, N. Y.

CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Anchors, (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre-Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Electric Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Clusters.
Benjamin Elec. Mfg. Co.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Crolius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduit and Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Electric Appliance Co.
Gest, G. M.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduits, Clay.
McRoy Clay Works.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Belden Mfg. Co.
Kunzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Herthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutler Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.

Dynamos and Motors.
Allis-Chalmers Company.
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Dozzee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Byllesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schon, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Corliss.
Allis-Chalmers Company.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Benton & Son.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Faries Mfg. Co.
McLeod, Ward & Co

Fixtures, Gas and Elec.
Beardsley Chandelier Mfg. Co.
Faries Mfg. Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.
Wesco Supply Co.

Flexible Sha'fts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

Globes, Reflectors and Shades.
Faries Mfg. Co.
Haller Machine Co.
Holophane Glass Co.
McLeod, Ward & Co.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Morse, Frank W.
Vought-Berger Co.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Machinery, Automatic.
M'Glehan & Co., C. H.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Brooks Hall L.
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Loud's Sons Co., E. M.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Peru Electric Mfg. Co.

Portables.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Highland Park College.

Searchlights.
Benton & Son.

Second-Hand Machin'y.
Amer. Electric Co.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Crolius & Son, E. R.
New Idea Soldering Paste Co.
Western Electric Co.

Solenoids.
Schureman Co., J. L.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Springs.
Manross, F. N.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co.
Vought-Berger Co
Wesco Supply Co.
Western Electric Co.

Telephone Service,
Chicago Telephone Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Towers, Elec. Transmission
American Company.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhiman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vulcanised Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 8.

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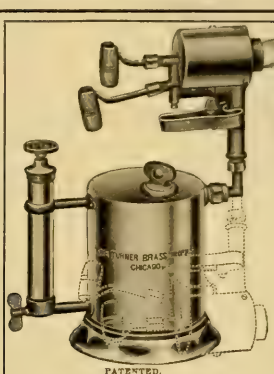

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WAGNER ELECTRIC MFG. CO.

MAIN OFFICE AND FACTORY, ST. LOUIS, U. S. A.

Mr. Switchboard Builder:

Our Bulletin No. 67-H gives data for switchboard builders.

We have saved money for many progressive and up-to-date switchboard builders by properly selecting their instruments, and by properly combining them with transformers.

We do not build switchboards, but have an expert at your disposal to answer any questions on switchboard practice.

District Offices in all the principal cities.

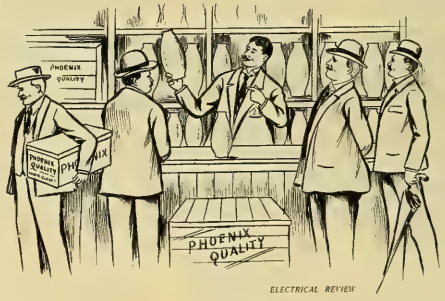
GENERATING SETS

Generators and Motors. Complete Lighting Equipments for Stationary or Marine Use
Search Lights, any candle-power. Electrical Repair Work Guaranteed
BENTON & SON, Manufacturers, LA CROSSE, WISCONSIN

INNER-GLOBE WISDOM

This is the dealer silent and sad,
Who restlessly slumbers when not cross and mad;
For customers are few and business is bad,
And his bank roll grows thinner and thinner.
The reason isn't hard to find,
His Inner-Globe customers knew their mind;
He tried to sell them some other kind,
But they wanted the "PHŒNIX INNER."

Let's pass the poor dealer and his globes untrue,
And his empty store and his feelings blue,
To the wide-awake "PHŒNIX" dealer, who
Has a disposition always sunny.
He's selling the boys the "PHŒNIX" brand,
The best Inner-Globe in all the land.
He's doing business to "beat the band"
And simply "coining money."

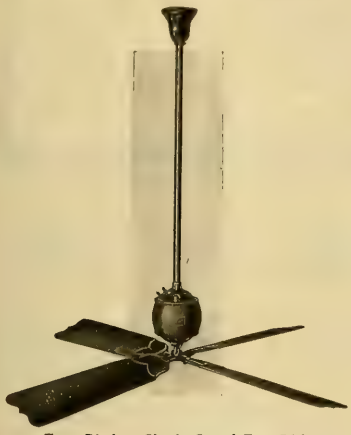


Write for Our Inner Globe Proposition
Inner and Outer Globe Catalogue upon Request

Phoenix Glass Company

PITTSBURG NEW YORK CHICAGO

General Electric Company



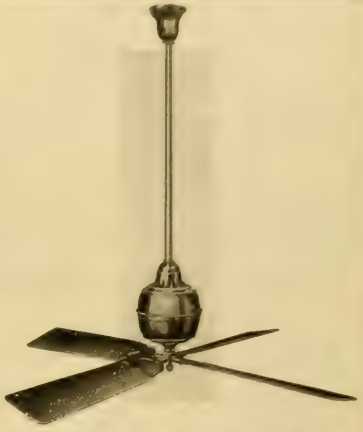
Four Blades, Single Speed Fan, 56 in. Sweep. Standard Finish Black Japan.

Electric Ceiling Fans

Made in two types, single and three speed for direct current only. Control for three speed type is self-contained within motor casing.

Frame, field core and yoke of the single speed fan is one casting.

Motors wound for standard voltages.



Four Blades, Three Speed Fan, 58 in. Sweep. Standard Finish Streaked Oxidized Copper.

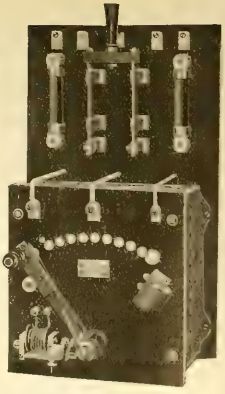
Special finish and special voltages to order

223

Chicago Office: MONADNOCK BLDG. **Principal Office: SCHENECTADY, N.Y.** Sales Offices In All Large Cities

C. & H. UNIVERSAL MOTOR STARTER

THIS is our regular No. 10 Motor Starter equipped with no voltage and overload release and mounted on a panel. On the latter one a knife switch and fuses. This starter comprises every device necessary for the complete installation and protection of a motor.



Bulletin 21 gives prices and full description

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Security, Convenience, Safety and Economy

SECURITY POLE SEATS are cheap notwithstanding the special machinery used in their construction or the quality of material.

Made of angle iron—bent corners.

Iron cross bars machine riveted.

No rough edges to tear hands or clothing.

Weighs only 28 pounds and will carry a ton.

You will be pleased upon investigation.

Novelty Pot Heads and Sleeves

Made of selected brass.

No expert plumber needed to fit head or sleeve.

Always ready for inspection or removal.

Waterproof after inspection same as before.

Samples sent on trial.

Complete information and blanks for ordering upon request.

TOLEDO, OHIO THE F. BISSELL COMPANY

THE F. BISSELL COMPANY · TOLEDO, O.

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WE ALWAYS CARRY A LARGE STOCK OF

Ansonia Magnet Wire
Bare Copper Wire
Paranite R. C. Wire
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Electric Appliance Company, Chicago
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Get acquainted with the
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THE WESCO SUPPLY CO., ST. LOUIS, MO.
"EVERYTHING ELECTRICAL"

Edison Low Candlepower Lamps

for ECONOMICAL LIGHTING
RELIABLY LONG AND BRILLIANT LIFE

10	C. P.	31 & 36 & 42	Watts
8	"	25 & 28 & 33	"
6	"	24 & 22	"
5	"	21	"
4	"	19	"
3	"	14	"
2	"	13	"
2	"	9	Watts (2 in series)

LOOK FOR THE LABEL IN THE SIGN

GENERAL ELECTRIC CO.

All types and varieties
Regular Multiple Lamps
Street Series Lamps
Miniature Lamps

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(493)

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Of all Qualities, in any Form at Lowest Prices
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That Is.

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You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes . . .

It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick.

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The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.

IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT

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STORAGE BATTERIES
Don't Buckle. Don't Blister. Don't Sulphate.
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MODEL AND MACHINE WORKS
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MEASURING RESISTANCE

is easy with our special volt-ammeters. Take two readings. Divide one by the other and subtract the resistance of the instrument. That's all. Write for Catalog

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SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
ST. LOUIS, MO.

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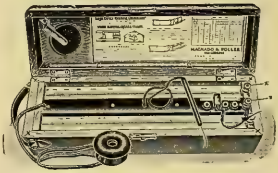

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So are all our other meters. Our 13 years of experience has enabled us to develope a line without equal.
Have you seen our guarantee label?
Printed matter pertaining to the complete line sent on application.

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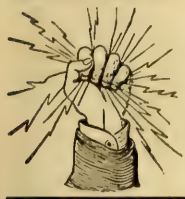

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SHOWING THE DETAIL
of the
NEW TYPE B ANCHOR AND WRENCH.

The upper part shows the new movable eye.
The middle shows the square wrench and sliding handles locked to the anchor by the eye.
The lower part shows the square mallet like key and the square shank of the anchor

THE RODS OF
Stombaugh Guy Anchors

Are not weakened by welds or holes for pins and rivets

STOMBAUGH GUY ANCHORS
SCREW INTO THE GROUND

An anchor is as strong as its weakest part
Stombaugh Guy Anchors have no weak parts

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HAIR SPRINGS
FOR ELECTRICAL INDICATING AND RECORDING INSTRUMENTS. MADE FROM MY SPECIAL BRONZE ALLOY
ESTABLISHED 1837
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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

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ELECTROLIERS
for public buildings, hotels, etc
In bronze and iron
Catalogues on application

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There is a hot-weather argument for the man who is talking about waiting until next fall before putting in "Two Balls" Adjusters—and for the man who is thinking about waiting until next fall before pushing them.

"TWO BALLS"

Adjusters are an all-the-year-'round necessity on drop lights in stores, offices, shops and homes; and they are an all-the-year-'round profit-bringer to the dealers who handle them.

The "Two Balls" is the pioneer lamp-cord Adjuster, and the best on the market to-day. It has no springs, drums or dangling loops, and is absolutely automatic and reliable.

It sells on sight—and electric light users see it in your store because we furnish you with illustrated circulars to send to them. Write us for full information concerning the various ways we help you to get good money out of the "Two Balls" Adjuster business.

We also send free to those interested, literature descriptive of our line of Telephone Equipment for Interior, Rural, Toll, Town and City use

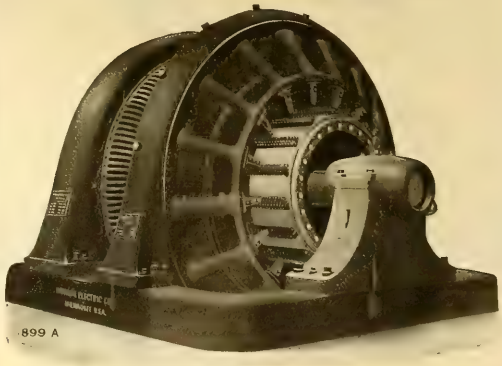
Address

The Vought-Berger Company
La Crosse, Wisconsin

National

Motor Generator Sets

BUILT IN ALL CAPACITIES



899 A

1000 KW. Motor Generator Set

National Electric Company
MILWAUKEE
New York, Philadelphia, Cleveland, Chicago, Denver, San Francisco

In 1905

The Western Electrician published 1042 LARGE pages of reading matter and 1575 illustrations. This is 3126 columns or about 3,000,000 words. Equivalent in amount to 23 average $2 technical Books. On the book basis $46 worth given for $3. If you are not a subscriber, send in your order now.

Western Electrician
510 Marquette Building, Chicago

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 2c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

As manager of electrical properties, or as superintendent of electric lighting interests of some large central station in Middle States. Am a business getter and have new business department experience. Will be open for engagement after June 1st. Am worth $2,000 a year to a live company. Address Box 597, care Western Electrician, 510 Marquette Building, Chicago.

POSITION WANTED

By a young man 29 years of age, on high or low potential work; high potential preferred. Or as assistant in some power house. Have a first-class technical education without experience. Strictly sober and industrious. S. P. DAUGHERTY, R. F. D. No. 3, Edwardsburg, Mich.

W ANTED

By a large telephone factory in Chicago, young men not over 22 years of age, preferably graduates of high schools or technical schools to enter an apprenticeship course and be trained to install and operate modern central office equipment. Address, stating age, education, and experience, Box 594, care of Western Electrician, Chicago.

WANTED.

A well-known Eastern concern, manufacturing dynamos and motors, would like to make arrangements with a salesman well acquainted with the electrical trade in Pittsburg, to handle their apparatus. A very satisfactory proposition will be made to the right man. Address Box 598, care of Western Electrician, 510 Marquette Bldg, Chicago.

WANTED

To purchase two 150 or 175 K-W. 60 cycle, 2 or 3 phase 2200 volts, alternating current generators; revolving field type; direct connected to Corliss engines; operating at a speed not to exceed 110 r. p. m. These outfits must be in first-class condition. In answering, state make of generator and engine, speed, length of time in operation, serial or shop number of the generator. Address reply to W. W. MOORE, care Wesco Supply Co., St. Louis, Mo.

WANTED SALESMAN

First-class salesman to sell new patent Rock Island dry batteries on commission basis. Must have first-class references. Apply at once. Rock Island Battery Co., 3rd and Vine Sts., Cincinnati, Ohio.

UNITED STATES ENGINEER OFFICE, WASHINGTON BARRACKS, D. C. Sealed proposals will be received here until noon, May 1, 1906, and then publicly opened, for furnishing and installing one electric elevator; for furnishing and installing lighting fixtures; for furnishing materials and labor for Terrazzo floors; furnishing labor for brick and stone slab flooring; furnishing material for timber floor, all for building for Army War College. Information on application. JOHN STEPHEN SEWELL, Captain Engineers.

DEPARTMENT OF THE INTERIOR, WASHINGTON, D. C., March 29, 1906. Sealed proposals will be received at the office of the Reclamation Service, 876 Federal Building, Chicago, Illinois, until 2 o'clock, p. m., May 23, 1906, for furnishing and installing near Garden City, Kan., complete, ready for operation, an electric power plant of 450-kilowatt switchboard output, for pumping purposes, including boilers, engines, generators, switchboards, and whatever may be necessary to make a complete plant, using for prime movers either steam turbines, or reciprocating steam engines, or gas engines. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, Washington, D. C., to O. H. Ensign, Electrical Engineer, 321 Merchants Trust Building, Los Angeles, Cal., or to the Engineer, Garden City, Kansas. THOS. RYAN, Acting Secretary.

When a man's electrical business shows a steady and healthy growth; when he sees only the bright side of things and never endeavors to discover a possible dark side; when he says business conditions are improving, you will be pretty safe in assuming that he advertises in the Western Electrician 52 times a year.

WANTED TO BUY MAGNET WIRE

and Electrical goods of any description and quantity for cash.

We are dealers in everything electrical.

THE AMBER ELECTRICAL MFG. CO.
60 W. Monroe St., Chicago

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BY
HERBERT LAWS WEBB.
Price $1.00.

A complete and practical work in handy pocket size.

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220-Volt Generators.

K. W.		
1	2	Crocker-Wheeler, comp.
1	7½	Holtzer-Cabot, compound.
1	7½	Westinghouse, M. P., comp.
1	13	Crocker-Wheeler, M. P., comp.
1	17½	Kester, comp.
1	17½	Lundell, M. P., new comp.
1	20	Eddy M. P., comp.
1	25	Commercial, 6 Po.e, comp., direct connected.
	35	Bernard, M. P., comp.
1	35	Western Electric, M. P., comp.
5	35	Lundell M. P., new comp.
1	45	Am. Eng. Co., M. P., comp.
1	50	C. & C., compound.
1	50	Maine, M. P., compound.
1	50	Westinghouse, 6 pole, comp., direct connected.
1	75	Westinghouse.
1	75	Siemens & Halske, M. P., brand new for direct connection.

Send for "Monthly Bargain Sheet," showing complete stock of machines in stock with net prices.

GREGORY ELECTRIC CO.
54-62 S. Clinton St., Chicago, Ill

NOTICE!

Notice is hereby given that specifications have been adopted by the City of Fond du Lac, by its Mayor and Common Council, for the granting of a franchise to construct, maintain and operate a plant or plants within or without the City of Fond du Lac, for the purpose of furnishing, and to furnish to the City of Fond du Lac and its citizens and others in said State electricity for light, heat and power, and to that end set poles and string wires and construct and maintain the necessary appurtenances to said business in said City of of Fond du Lac, which said specifications are now on file in the office of the City Clerk of said City of Fond du Lac, to which reference is hereby made

Now therefore, notice is hereby given that bids will be received for the sale of such franchise at the office of F. A. Bartlett, City Clerk of the City of Fond du Lac, up to 5 o'clock p.m., on Wednesday, May 16, 1906, which such bids shall propose, on behalf of the applicant, to pay annually into the treasury of said city, in consideration of receiving such franchise, a percentage of the gross receipts from the business carried on under said franchise. Such bid must be accompanied by a certified check in the sum of ten thousand ($10,000) dollars, as a guarantee of the acceptance of the franchise if granted and the giving of the bond provided for in said specifications.

By order of the Common Council.
Dated Fond du Lac, Wis., April 14, 1906.

F. A. BARTLETT,
City Clerk, Fond du Lac, Wis.

Electrical book buyers buy electrical books from the Electrician Publishing Co., 510 Marquette Bldg., Chicago.

90% of the Air Hammers used are Boyer or Keller.
of the Air Drills used are Boyer, Keller or "Little Giant."

Why? Because they do more work, use less air, require less repairs, represent basic patents and are not liable to infringement.

THE KIND YOU HAVE ALWAYS USED — MANUFACTURED BY

Chicago Pneumatic Tool Company
Fisher Building, CHICAGO 95 Liberty Street, NEW YORK

TRANSFORMERS

KUHLMAN ELECTRIC CO., - - ELKHART, IND.

BOSSERT'S BOXES

Drawn steel. One blow of a hammer gives clean round hole. No filing.
SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA, N.Y.

NEW VARIABLE SPEED A. C. MOTOR

Single Phase

No complicated or delicate starting devices used. Requires no skill for operation.

⅛ to ⅓ H. P.

Write for Description

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Doxsee-Barrere Electric Co.
1414 Chestnut St., St. Louis, Mo.

We are the real manufacturers of 75 per cent. of the Enameled Rings used in this country. Try us and see.

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147-149 CEDAR ST.,
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WATER-Tight Push Buttons for use in damp places We are prepared to supply anything electrical.

Catalogue No. 21 is a 700 page encyclopaedia of "Something Electrical for Everybody"

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Satisfactory Inducements,
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ON THE LINES OF
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WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 18 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

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SAMPLES SENT FREE
GEO. W. HOFFMAN
POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
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Publishers and Dealers of Electrical Books

CHICAGO EDISON COMPANY REPAIR SHOPS

High-Grade Machine Work of All Kinds
Correspondence Solicited.

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FIRST CLASS EQUIPMENT THROUGHOUT

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

THE SPECIAL TRAIN

TO THE

National Electric Light Association Meeting

ATLANTIC CITY, N. J.,

JUNE 5, 6, 7 AND 8, 1906.

For the exclusive use of delegates, supply men, their friends and ladies, via

Pennsylvania Short Lines.

This special train will leave Chicago 2 p. m. (Chicago time), Sunday, June 3rd, so as to reach Atlantic City in the middle of Monday afternoon. By this schedule the party from the West will reach Atlantic City in time perhaps for an ocean dip, or at any rate in ample time for supper and the evening's amusements.

It is proposed to make this train first class in every respect—in fact, equal to the "Pennsylvania Limited" in service, viz., it will be equipped with the same beautiful parlor smoker, dining car, sleepers and observation car. This N. E. L. A. train will be run east from Chicago over the Fort Wayne Route through Fort Wayne, Pittsburg, Harrisburg and Philadelphia, all rail to Atlantic City.

In view of the enthusiasm already evident relative to this coming Atlantic City convention and the fact that all berths on the train are not "lowers" (!), those in the West desiring to join the convention party and go East from Chicago to Atlantic City on this special train should without delay early make reservations DIRECT, addressing

C. L. KIMBALL, Assistant General Passenger Agent,

ROOM 22, No. 2 SHERMAN ST., CHICAGO,

Who is handling all inquiries appertaining to reservations for Assistant Master of Transportation Frank L. Perry of the National Electric Light Association.

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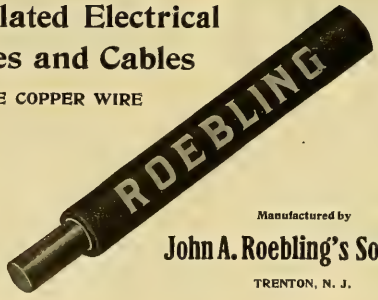

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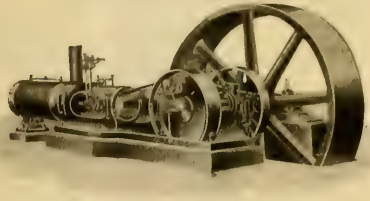

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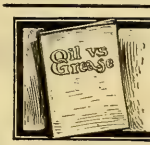

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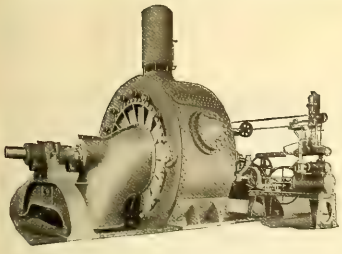

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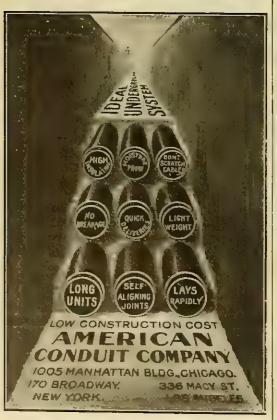

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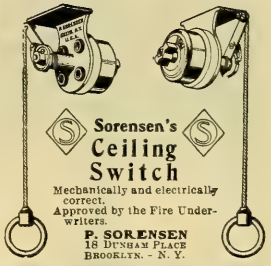

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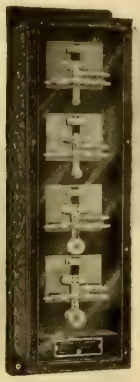

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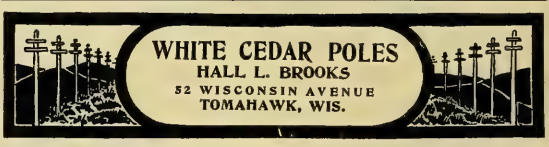

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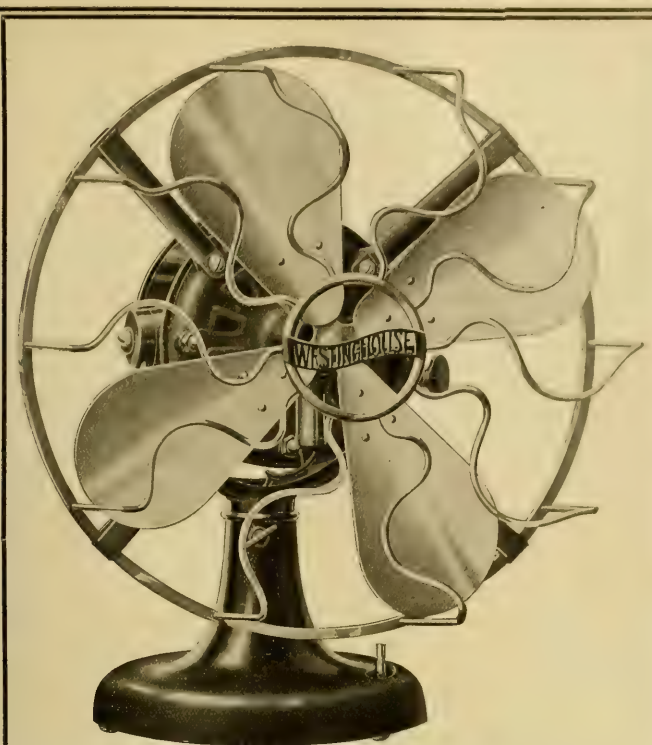

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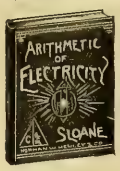

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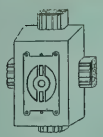
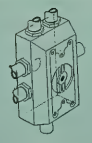
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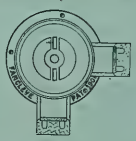
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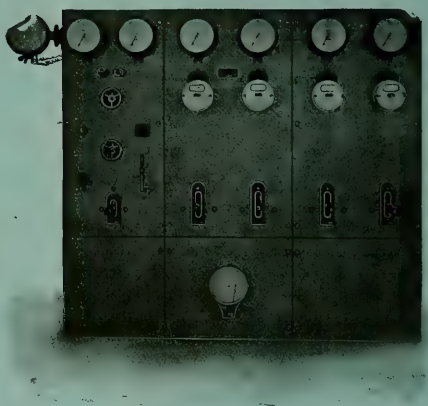
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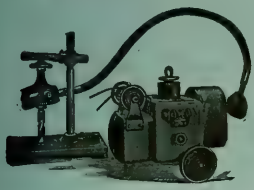

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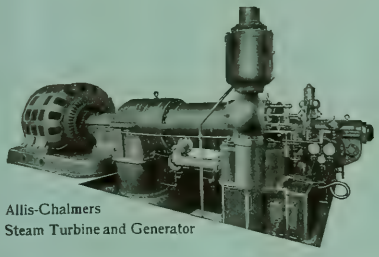

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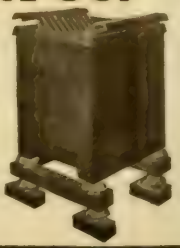

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig....18
Alton Machine Co....4
Allis-Chalmers Company....2
Amber Electric Co....12
American Battery Co....—
Amer. Circular Loom Co....1
American Conduit Co....16
American Diesel Engine Co.—
Amer. District Steam Co....14
Amer. Elect'l. Supply Co....—
Amer. El. Telephone Co....17
American Electrical Works..11
Arnold Co., The....14
Automatic Electric Co....16

Babcock & Wilcox Co....—
Badt, F. B....14
Bain, Forée & May....—
Baker & Co., Inc....3
Baker & Co., W. E....14
Beardslee Chandelier Mfg. Co.—
Belden Mfg. Co....11
Benjamin Elec. Mfg. Co....—
Benton & Son....—
Berthold & Jennings....18
Bissell Co., The F....9, 18
Bossert Electric Construction Co....12
Boston Incan. Lamp Co....—
Brooks, Hall L....18
Brown Specialty-Mchy. Co..10
Bruer, Will F....18
Buckeye Electric Co....—
Buckeye Engine Co....15
Butterfield Construction Co.—
Byllesby & Co., H. M....14

Central Electric Co....5
Century Electric Co....14
Chicago Edison Co....4, 12
Chic. Fuse Wire & Mfg. Co...11
Chicago Ins. Wire & Mfg. Co.10
Chicago Mica Co....10
Chicago Pneumatic Tool Co...12
Chicago Telephone Co....16
Colonial Fan & Motor Co....8
Columbia Incand. Lamp Co.—
Cope, T. J....16
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co....5
Crollius & Son, E. R....—
Crouse-Hinds Co....7
Cutler-Hammer Mfg. Co....9
Cutter Elec. & Mfg. Company—

D. & W. Fuse Company....—
Davis Electric Mfg. Co....—
Dearborn Drug & Chem. Wks.15
Diamond Meter Company....—
Directory of Engineers....14
Dixon Crucible Co., Joseph..15
Doxsee-Barrere Elec. Co....—
Duncan Elec. Mfg. Co....21

Edison Decorative & Miniature Lamp Departm't....10
Edison Mfg. Company....12
Electric Appliance Co....10
Electric Storage Battery Co.. 3
Electrician Pub. Company...11

Faries Mfg. Co....1
"For Sale" Advertisements..12
Ft. Wayne Elec. Works, Inc..21
Fowler & Co., John H....18
French Battery Co....—

General Electric Co....9, 10
General Storage Battery Co..10
Gest, G. M....16
Gleason, John L....—
Gould Storage Battery Co....—
Gregory Electric Co....12

Haller Machine Co....12
Hart Mfg. Co....20
Hartford Steam Boiler Inspection & Insurance Co....—
Hazard Manufacturing Co...22
Helios Mfg. Co....5
Hensel & Co., John A....—
Highland Park College....14
Hoffman, G. W....16
Hoffmann, Emil R....—
Holmes Fibre-Graph. Co....15
Holophane Glass Co....7
Humphrey, Henry H....14
Hunt & Co., Robt. W....14
Hydro Elec. Developmeat Co14

Illinois Central Ry....12
Indiana Rub. & Ins. W. Co.... 1
India Rubber & Gutta Percha Insulating Company....6
International Elec. Meter Co22
International Tel. Mfg. Co...17

Jackson, D. C. & W. B....14
Jeffrey Manufacturing Co....15

Kartavert Manufacturing Co.22
Kellogg Switchboard & Supply Company....17, 18
Klein & Sons, Mathias....16
Kohler Brothers....14
Kuhlman Electric Co....1

La Fayette Elect'l Mfg. Co...10
Leather Preserv. M. Corp....12
Leffel & Co., James....15
Loud's Sons Co., H. M....18
Ludlow Valve Co....—

Machado & Roller....—
Maine Hub Mfg. Co....—
Manhattan El. Supply Co.... 1
Manross, F. N....—
Marion Ins. Wire & Rub. Co.11
Matthews & Bros., W. N...3, 11
McCandless, H. W. & Co....12
M'Gleban & Co., C. H....17
McLennan & Company, K....10
McRoy Clay Works....16
Mica Insulator Company....10
Miscellaneous Advs....12
Monarch Elec. Mfg. Co ....—
Morse, Frank W....—
Mott Iron Wks., J. L....10
Mueller Company, William..18
Munsell & Co., Eugene....10

National Battery Co.... 4
National Carbon Co.... 4
National Electric Co.... ..22
National India Rubber Co....—
New Idea Soldering Paste Co.11
New York Ins. Wire Co....14
Northern Elect'l Mfg. Co....23

Okonite Co., The.... 1
Oneida Community, Ltd.... 1
Osburn Flex. Conduit Co....16
Ostrander & Co., W. R....11
Otto Gas Engine Works....—

Pacific Coast Pole Co....18
Peerless Elec. Co....13
Penn. R. R....19
Perrizo & Sons....18
Peru Elec. Mfg. Co....—
Phillips, Eugene F....11
Phillips Insulated Wire Co....11
Phoenix Glass Co....1
Phosphor-Bronze S. Co....15
Pignolet, L. M....10
Plume & Atwood Mfg. Co....22
Porter Cedar Company....18

Rail Joint Co., The.... 3
Reisinger, Hugo....—
Replogle Governor Works..15
Reynolds El. Flasher Mfg. Co.12
Robbins & Myers Co.... 4
Robert Instrument Co., The..16
Robertson & Sons, Jas. L....12
Rock Island Battery Co 21
Roebling's Sons Co., J. A....20
Ruebel & Wells....14
Runzel-Lenz Elec. Mfg. Co...17

Safety Ins. Wire & Cable Co.. 1
Samson Cordage Works.... 14
Sandwich Pole Changer Co...17
Sargent & Lundy....—
Schott, W. H....14
Schureman Co., J. L.... 3
Seymour Mfg. Co....11
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co....14
Smith Storage Battery Co.... 4
Sorensen, P....—
Speer Carbon Co.... 4
Spon & Chamberlain....15
Standard Elect'l. Mfg. Co....14
Standard Underg. Cable Co.... 1
Stanley—G. I. Elec. Mfg. Co. 7
Star Expansion Bolt Co....15
Sterling & Son, W. C....18
Stewart Elec. Co., Frank H...22
Stow Mfg. Company.... 1
Stromberg-Carlson Tel. Mfg. Company....17
Sturgess Engineering Dept..—
Switchboard Equipment Co.10

Torrey Cedar Company....18
Trumbull Elec. Mfg. Co.... 3
Turner Brass Works....—

Van Nostrand Co., D....—
Vulcanized Fibre Company..22

Wabash R. R....12
Wagner Electric Mfg. Co....—
Wesco Supply Co....—
Western Electric Company ..20
Western Lumber & Pole Co. 18
Westinghouse Electric & Manufacturing Co....20
Westinghouse Machine Co....—
Weston Electrical Inst. Co... 1
Willard Storage Bat. Co....—
Williamson & Co., R....11
Willis, G. M....14
Wilson, Co., Jas. L. M....18
Worcester Company, C. H....18
Wrigley Co., Thos....—

Yonkers Specialty Co.... 1

Zeller, Geo. A. Book Co....—

For Classified Index of Advertisements See Page 6.

Motors, Switches, Arc Lamps, Circuit Breakers, Etc., Etc.

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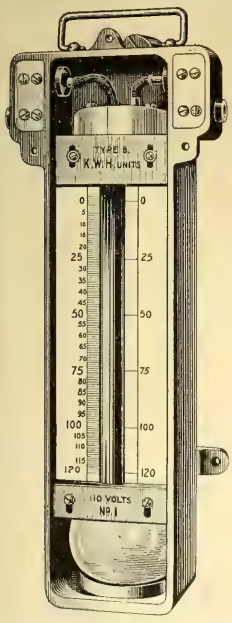

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Anchors, (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Electric Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanised.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Clusters.
Benjamin Elec. Mfg. Co.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Crolius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse Hinds Co.
Electric Appliance Co.
Gest, G. M.
McRoy Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Fern Electric Mfg. Co.
Sorensen, P.
Switchboard Equipment Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.

Dynamos and Motors.
Allis-Chalmers Company.
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Dozsee-Barreen Elec. Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Eyllesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Brown Specialty-Mchy. Co.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Corliss.
Allis-Chalmers Company.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Benton & Son.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Colonial Fan & Motor Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Peerless Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Faries Mfg. Co.
McLeod, Ward & Co

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg.Co.
Faries Mfg. Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

German Silver.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Faries Mfg. Co.
Haller Machine Co.
Holophane Glass Co.
Mcleod, Ward & Co.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Morse, Frank W.
Vought-Berger Co.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Machinery, Automatic.
M'Gehan & Co., C. H.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Brooks Hall L.
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Loud's Sons Co., H. M.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Peru Electric Mfg. Co.

Portables.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Highland Park College.

Searchlights.
Benton & Son.

Second-Hand Machin'y.
Amber Electric Co.
Bissell Co., The F.
Gregory Electric Co.
Mathews & Bro., W. N.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Crolius & Son, E. R.
New Idea Soldering Paste Co.
Western Electric Co.

Solenoids.
Schureman Co., J. L.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.
Weston Electrical Inst. Co.

Speed Indicators.
Manross, F. N.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co
Chicago Edison Co.
Electric Appliance Co.
Manhatan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service,
Chicago Telephone Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips Rubber Co., E. F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
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Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 3.

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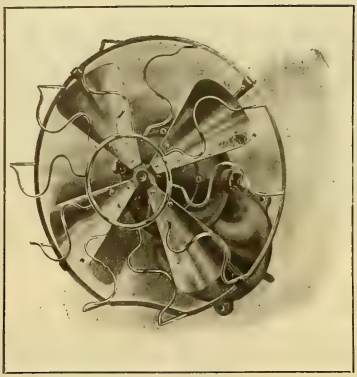

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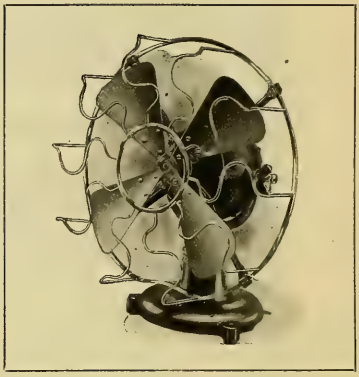

Was to strive for the "Right," at any cost

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Direct Current Motors, Generators, Exhaust Fans, Rotary Converters, Motor-Generator Sets

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Two Electric Heating Devices

For Daily Service

THE G. E. CEREAL COOKER

The G. E. Combination Cereal Cooker constitutes a water heater, a cereal cooker or double boiler, a vegetable steamer and an egg boiler.

It is made of sheet aluminum and tinned copper. The heating element is the Quartz Enamel type. This heater has high economy because it can be safely used with a small quantity of water which rapidly generates steam for cooking.

Combination Electric Cereal Cooker, Consuming 500 to 720 watts. One and two quart sizes.

Electric Coffee Percolator, Capacity 6 cups. Consumes 250 watts. 105 to 115 volts.

THE G. E. COFFEE PERCOLATOR

With the G. E. Percolator coffee can be prepared in a few minutes wherever connection can be made to an ordinary lamp socket.

The percolator is made of heavy copper highly polished and nickel plated. It is easy to use and wash. There is no flame, no alcohol to spoil polished table tops, no difficulty in controlling heat. It is always ready to use.

These two electric heating devices used in the morning will influence the introduction of others that will extend the service through the day. Central stations can profit by disposing of a stock of these.

956

Sales Offices in all large cities

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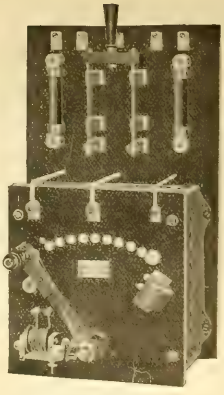
C. & H. UNIVERSAL MOTOR STARTER

THIS is our regular No. 10 Motor Starter equipped with no voltage and overload release and mounted on a panel. On the latter one a knife switch and fuses. This starter comprises every device necessary for the complete installation and protection of a motor.



Bulletin 21 gives prices and full description

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Cutler-Hammer Mfg. Co.

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SECURITY POLE SEATS are cheap notwithstanding the special machinery used in their construction or the quality of material.

Made of angle iron—bent corners.

Iron cross bars machine riveted.

No rough edges to tear hands or clothing.

Weighs only 28 pounds and will carry a ton.

You will be pleased upon investigation.

Novelty Pot Heads and Sleeves

Made of selected brass.

No expert plumber needed to fit head or sleeve.

Always ready for inspection or removal.

Waterproof after inspection same as before.

Samples sent on trial.

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EDISON LAMPS

Do Your Lighting

They cost less than all others in the end.

Over 25 Millions Annually Sold

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All types and varieties.
Regular Multiple Lamps.
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ALL STANDARD TYPES AND BUILT TO SPECIAL DESIGNS

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Of all Qualities, In any Form at Lowest Prices
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LET US HAVE YOUR INQUIRIES WHEN IN NEED OF MICA OF ANY DESCRIPTION—WE CAN GIVE YOU WHAT YOU NEED QUICK AND AT THE RIGHT PRICES.
CHICAGO MICA CO., VALPARAISO, IND.

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Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

50 Cents per Stick. $8.00 per Dozen.
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For A.-C. and D.-C. Circuits

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Face of meter 6¼ inches. Base of meter 6¾ inches
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Chicago Insulated Wire & Mfg. Co.

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NEW TYPE B ANCHOR AND WRENCH.

The upper part shows the new malleable eye.
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THE RODS OF
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Are not weakened by welds or holes for pins and rivets

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An anchor is as strong as its weakest part.
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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

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in sheet, wire, rods blanks, etc.
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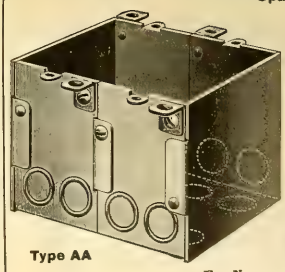
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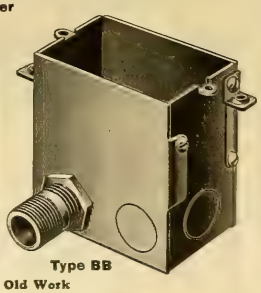
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COMBINATION SWITCH BOX
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Takes all Standard Switches and Receptacles.

Designed so that a **two-gang** box can be converted into any number of gangs by releasing the clamping screws and inserting "Spacers." These gangs are easily assembled with the aid of a screw-driver, and fit together snugly, making a perfect and solid gang box for any required number of switches.

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WESTERN ELECTRICIAN

June 2, 9, 16, 1906.

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NOW
for your advertising announcement in these important issues and obtain a choice location.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.*
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WANTED

An experienced solicitor for steam heating, electric light and power contracts in St. Paul, Minnesota. Must be a first-class man. State experience, salary expected and reference. Address Northern Heating & Electric Company, 209 Bradley Bldg., St. Paul, Minn.

WANTED

Chandelier hanger for high grade work. The Sanborn-Marsh Electric Co., 116 N. Illinois St., Indianapolis, Ind.

FOR SALE

One alternating current generator; one smaller generator; one constant current transformer; street lamp; switchboard appliances, etc. Machines used about two years. Also 54-ft. 14-inch double leather endless belt. A big bargain to the right party. For particulars, address S. C., Lock Box 11, Greentown, Ind.

WANTED

By a large telephone factory in Chicago, young men not over 22 years of age, preferably graduates of high schools or technical schools to enter an apprenticeship course and be trained to install and operate modern central office equipment. Address, stating age, education, and experience, Box 594, care of Western Electrician, Chicago.

WANTED.

A well-known Eastern concern, manufacturing dynamos and motors, would like to make arrangements with a salesman well acquainted with the electrical trade in Pittsburg, to handle their apparatus. A very satisfactory proposition will be made to the right man. Address Box 59E, care of Western Electrician, 510 Marquette Bldg., Chicago.

WANTED SALESMAN

First-class salesman to sell new patent Rock Island dry batteries on commission basis. Must have first-class references. Apply at once. Rock Island Battery Co., 3rd and Vine Sts., Cincinnati, Ohio.

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Switchboard and apparatus outgrown and displaced by automatic equipment.

Kellogg switchboard—twenty 8-panel, 3-position, mahogany, equipped for 5200 main lines, ultimate capacity, 6,000 lines.

Kellogg toll board of 9 positions.

Kellogg telephones—4064 wall and 2136 desk.

Sterling terminal rack, with protection.

Power plant, with charging and ringing machines and storage batteries.

Offered for sale in whole or in part.

For particulars, see description in WESTERN ELECTRICIAN of January 20, Electrical Review of January 27, Telephony and Sound Waves for February; or address

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on Electrical Subjects, and think Electrical Thoughts.

We have the books.

Send for a catalogue.

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Chicago.

The more a man advertises, the greater his business. The greater his business, the more he advertises.

TO-DAY
is a good day to send for catalog of
ROBERTSON-THOMPSON INDICATOR
Willis Planimeter and Victor Reducing Wheel and the moderate prices and easy terms of payment.
Jas. L. Robertson & Sons
198 Fulton St., New York

WANTED TO BUY MAGNET WIRE AND ELECTRICAL GOODS

of any description and quantity

FOR CASH

We are dealers in everything electrical.
THE AMBER ELECTRICAL MFG. CO.
60 W. Monroe St., Chicago

UNITED STATES ENGINEER OFFICE, WASHINGTON BARRACKS, D. C. Sealed proposals will be received here until noon, May 1, 1906, and then publicly opened, for furnishing and installing one electric elevator; for furnishing and installing lighting fixtures; for furnishing materials and labor for Terrazzo floors; furnishing labor for brick and stone slab flooring; furnishing material for timber floor, all for building for Army War College. Information on application. JOHN STEPHEN SEWELL, Captain Engineers.

DEPARTMENT OF THE INTERIOR, WASHINGTON, D. C., March 29, 1906. Sealed proposals will be received at the office of the Reclamation Service, 876 Federal Building, Chicago, Illinois, until 2 o'clock, p. m., May 28, 1906, for furnishing and installing near Garden City, Kan., complete, ready for operation, an electric power plant of 450-kilowatt switchboard output, for pumping purposes, including boilers, engines, generators, switchboards, and whatever may be necessary to make a complete plant, using for prime movers either steam turbines, or reciprocating steam engines, or gas engines. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, Washington, D. C., to O. H. Ensign, Electrical Engineer, 321 Merchants Trust Building, Los Angeles, Cal., or to the Engineer, Garden City, Kansas. THOS. RYAN, Acting Secretary.

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1	17½	Lundell, M. P., new comp.
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1	50	Westinghouse, 6 pole, comp., direct connected.
1	75	Westinghouse.
1	75	Siemens & Halske, M. P., brand new, for direct connection.

Send for "Monthly Bargain Sheet," showing complete stock of machines in stock with net prices.

GREGORY ELECTRIC CO.
54-62 S. Clinton St., Chicago, Ill

NOTICE!

Notice is hereby given that specifications have been adopted by the City of Fond du Lac, by its Mayor and Common Council, for the granting of a franchise to construct, maintain and operate a plant or plants within or without the City of Fond du Lac, for the purpose of furnishing, and to furnish to the City of Fond du Lac and its citizens and others in said State electricity for light, heat and power, and to that end set poles and string wires and construct and maintain the necessary appurtenances to said business in said City of Fond du Lac, which said specifications are now on file in the office of the City Clerk of said City of Fond du Lac, to which reference is hereby made.

Now therefore, notice is hereby given that bids will be received for the sale of such franchise at the office of F. A. Bartlett, City Clerk of the City of Fond du Lac, up to 5 o'clock p.m., on Wednesday, May 16, 1906, which such bids shall propose, on behalf of the applicant, to pay annually into the treasury of said city, in consideration of receiving such franchise, a percentage of the gross receipts from the business carried on under said franchise. Such bid must be accompanied by a certified check in the sum of ten thousand ($10,000) dollars, as a guarantee of the acceptance of the franchise if granted and the giving of the bond provided for in said specifications.

By order of the Common Council.

Dated Fond du Lac, Wis., April 14, 1906.

F. A. BARTLETT,
City Clerk, Fond du Lac, Wis.

"Little" Giant Storage Batteries

are constructed for all purposes to which storage batteries are adaptable. They retain their charge for long periods. Have greatest output for size and weight. Our Sparking Batteries have hard wood cases, thoroughly acid proof. Every battery guaranteed.

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HALLER MACHINE CO.
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SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA, N.Y.

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WE CLEAN, REPAIR AND RENEW OLD BELTS.
LEATHER PRESERVER MFG. CORP.
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Practical Running of Dynamos.

A little booklet on the care and the locating and remedying of troubles in dynamos and motors.

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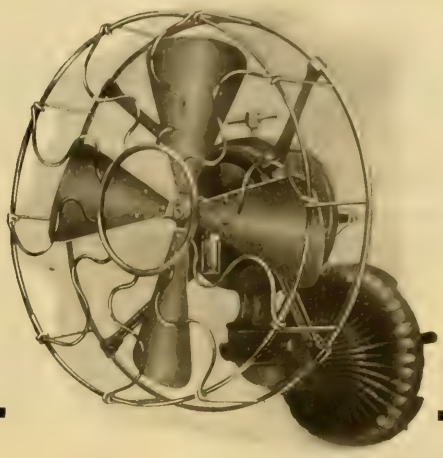

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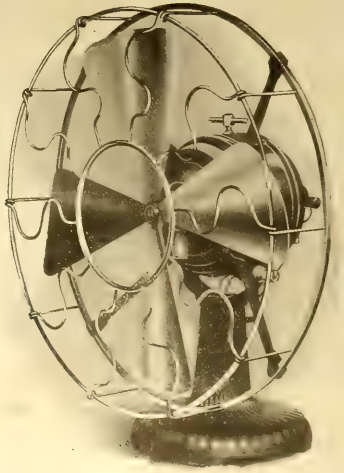

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Transformers—Standard and Special; Direct Current Motors and Generators; Designers of Electric Drives of all kinds.

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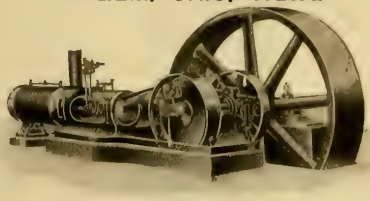

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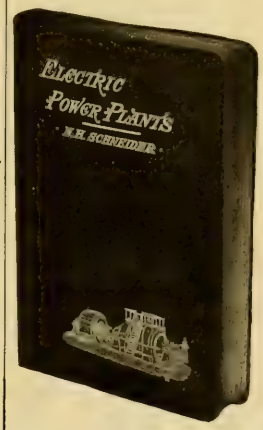

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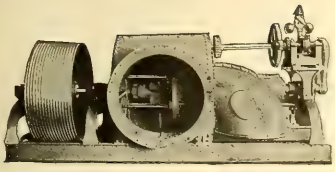

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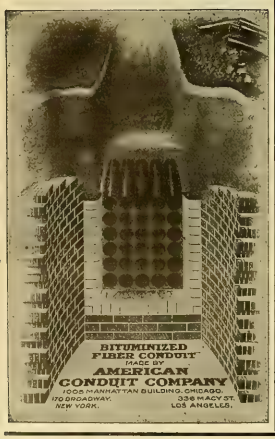

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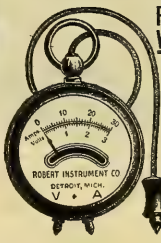

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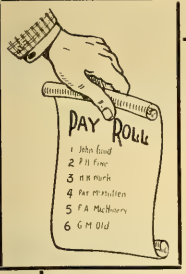

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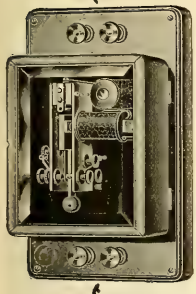

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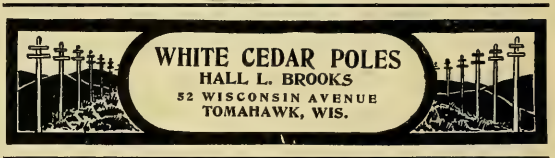

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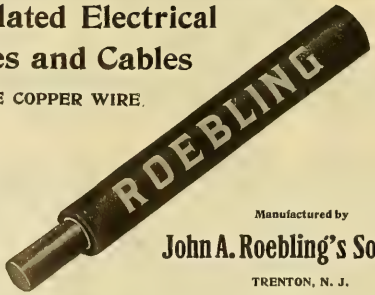

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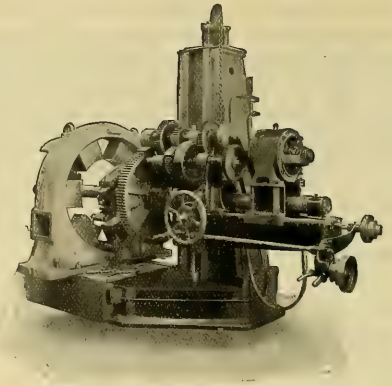

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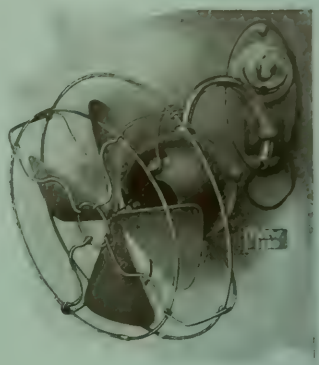

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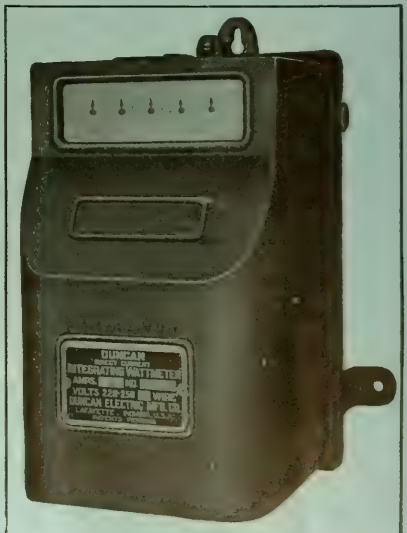

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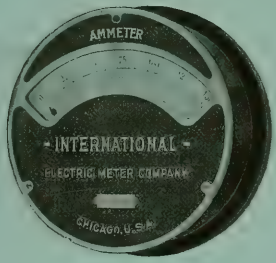

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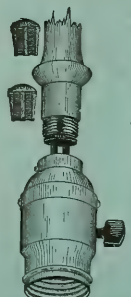

are made in two styles: One of them fits ⅜-inch socket caps, and the other is made for rosette or ⅜-inch socket handle.

Why tie knots in cords which increase the dangers of short circuits?

The "Knostrain" Bushings fit either No. 16 or No. 18 lamp or show window cords.

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PHILADELPHIA, PA.

Western Electrician

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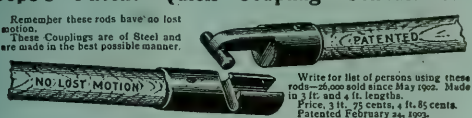
Cope's Patent Quick Coupling Conduit Rod

Remember these rods have no lost motion. These Couplings are of Steel and are made in the best possible manner.



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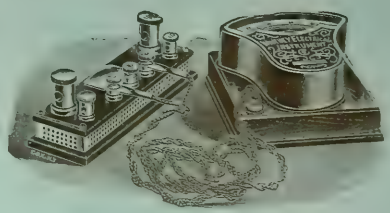
BERLIN—European Weston Electrical Instrument Co., Ritterstrasse No. 88.

New York Office—74 Cortlandt St.



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Universal Exposition
ST. LOUIS, 1904

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig....20
Alton Machine Co....4
Allis-Chalmers Company....2
Amber Electric Co....—
American Battery Co....11
Amer. Circular Loom Co....1
American Conduit Co....18
American Diesel Engine Co.17
Amer. District Steam Co....16
Amer. Elect'l. Supply Co....—
Amer. El. Telephone Co....19
American Electrical Works..11
Arnold Co., The....16
Automatic Electric Co....18

Babcock & Wilcox Co....24
Badt, F. B....16
Bain, Forés & May....11
Baker & Co., Inc....3
Baker & Co., W. E....16
Beardslee Chandelier Mfg. Co.—
Belden Mfg. Co....—
Benjamin Elec. Mfg. Co....—
Benton & Son....15
Berthold & Jennings....20
Bissell Co., The F....9, 20
Bliss Electrical School....16
Bossert Electric Construction Co....13
Boston Incan. Lamp Co....—
Brooks, Hall L....20
Brown Specialty-Mchy. Co.. 7
Bruer, Will F....20
Buckeye Electric Co....8
Buckeye Engine Co....17
Butterfield Construction Co.16
Byllesby & Co., H. M....16

Central Electric Co....5
Century Electric Co....10
Chicago Edison Co....4, 12
Chic. Fuse Wire & Mfg. Co...—
Chicago Ins. Wire & Mfg. Co.16
Chicago Mica Co....10
Chicago Pneumatic Tool Co..12
Chicago Telephone Co....18
Columbia Incand. Lamp Co.—
Cope, T. J....1
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co....4
Crollius & Son, E. R....10
Crouse-Hinds Co....24
Cutler-Hammer Mfg. Co....9
Cutter Elec. & Mfg. Company 1

D. & W. Fuse Company....—
Davis Electric Mfg. Co....15
Dearborn Drug & Chem. Wks.17
Devine Co., Joseph P....13
Diamond Meter Company.... 5
Directory of Engineers....16
Dixon Crucible Co., Joseph..17
Doxsee-Barrere Elec. Co....15
Duncan Elec. Mfg. Co....23

Edison Decorative & Miniature Lamp Departm't....10
Edison Mfg. Company....13
Electric Appliance Co....10
Electric Storage Battery Co.. 3
Electrician Pub. Company... 7

Faries Mfg. Co....—
"For Sale" Advertisements..12
Ft. Wayne Elec. Works, Inc..23
Fowler & Co., John H....20
French Battery Co....—

General Electric Co....9, 10
General Storage Battery Co..10
Gest, G. M....19
Gleason, John L....24
Gould Storage Battery Co.... 6
Gregory Electric Co....12

Haller Machine Co....—
Hart Mfg. Co....13
Hartford Steam Boiler Inspection & Insurance Co....17
Hazard Manufacturing Co....—
Helios Mfg. Co....—
Hensel & Co., John A....5
Highland Park College....16
Hoffman, G. W....18
Hoffmann, Emil R....12
Holmes Fibre-Graph. Co....—
Holophane Glass Co....13
Humphrey, Henry H....16
Hunt & Co., Robt. W....16
Hydro-Elec. Developmeat Co16

Illinois Central Ry....12
Indiana Rub. & Ins. W. Co.... 1
India Rubber & Gutta Percha Insulating Company....—
International Elec. Meter Co16
International Tel. Mfg. Co....19

Jackson, D. C. & W. B....16
Jeffrey Manufacturing Co....17

Kartavert Manufacturing Co.—
Kellogg Switchboard & Supply Company....19, 20
Klein & Sons, Mathias....11
Kohler Brothers....16
Kuhlman Electric Co....15

La Fayette Elect'l Mfg. Co...—
Leather Preserv. M. Corp....—
Leffel & Co., James....17
Loud's Sons Co., H. M....20
Ludlow Valve Co....17

Machado & Roller....1
Maine Hub Mfg. Co....20
Manhattan El. Supply Co....16
Manross, F. N....16
Marion Ins. Wire & Rub. Co.—
Matthews & Bros., W. N...3, 11
McCandless, H. W. & Co....18
McLennan & Company, K....10
McRoy Clay Works....18
Mica Insulator Company....10
Michigan College of Mines..16
Miscellaneous Advs....12
Monarch Elec. Mfg. Co....15
Morse, Frank W....12
Mott Iron Wks., J. L....15
Mueller Company, William..20
Munsell & Co., Eugene....10

National Battery Co....5
National Carbon Co....4
National Electric Co....4
National India Rubber Co.... 1
New York Ins. Wire Co.... 1
Northern Elect'l Mfg. Co....15

Okonite Co., The....1
Oneida Community, Ltd....—
Osburn Flex. Conduit Co....18
Ostrander & Co., W. R....11
Otto Gas Engine Works....17

Pacific Coast Pole Co....20
Penn. R. R....21
Perrizo & Sons....20
Peru Elec. Mfg. Co....11
Phillips, Eugene F....11
Phillips Insulated Wire Co...11
Phoenix Glass Co....—
Phosphor-Bronze S. Co....17
Pignolet, L. M....10
Plume & Atwood Mfg. Co....—
Porter Cedar Company....20

Rail Joint Co., The....3
Reisinger, Hugo....7
Replogle Governor Works....—
Reynolds El. Flasher Mfg. Co. 1
Robbins & Myers Co....24
Robert Instrument Co., The..—
Robertson & Sons, Jas. L....—
Rock Island Battery Co....—
Roebling's Sons Co., J. A....15
Rossiter, MacGovern & Co....12
Ruebel & Wells....16
Runzel-Lenz Elec. Mfg. Co.—

Safety Ins. Wire & Cable Co..24
Samson Cordage Works.... 1
Sandwich Pole Changer Co.—
Sargent & Lundy....16
Schott, W. H....16
Schureman Co., J. L....3
Seymour Mfg. Co....10
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co....16
Smith Storage Battery Co.. —
Sorensen P....12
Speer Carbon Co....—
Spon & Chamberlain....—
Standard Elect'l. Mfg. Co....—
Standard Underg. Cable Co....—
Stanley—G. I. Elec. Mfg. Co.—
Star Expansion Bolt Co....18
Sterling & Son, W. C....20
Stewart Elec. Co., Frank H.—
Stow Mfg. Company....—
Stromberg-Carlson Tel. Mfg. Company....19
Sturgess Engineering Dept..17
Switchboard Equipment Co.11

Torrey Cedar Company....20
Trumbull Elec. Mfg. Co....3
Turner Brass Works....7

Van Nostrand Co., D....—
Vulcanized Fibre Company..24

Wagner Electric Mfg. Co....14
Wesco Supply Co....10
Western Electric Company ..24
Western Lumber & Pole Co. 20
Westinghouse Electric & Manufacturing Co....22
Westinghouse Machine Co....22
Weston Electrical Inst. Co.... 1
Willard Storage Bat. Co.... 5
Williamson & Co., R....11
Willis, G. M....16
Wilson, Co., Jas. I. M....20
Worcester Company, C. H....20
Wrigley Co., Thos....11

Yonkers Specialty Co.... 1

Zeller, Geo. A Book Co....—

For Classified Index of Advertisements See Page 6.

Motors, Switches, Arc Lamps, Circuit Breakers, Etc., Etc.

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C-W TRANSFORMERS

CHAPTER IV.

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"It gives me great pleasure to say that I personally saw one of these 667-K. W., 35,000-volt Transformers subjected to a test of 60,000 volts from primary to ground. This pressure was applied to the Transformer after it was removed from the case and not immersed in oil. I consider the performance of this Transformer under the above test very satisfactory. Yours very truly,
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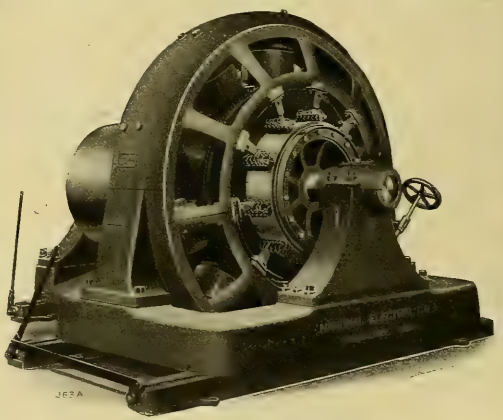
DIRECT AND ALTERNATING CURRENT

GENERATORS

FOR

LIGHTING POWER AND RY. SERVICE



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FOR ALL PURPOSES
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THE WILLARD STORAGE BATTERY CO.
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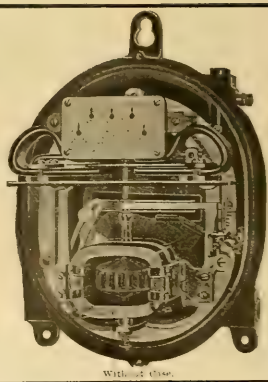

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And Learn the Merits and Details of the MUCH CONTESTED BUT VICTORIOUS

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Anchors, (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Anodes, Nickel and Copper
Seymour Mfg. Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elec. Const. Co.

Boxes, Moulding.
Gleason, John L

Brass, Sheet and Red.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes, Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Siewert Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Electric Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanised.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Faries Mfg. Co
Plume & Atwood Mfg. Co.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Clusters.
Benjamin Elec. Mfg. Co.
Faries Mfg. Co
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Crollius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse Hinds Co.
Electric Appliance Co.
Gest, G. M.
McRoy Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg Co.

Controllers.
Cutler-Hammer Mfg. Co
Schureman Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Switchboard Equipment Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
Allis-Chalmers Company.
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Doxsee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Bylesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Walls.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Brown Specialty-Mchy. Co.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Corliss.
Allis-Chalmers Company.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Benton & Son.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Faries Mfg. Co.
McLeod, Ward & Co
Moire, Frank W.

Fixtures, Gas and Elec.
Beardsley Chandelier Mfg. Co.
Faries Mfg. Co.
Williamson & Co., R

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

German Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Faries Mfg. Co.
Haller Machine Co.
Holophane Glass Co.
McLeod, Ward & Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Morse, Frank W.
Vought-Berger Co.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Harford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan Lamp Co.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Standard Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers.
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Brooks Hall L.
Bruce, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Loud'n Sons Co., H. M
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Peru Electric Mfg. Co.

Portables.
Faries Mfg Co.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Bliss Electrical School.
Highland Park College.
Michigan College of Mines

Searchlights.
Benton & Son.

Second-Hand Machin'y.
Amber Electric Co.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.
Rossiter, MacGovern & Co.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Crollius & Son, E. R.
Western Electric Co.

Solenoids.
Schureman Co., J. L.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Springs.
Manross, F. N.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service.
Chicago Telephone Co.

Time Switches.
Bissell Co., The F

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc
General Electric Co.
Kuhlman Electric Co.
Lis Fayette Elect'l. Mfg. Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Vulcanized Fibre.
Vulcanized Fibre Co.

Waitmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

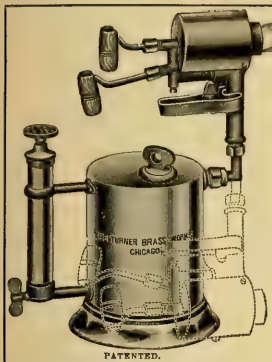
Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 3.

ELECTRA CARBONS

"ELECTRA" CARBONS ARE MADE OF THE BEST MATERIAL.
"ELECTRA" CARBONS ARE ALWAYS UNIFORM IN QUALITY, DIAMETER AND STRAIGHTNESS.
"ELECTRA" CARBONS ALWAYS GIVE SATISFACTION.

HUGO REISINGER 11 BROADWAY NEW YORK



WIND PROOF BRAZING TORCH

The Turner Double Jet Torch No. 96 produces the highest heat that is obtainable from gasoline. It is constructed especially for Electricians' use and can be used for either inside or outdoor work. The strongest wind has no effect on it, and as a Lineman's tool and for brazing in the wind it is unexcelled.

Manufactured by
The TURNER BRASS WORKS
23 N. Franklin St., - CHICAGO

PATENTED.
No. 96 Double Jet Torch. $5.00 Each.

A RELIABLE PAIR
THE VERY LATEST IN MAGNETIC-VANE INSTRUMENTS

Reliance Volt-meters AND Ampere Meters
For A.-C. and D.-C. Circuits

Fill the demand for reliable yet inexpensive switchboard instruments. Especially designed for automobile charging boards and small plant work. Neat and attractive in appearance.
Black enameled finish with raised parts polished nickel.
Face of meter 6¼ inches. Base of meter 6¾ inches.
Write for circulars and special discounts to the trade.

Made by RELIANCE INSTRUMENT CO.
BROWN SPECIALTY-MACHINERY CO., Exclusive Sales Agents
71 W. Jackson Blvd., Chicago

Electric Light Convention Numbers

The WESTERN ELECTRICIAN of June 2, 9 and 16, 1906, will give much space to the National Electric Light Convention, which will be held at Atlantic City, N. J., June 5th to 8th.

The first or preliminary number will be dated June 2d, and will contain the full official program and all other obtainable advance information concerning the meeting and will be of the greatest value, therefore, to members attending the Convention and will be found in the hands of all delegates and visitors during convention week.

The issue of June 9th will contain a report of the proceedings of the early portion of the meeting, some of the papers read and other Convention news.

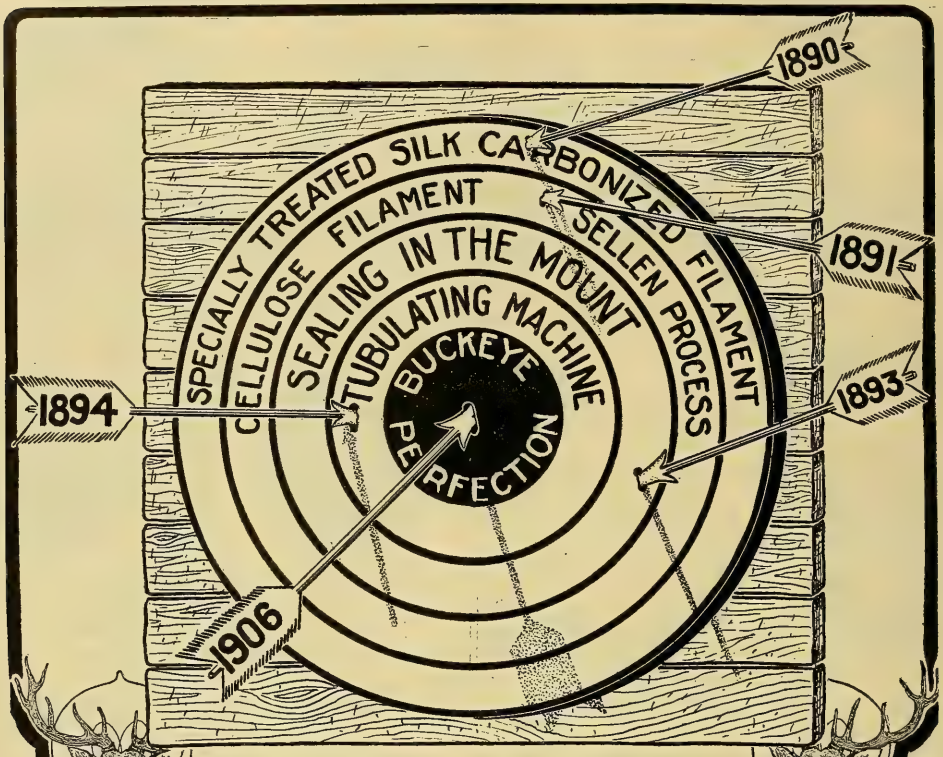
The issue of June 16th will contain the report of the final days of the Convention together with papers read, discussions, convention notes, etc.

These three numbers will be of great and permanent value, and manufacturers and dealers wishing to increase their business with the electric lighting industry are urged to be largely represented therein. We hope you will make your reservation for space NOW, so as to receive a choice location.

WESTERN ELECTRICIAN

EASTERN OFFICE:
150 Nassau St., NEW YORK

507 Marquette Building, CHICAGO



This Shows Why

you'd "Better Buy Buckeye" Lamps. Buckeye Lamps have always been pioneers, and every innovation brought them nearer to the Buckeye Perfection of to-day. We've made a success of our lamps for the past 16 years. We were the first to manufacture the cellulose filament in this country; the first to introduce modern glassmaking machinery into a lamp factory.

Do you think you can go wrong by choosing a lamp with such a record.

Buckeye Electric Company

LOOK FOR THE LICENSE LABEL IN THE STEM

THE BUCKEYE ELECTRIC CO., Chicago Office, 25 East Lake Street

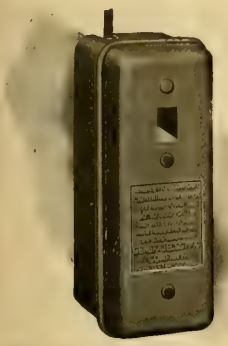
MAIN SALES OFFICE AND WORKS CLEVELAND, OHIO

THE BUCKEYE ELECTRIC CO., Pittsburg Office, 1107 Empire Building.

General Electric Company

M D 2 Lightning Arresters

For All Direct Current Circuits



Exterior

The M D 2 lightning arrester offers a straight path to earth through an adjustable spark gap and a non-inductive resistance. It also has a magnetic blowout which prevents passage of line current.

One of the valuable features of the M D 2 arrester is the fact that all parts are readily inspected. On removing the cover of the porcelain enclosing box one can see at a glance if the arrester is in proper condition for the next storm.

Interior

210

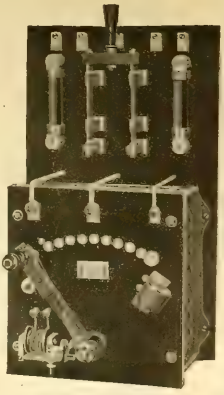
Chicago Office: MONADNOCK BLDG.

Principal Office: SCHENECTADY, N.Y.

Sales Offices In All Large Cities

C. & H. UNIVERSAL MOTOR STARTER

THIS is our regular No. 10 Motor Starter equipped with no voltage and overload release and mounted on a panel. On the latter one a knife switch and fuses. This starter comprises every device necessary for the complete installation and protection of a motor.



Bulletin 21 gives prices and full description

THE

Cutler-Hammer Mfg. Co.

Milwaukee

New York Boston Chicago Pittsburg

Security, Convenience, Safety and Economy

SECURITY POLE SEATS are cheap notwithstanding the special machinery used in their construction or the quality of material.

Made of angle iron—bent corners.

Iron cross bars machine riveted.

No rough edges to tear hands or clothing.

Weighs only 28 pounds and will carry a ton.

You will be pleased upon investigation.

Novelty Pot Heads and Sleeves

Made of selected brass.

No expert plumber needed to fit head or sleeve.

Always ready for inspection or removal.

Waterproof after inspection same as before.

Samples sent on trial.

Complete information and blanks for ordering upon request.

TOLEDO, OHIO THE F. BISSELL COMPANY

THE F. BISSELL COMPANY · TOLEDO, O.

COPPER

WE ALWAYS CARRY A LARGE STOCK OF

Ansonia Magnet Wire
Bare Copper Wire
Paranite R. C. Wire
Peerless R. C. Wire
"O-K" Weatherproof Wire
"O-K" Ideal Wire
"O-K" Office Wire
"O-K" Annunciator Wire

Electric Appliance Company, Chicago
ELECTRICAL SUPPLIES
Branches: San Francisco, Dallas, New Orleans

Transformer Thrift

A central station can save considerable money by using proper care in selecting alternating current transformers. "Using proper care" means selecting the Moloney Transformer. Send for Bulletins.

THE WESCO SUPPLY CO.
BRANCH WAREHOUSE: FT. WORTH, TEXAS **ST. LOUIS, MO.**

Edison Miniature Lamps

..FOR..

NOVELTY DEVICES

For use in electric flashlights, candlesticks, pocket lanterns, carriage and bicycle lamps, clock lights for bedrooms, ruby lanterns for photography, and for optical, dental and surgical instruments.

All types supplied—accurately rated—carefully selected.

LOOK FOR THE LABEL IN THE STEM

Telephone Lamps
Candelabra Lamps
Decorative Lamps

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT

General Electric Company, Harrison, N.J.
(512)

MICA

Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

MICABOND

will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.

CHICAGO MICA CO. VALPARAISO, IND.

Design, Finish and Accuracy

The above are the features of the

International

Instrument

which

ARE NOT and CAN NOT be EXCELLED

International Electric Meter Co.
Descriptive Catalogue Mailed Upon Request
330 W. Randolph St. Chicago

BIJUR

"HIGH-DUTY" STORAGE BATTERIES
42 Broadway, - NEW YORK

MEASURING RESISTANCE

is easy with our special volt-ammeters. Take two readings. Divide one by the other and subtract the resistance of the instrument. That's all. Write for Catalog

L. M. PIGNOLET
78-80 Cortlandt Street, NEW YORK

CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING MOTORS AND CEILING FANS
ST. LOUIS, MO.

YOU NEED IT!

Gale's Commutator Compound.

The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

50c. per stick. $5.00 per dozen. Send 50c. for trial stick.

FOR SALE BY ALL SUPPLY HOUSES OR

K. McLENNAN & CO., Sole Manufacturers, 1411, Room Inter Ocean Bldg., 130 Dearborn St., CHICAGO.

German Silver

in sheet, wire, rods blanks, etc.

Phosphor Bronze
Nickel and Copper Anodes

THE SEYMOUR MFG. CO.
Box 667, SEYMOUR, CONN.

DOES THE WORK

Convenient—Non-Corrosive—Effective

We also make the famous Crolius Commutator Compound; eliminates sparking and all commutator troubles.

E. R. CROLIUS & SON
6419 Peoria Street - CHICAGO, ILL.

HIGH TENSION TROUBLES?

DRY AND IMPREGNATE BY VACUUM

LARGEST ELECTRICAL FACTORIES IN U. S. AND ABROAD NOW USE OUR—THE PASSBURG—SYSTEM.

INVESTIGATE—YOU MAY BE SURPRISED.

JOSEPH P. DEVINE CO., BUFFALO, N. Y.

314 MOONEY-BRISBANE BLDG.

"Diamond H"

Switches

Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

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BOSSERT'S BOXES

Drawn steel. One blow of a hammer gives clean round hole. No filing.

SAVE TIME, BOXES AND MONEY

Be up to date. Use them. Write for bulletin giving full particulars.

Bossert Electric Construction Co., Utica, N.Y.

DOUBLE YOUR ILLUMINATION!

With Your STANDARD Lamps

PRICES

6 Lights, $13.15 5 Lights, $12.40 4 Lights, $11.65

WRITE FOR DISCOUNTS

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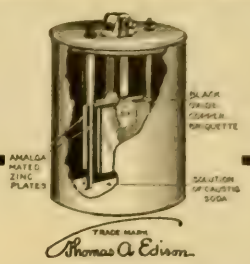

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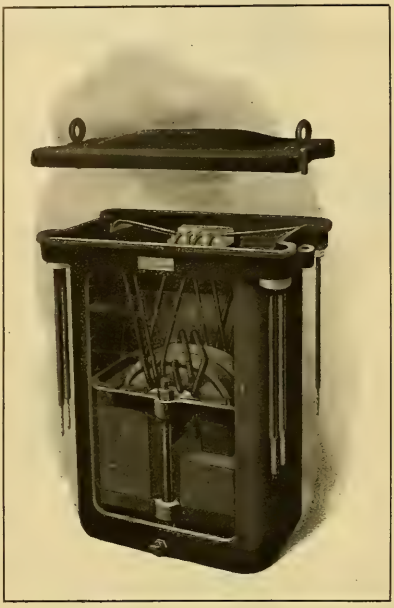

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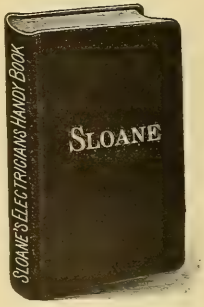

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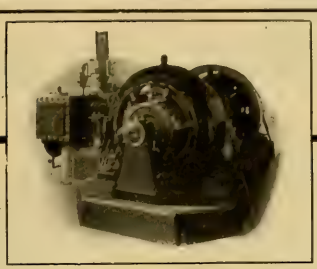

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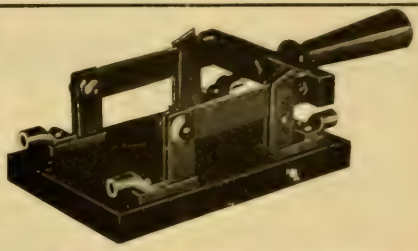

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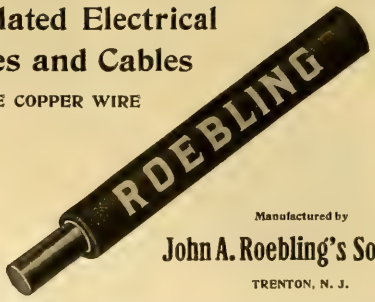

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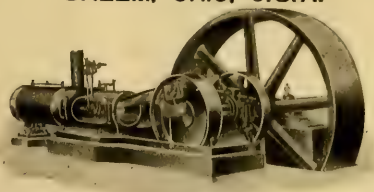

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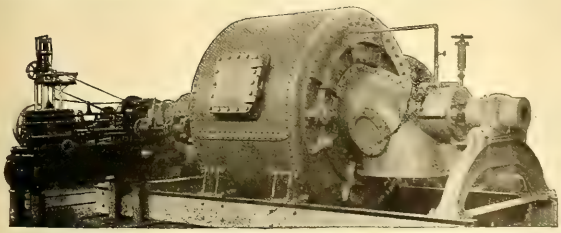

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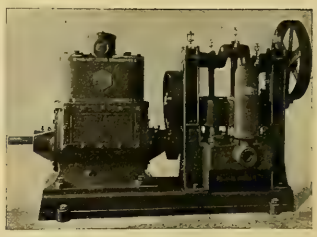

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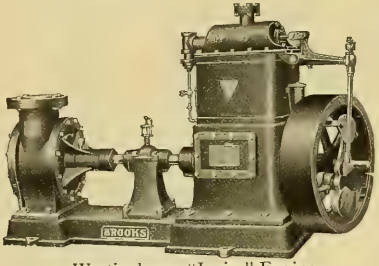

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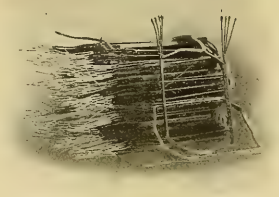

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CONTENTS

CHAPTER
Preface
I The Electric Current
II The Electric Battery
III The Effects of Electric Flow in the Circuit—Heat and Chemical Action
IV The Effects of Electric Flow Outside the Circuit—Magnetism and Induction—The Electrical Units
V Electromagnets—The Telegraph
VI Electric Signaling Apparatus
VII The Relations Between Magnets and Electric Currents
VIII Induction and Reactive Coils
IX The Telephone
X Telephone Accessories
XI The Mechanical Generation of Electricity
XII The Dynamo Machine
XIII Various Types of Dynamo Machines
XIV Alternators—Polyphase Currents
XV The Electric Motor
XVI The Electric Railway
XVII Polyphase Currents and Motors
XVIII Electrical Power Transmission
XIX The Incandescent Light
XX The Arc Light
XXI Electrochemistry—Storage Batteries
XXII Wireless Telegraphy
XXIII Radiation—X-Rays
XXIV Recent Theories

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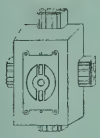
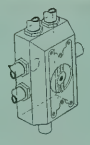
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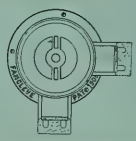
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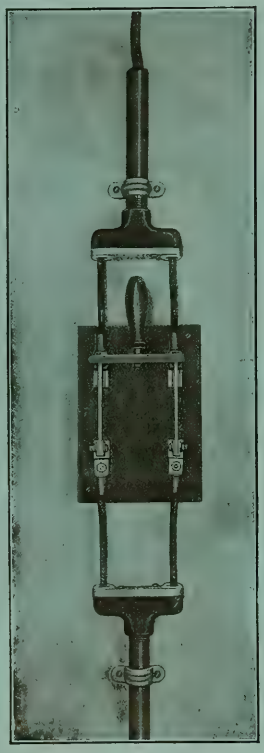
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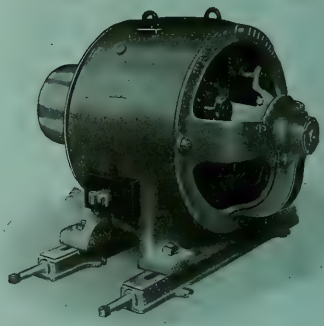
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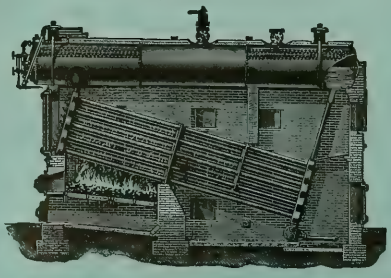
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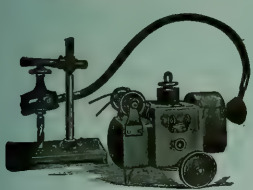

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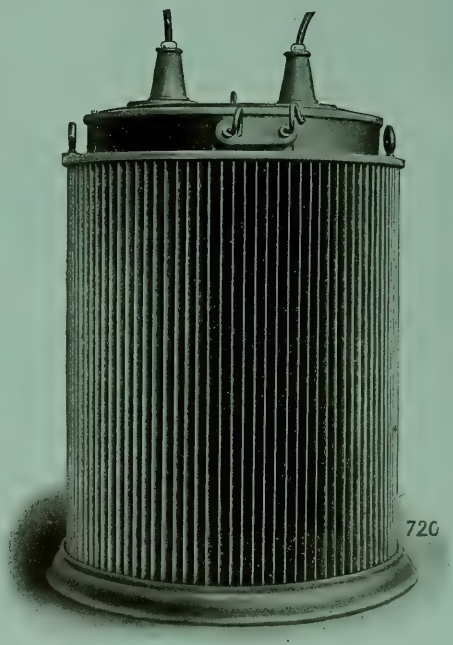

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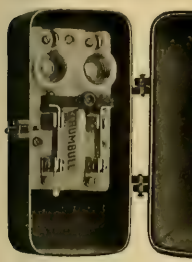

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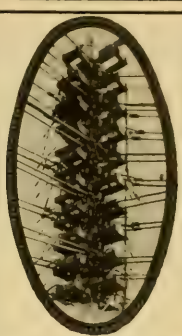

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig....20
Alton Machine Co....4
Allis-Chalmers Company....2
Amber Electric Co....—
American Battery Co....—
Amer. Circular Loom Co....1
American Conduit Co....18
American Diesel Engine Co.—
Amer. District Steam Co....16
Amer. Elect'l. Supply Co....—
Amer. El. Telephone Co....19
American Electrical Works..11
Arnold Co., The....16
Automatic Electric Co....18

Babcock & Wilcox Co....—
Badt, F. B....16
Bain, Forée & May....—
Baker & Co., Inc....3
Baker & Co., W. E....16
Beardsley Chandelier Mfg. Co.—
Belden Mfg. Co....7
Benjamin Elec. Mfg. Co....7
Benton & Son....—
Berthold & Jennings....20
Bissell Co., The F....9, 20
Bliss Electrical School....—
Bossert Electric Construction Co....10
Boston Incan. Lamp Co....—
Brooks, Hall L....20
Brown Specialty-Mchy. Co.. 5
Bruer, Will F....20
Buckeye Electric Co....—
Buckeye Engine Co....17
Burke, James V....5
Butterfield Construction Co.—
Byllesby & Co., H. M....16

Central Electric Co....5
Century Electric Co....7
Chicago Edison Co....4, 12
Chic. Fuse Wire & Mfg. Co...15
Chicago Ins. Wire & Mfg. Co. 7
Chicago Mica Co....10
Chicago Pneumatic Tool Co..12
Chicago Telephone Co....18
Columbia Incand. Lamp Co..—
Cope, T. J....7
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co....14
Crollius & Son, E. R....—
Crouse-Hinds Co....24
Cutler-Hammer Mfg. Co....9
Cutter Elec. & Mfg. Company—

D. & W. Fuse Company....—
Davis Electric Mfg. Co....—
Dearborn Drug & Chem. Wks.17
Devine Co., Joseph P....10
Diamond Meter Company....—
Directory of Engineers....16
Dixon Crucible Co., Joseph..17
Doxsee-Barrere Elec. Co....—
Duncan Elec. Mfg. Co....23

Edison Decorative & Miniature Lamp Departm't....10
Edison Mfg. Company....7
Electric Appliance Co....10
Electric Storage Battery Co. 3
Electrician Pub. Company...15

Faries Mfg. Co....5
"For Sale" Advertisements..12
Ft. Wayne Elec. Works, Inc..23
Fowler & Co., John H....20
French Battery Co....—

General Electric Co....9, 10
General Storage Battery Co..10
Gest, G. M....18
Gleason, John L....—
Gould Storage Battery Co....—
Gregory Electric Co....12

Haller Machine Co....7
Hart Mfg. Co....17
Hartford Steam Boiler Inspection & Insurance Co....—
Hazard Manufacturing Co...24
Hellos Mfg. Co....24
Hensel & Co., John A....—
Highland Park College....16
Hoffman, G. W....11
Hoffmann, Emil R....—
Holmes Fibre-Graph. Co....17
Holophane Glass Co....—
Humphrey, Henry H....16
Hunt & Co., Robt. W....16
Hydro Elec. Developmeat Colo

Illinois Central Ry....12
Indiana Rub. & Ins. W. Co.... 1
India Rubber & Gutta Percha Insulating Company....6
International Elec. Meter Co11
International Tel. Mfg. Co...19

Jackson, D. C. & W. B....16
Jeffrey Manufacturing Co....17

Kartavert Manufacturing Co.24
Kellogg Switchboard & Supply Company....19, 20
Klein & Sons, Mathias....10
Kohler Brothers....16
Kuhlman Electric Co....1

La Fayette Elect'l Mfg. Co..10
Leather Preserv. M. Corp....12
Leffel & Co., James....17
Loud's Sons Co., H. M....20
Ludlow Valve Co....—

Machado & Roller....—
Maine Hub Mfg. Co....—
Manhattan El. Supply Co....11
Manross, F. N....—
Marion Ins. Wire & Rub. Co.11
Matthews & Bros., W. N...3, 11
McCandless, H. W. & Co.... 7
McLennan & Company, K....10
McRoy Clay Works....18
Mica Insulator Company....10
Michigan College of Mines..—
Miscellaneous Advs....12
Monarch Elec. Mfg. Co....—
Morse, Frank W....—
Mott Iron Wks., J. L....11
Mueller Company, William..20
Munsell & Co., Eugene....10

National Battery Co....4
National Brake & Elec. Co..13
National Carbon Co....4
National India Rubber Co....—
Nat'l. Stamp. & Elec. Wks 10
New York Central Lines....17
New York Ins. Wire Co.... 5
Northern Elect'l Mfg. Co....10

Okonite Co., The....1
Oneida Community, Ltd.... 1
Osburn Flex. Conduit Co....18
Ostrander & Co., W. R.... 1
Otto Gas Engine Works....—

Pacific Coast Pole Co....20
Penn. R. R....21
Perrizo & Sons....20
Peru Elec. Mfg. Co....—
Phillips, Eugene F....11
Phillips Insulated Wire Co...11
Phœnix Glass Co....1
Phosphor-Bronze S. Co....17
Pignolet, L. M....10
Plume & Atwood Mfg. Co....24
Porter Cedar Company....20

Rail Joint Co., The....3
Reisinger, Hugo....—
Replogle Governor Works....17
Reynolds El. Flasher Mfg. Co.11
Robbins & Myers Co....4
Robert Instrument Co., The..11
Robertson & Sons, Jas. L....12
Rock Island Battery Co....14
Roebling's Sons Co., J. A....24
Rose Polytechnic Institute..16
Rossiter, MacGovern & Co....12
Ruebel & Wells....16
Runzel-Lenz Elec. Mfg. Co...19

Safety Ins. Wire & Cable Co.. 1
Samson Cordage Works.... 7
Sandwich Pole Changer Co..19
Sargent & Lundy....—
Schott, W. H....16
Schureman Co., J. L....3
Seymour Mfg. Co....7
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co.... 7
Smith Storage Battery Co.... 4
Sorensen, P....—
Speer Carbon Co....4
Spon & Chamberlain....16
St. Marys Incand. Lamp Co.. 8
Standard Elect'l. Mfg. Co.... 7
Standard Underg. Cable Co.. 1
Stanley—G. I. Elec. Mfg. Co.14
Star Expansion Bolt Co....7
Sterling & Son, W. C....20
Stewart Elec. Co., Frank H..24
Stow Mfg. Company....1
Stromberg-Carlson Tel. Mfg. Company....19
Sturgess Engineering Dept..—
Switchboard Equipment Co. 1

Torrey Cedar Company....20
Trumbull Elec. Mfg. Co....3
Turner Brass Works....—

Van Nostrand Co., D....—
Vulcanized Fibre Company..24

Wagner Electric Mfg. Co....—
Wesco Supply Co....—
Western Electric Company ..15
Westinghouse Electric & Manufacturing Co....22
Westinghouse Machine Co....—
Weston Electrical Inst. Co... 1
Willard Storage Bat. Co....—
Williamson & Co., R....11
Willis, G. M....16
Wilson, Co., Jas. I. M....20
Worcester Company, C. H....20
Wrigley Co., Thos....—

Yonkers Specialty Co.... 1

Zeller, Geo. A. Book Co....—

For Classified Index of Advertisements See Page 6.

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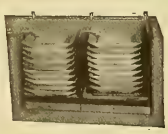

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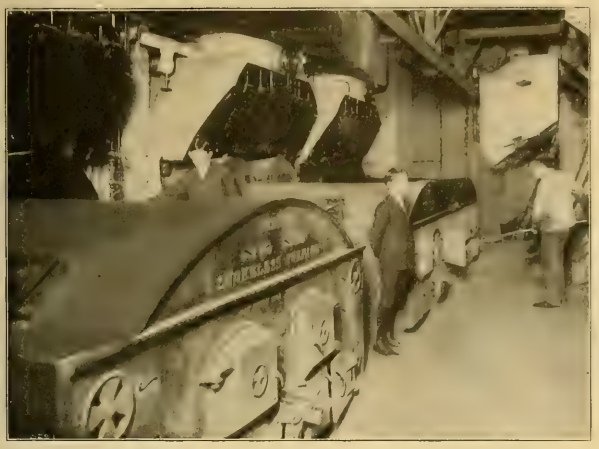

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Anchors. (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Anodes, Nickel and Copper
Seymour Mfg. Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., F. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Brake & Elec. Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Clusters.
Benjamin Elec. Mfg. Co.
Faries Mfg Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Crollius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse Hinds Co.
Electric Appliance Co.
Gest, G. M.
McRoy Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Electric Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Switchboard Equipment Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
Allis-Chalmers Company.
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Dorsee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
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Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Byllesby & Co., E. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Brown Specialty Mchy. Co.
Central Electric Co.
Diamond Meter Co.
Dunham Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Nat'l Stamping & Elec. Wks.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
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Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
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Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Faries Mfg. Co.
McLeod, Ward & Co
Morse, Frank W.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg. Co.
Faries Mfg. Co.
Williamson & Co., R

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Furnaces.
Brace, James V.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Electric Appliance Co.
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German Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Faries Mfg. Co.
Haller Machine Co.
Holophane Glass Co.
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Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Morse, Frank W.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
St. Marys Incand. Lamp Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
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Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

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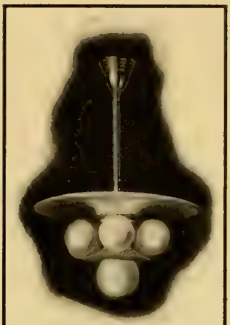
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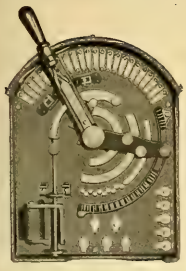

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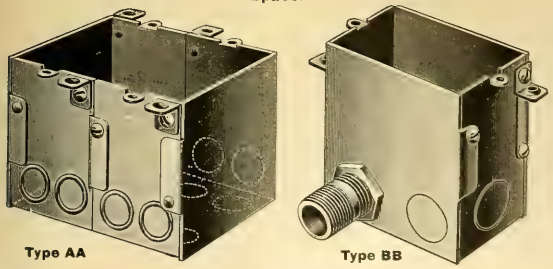

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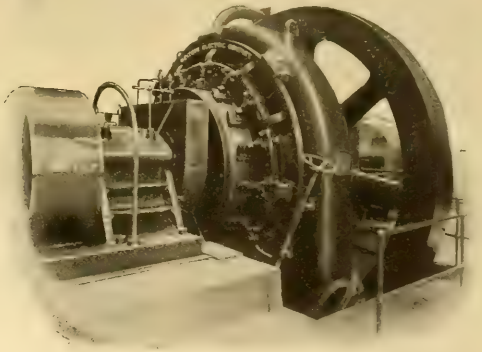

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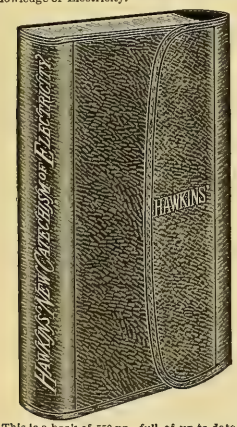

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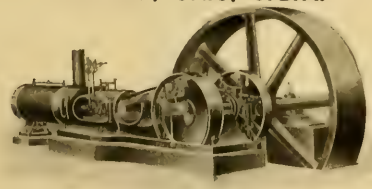

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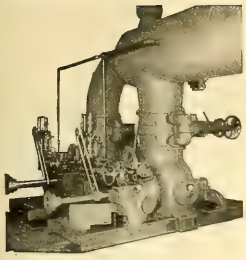

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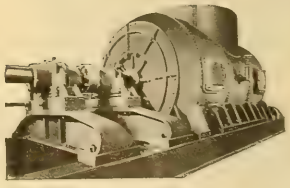

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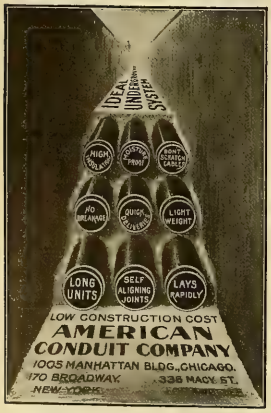

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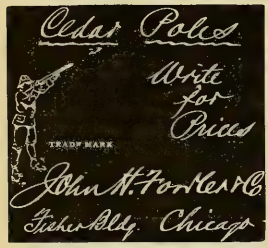

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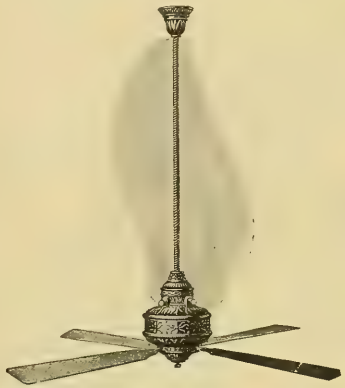

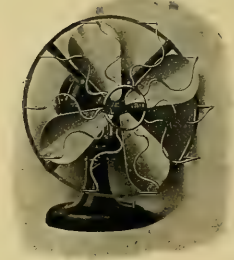

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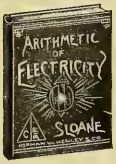

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VI Electric Signaling Apparatus
VII The Relations Between Magnets and Electric Currents
VIII Induction and Reactive Coils
IX The Telephone
X Telephone Accessories
XI The Mechanical Generation of Electricity
XII The Dynamo Machine
XIII Various Types of Dynamo Machines
XIV Alternators—Polyphase Currents
XV The Electric Motor
XVI The Electric Railway
XVII Polyphase Currents and Motors
XVIII Electrical Power Transmission
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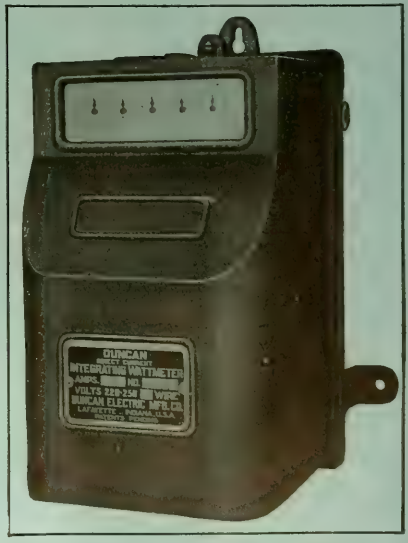

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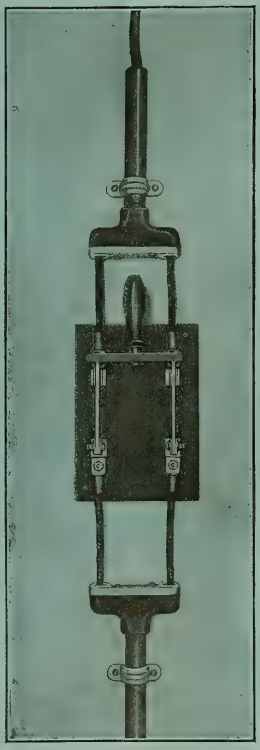

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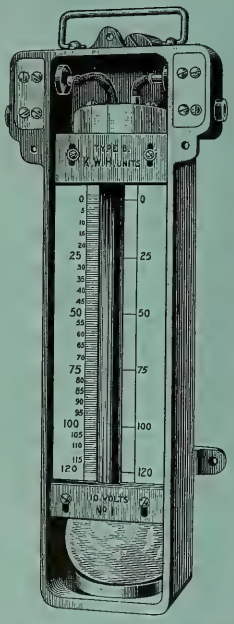

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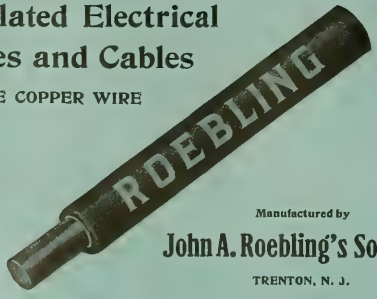

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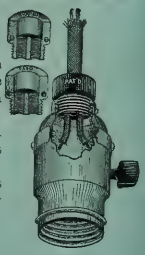

are made in two styles: One of them fits ⅜-inch socket caps, and the other is made for rosette or ⅜-inch socket handle.

Why tie knots in cords which increase the dangers of short circuits?

The "Knostrain" Bushings fit either No. 16 or No. 18 lamp or show window cords.

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PHILADELPHIA, PA.

Western Electrician

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Are easy to sell. You make a fine profit. Everybody with an electric sign wants one. Write us today for particulars and prices. Also pointers on electric signs.

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For connecting telephone ground wires to pipes and cables. Cheaper than a wrapped connection; as good as a soldered connection. Adopted by nearly all the Bell Tel. Cos. and most of the larger Independent Tel. Cos. Samples free on application. Write for list of other specialties.

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Cope's Patent Quick Coupling Conduit Rod

Remember these rods have no lost motion. These Couplings are of Steel and are made in the best possible manner.

Write for list of persons using these rods—26,000 sold since May 1902. Made in 3 ft. and 4 ft. lengths. Price, 3 ft. 75 cents, 4 ft. 85 cents. Patented February 24, 1903.

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Are the only standard portable instruments of the type deserving this name. Write for circular and price lists.

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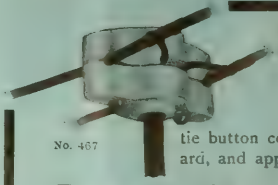

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The Safest Job

Is the result of using "Peru" Cleat-Tie Buttons, a cleat and tie button combined. National Code Standard, and approved by your city inspector.

"Peru" Cleat-Tie Button

Saves a pair of cleats, two screws, and half the time in wiring, and guarantees the neatest and safest job, passing every inspection. Specify "Peru" to your jobber or order direct.

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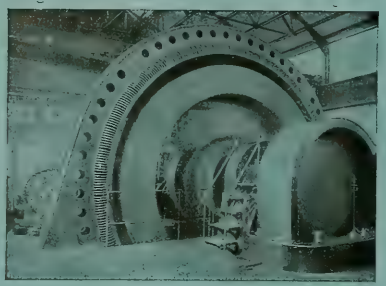

THE RISE OF A GREAT COMPANY

Allis-Chalmers Plants Supply the World

Machinery That Has Revolutionized Several of the Principal Industries

(Reprinted from Dun's Review.)

For the American of to-day few things have greater interest, from whatever point of view, than the rise and development of the mighty industrial enterprises upon which the prosperity of the country is now so largely dependent. And particularly is this true of the great engineering companies, whose work has been and always will remain constructive in its character—not the accumulation of huge fortunes based upon speculative enterprises or the acquirement of monopolistic privileges in already well tilled fields, but a reaching out into the unknown and laying hold upon the forces of nature to yoke and control them for the use of man. Such is the character of the work done by the Allis-Chalmers Company, whose creative and productive capacity is acknowledged to-day as among the foremost in the world.

Manufacturing is conducted by this company at six large plants, located in Milwaukee, Chicago, Scranton and Cincinnati. These are capable of employing about 12,000 men and the extensions at West Allis now in progress will eventually result in the employment of at least 18,000 men. The large new plant at West Allis, Milwaukee, which is constructed throughout on the "unit system," is regarded as one of the model engineering works of the world, both for designs and equipment.

Occupying the Electrical Field.

When Allis-Chalmers Company entered the electrical field, this was dominated by two large companies. In Cincinnati, however, there was a smaller concern, known as the Bullock Electric Manufacturing Company, which had for years been building electrical generating, transforming and driving apparatus, in sizes ranging from the smallest to the largest, and, through installations in this country and abroad, had acquired a reputation for the most skillfully designed and carefully constructed machinery on the market. This admirably equipped plant the Allis-Chalmers Company purchased and greatly enlarged, and soon developed facilities for the manufacture and sale of electrical machinery second to none in the world. The meaning of this becomes clear when one realizes that Allis-Chalmers Company also builds every type of prime mover—steam turbines, reciprocating steam engines, hydraulic turbines and gas engines—putting it in a position to accomplish what no other company in existence can perform, viz., the construction of complete power equipments of every description, with auxiliary electrical apparatus, in one set of shops and under one management. The result is harmonious working of the machinery in every detail and the highest possible efficiency.

Developing the Steam Turbine.

A little over a year ago the Allis-Chalmers Company entered the steam turbine field and its engineers have already made notable advances in the construction of power units of the rotary type. Among those now being installed is one of 5,500 kilowatts, built for the Brooklyn Rapid Transit Company. The introduction of the steam turbine and its rapidly increasing use has not, however, affected the sale of reciprocating engines, which still have their distinct field of operation.

Equipment of Immense Power Stations.

Steam engines aggregating nearly 6,000,000 horsepower have been built by the Allis-Chalmers Company. These range in size from 30 to 15,000 horsepower each, and number between 5,000 and 6,000. They are installed in every quarter of the globe. In the most important power plants the engines are of this build. Greater New York has the four largest power stations in America. They are all equipped with Allis-Chalmers engines, as follows:

The New York City Railway Company, formerly the Metropolitan, operating every surface car in New York City, has at its Ninety-sixth street power house eleven engines, aggregating about 61,000 horsepower at the minimum rating.

The Interborough Rapid Transit Company has seventeen engines, aggregating more than 200,000 horsepower, nine of which are in its Fifty-eighth street power house, for operating the subway, and eight at the Manhattan station for operating the elevated roads.

In Brooklyn the Brooklyn Rapid Transit Company has nineteen engines aggregating 60,000 horsepower.

In Chicago the Metropolitan West Side Elevated Railway Company has eight Allis-Chalmers engines, aggregating 30,000 horsepower, and the South Side Elevated Railroad Company has eight also of these engines, aggregating 30,000 horsepower.

Abroad, the engines are operated in London, Glasgow, Dublin, and other cities of Great Britain; in France, Germany, and Austria; in Australia, South Africa, the Argentine Republic, Chile, and Mexico; in Cuba, in the Sandwich Islands, and in China.

Mammoth Pumping Engines.

The Allis-Chalmers Company's steam pumping engines are commensurate in size and importance with its power station apparatus. The first "high duty" pumping engine of the triple expansion, vertical type, which has been adopted everywhere by other makers as the highest standard of construction, was originated by this company. It was built for the Milwaukee water works and has a capacity of 6,000,000 gallons daily. Pumping engines of the same type made by this company, ranging in capacity from 3,000,000 to 50,000,000 gallons per twenty-four hours, are now located in large centers of population throughout the United States—at Albany, Chicago, Detroit, New Orleans, Omaha, Pittsburg, McKeesport, San Antonio, Sacramento, St. Louis, Washington and other leading cities.

Electricity Drives Powerful Pumps.

Besides this type of pumping machinery, the company has developed pumps of the centrifugal type, of which a great number have been installed and are at present being installed in different parts of the country. Boston has nine of these engines, New Orleans nine and Chicago four. About thirty-five are at present in various stages of construction in the company's works at West Allis. Six of the largest of these pumps have a capacity of 165,000,000 gallons per twenty-four hours each. They are of the vertical shaft type and are operated by direct connected synchronous motors.

Harnessing the Waterfalls.

Realizing the great advantages to be derived from the development of the natural water powers of this country, the Allis-Chalmers Company has put itself in a position to build hydraulic turbines and governors especially designed to meet the requirements of any given case. Machines of the type furnished may be seen in operation at Niagara Falls, where the force of the waters is converted into electrical energy for both American and Canadian companies.

At Shawinigan, Province of Quebec, Canada, is another great hydraulic plant of like character. The sum of the energy developed by turbines at these two places alone is equal to 135,000 horsepower.

Powerful Gas Engines.

The Allis-Chalmers Company has acquired the American patents and is the sole licensee for the eastern hemisphere for the Nurnberg gas engine. These engines are built in many sizes, ranging from 450 to 4,000 horsepower. They operate with illuminating gas, natural gas, furnace gas or producer gas.

Machinery for All Mining Work.

From Alaska to Cape Horn, from Maine to California, in Australia, South Africa, the mountains bordering Russia, in China, in Japan, and in many of the countries of Europe the mining machinery of the Milwaukee company is the acknowledged standard of excellence. The steam stamp, now so generally used for crushing copper ores, owes its development to the ingenuity of Allis-Chalmers engineers. The company makes machinery for every operation in mining, from the hoist at the pit's mouth to devices for recovering the metals themselves by roasting, crushing, pulverizing, sifting and all the processes necessary to separate them from the mixtures in which nature stored them for man's benefit.

The Crushed Rock and Cement Industries.

The Gates rock and ore breakers made by this company are known all over the world. The latest of these is the new style "K" breaker. They are extensively employed in crushing rock for concrete work and ballasting railroad beds, and for public highways. Complete portable rock crushing plants built on railroad cars form one of the products of the company.

Cement is rapidly taking the place of masonry for structural work and its manufacture has increased with remarkable rapidity. This company has kept pace with the industry in the production of cement making machinery, and its work in this line ranks with its other machinery. Its machinery operates in the largest and best plants in the country. Among the machines used in this work are rock breakers, crushing rolls, ball mills, mixing pans, tube mills, rotary kilns and driers, revolving screens and elevators.

The Passing of Grandfather's Mill.

It was the Milwaukee company which, thirty years ago, revolutionized the flour mill industry by breaking away from the old system of grinding with burr stones and introducing the roller mill. The roller mill is used everywhere to-day. With the change in the initial machinery came opportunities for improvements all along the line. The Allis-Chalmers Company met these demands and has kept in the lead from the first. The largest flour mills in America, including the great group at Minneapolis, where more flour is produced than anywhere else on the globe, were equipped by the Allis-Chalmers Company and there is scarcely a country in the world where its mills have not been installed.

Pioneers in Equipping Lumber Mills.

The double cutting band mill, which has added more than 40 per cent to the capacity of the saw mills of America, was introduced by this concern. The company is to-day, as it has been for many years, the foremost builder of saw mill machinery. For more than a quarter of a century its products have been the standards with which all others have been compared. The principal saw mill plants in America and many in other parts of the world have been equipped from its works. One of these modern mills, containing six double cutting band mills and a complete outfit of accessory machinery, is capable of cutting 500,000 feet of lumber in a ten-hour day.

Timber Preserving.

The value of preservative treatment for timber which is to be exposed to the elements is well recognized. Railroad ties, poles for telephones, telegraph and trolley wires, and the timber used in piers, wharves and bulkheads are particularly subject to decay unless they are treated beforehand with creosote or other chemicals. The Allis-Chalmers Company builds all the larger kinds of apparatus for this work. Its product includes the retorts in which the timber is treated, cars and other necessary accessories.

The World for Its Field.

It must be admitted that nothing less than an engineering encyclopedia could adequately describe the variety and extent of the Allis-Chalmers products. In the economic life of the nation they play a large part, for upon the prosperity of the company depends the livelihood of many thousands of American employes and their families. Profoundly affected by it are yet more thousands whose labor supplies the domestic market.

But the scope of the company's operations is not limited by bounds of country. Its field is world wide. Its influence is felt by millions.

Canadian Representatives, Allis-Chalmers-Bullock, Ltd., Montreal

THE ELECTRIC STORAGE BATTERY CO.

PHILADELPHIA

MANUFACTURER OF THE

"Chloride Accumulator"

For Central Stations, Electric Railways, Isolated Lighting and Power Stations, Fire Alarm, Telegraph, Train Lighting, etc., etc.

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Iron Clad Service Switch

This device was designed for use in locations exposed to dampness, corrosive fumes, or mechanical injury.

The case is of cast-iron, having a closely fitting door with spring latch, which can be sealed or pad-locked.

In the box is mounted a 25-ampere combined switch and cut-out on a porcelain base. The three following styles are now furnished:

Cat. No.		Price
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1212	250-v. 2 "	3.75
1214	260-v. 3 "	4.50

Discount 50 per cent

Special prices in quantities

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$250

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Kearney Clamps

PATENTED OCT 10, 05

For Supporting Electric Light and Power Cables of From 3-0 to 1,500,000 C. M.

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If you will send in an order for 25 or more to be shipped by prepaid freight, you can take 30 days to decide whether you prefer to return the clamps or the money. You can't lose. Let us hear from you.

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig....18
Alton Machine Co....4
Allis-Chalmers Company....2
Amber Electric Co....12
American Battery Co....16
Amer. Circular Loom Co....1
American Conduit Co....16
American Diesel Engine Co.—
Amer. District Steam Co....14
Amer. Elect'l. Supply Co....—
Amer. El. Telephone Co....17
American Electrical Works..11
Arnold Co., The....14
Automatic Electric Co....16

Babcock & Wilcox Co....—
Badt, F. B....14
Bain, Forée & May....11
Baker & Co., Inc....3
Baker & Co., W. E....14
Beardslee Chandelier Mfg. Co.—
Belden Mfg. Co....—
Benjamin Elec. Mfg. Co....—
Benton & Son....4
Berthold & Jennings....18
Bissell Co., The F....9, 18
Bliss Electrical School....—
Bossert Electric Construction Co....14
Boston Incan. Lamp Co....—
Brooks, Hall L....18
Brown Specialty-Mchy. Co..11
Bruer, Will F....18
Buckeye Electric Co....—
Buckeye Engine Co....15
Burke, James V....—
Butterfield Construction Co.14
Byllesby & Co., H. M....14

Central Electr e Co....5
Century Electric Co....11
Chicago Edison Co....4, 12
Chic. Fuse Wire & Mfg. Co.—
Chicago Ins. Wire & Mfg. Co.17
Chicago Mica Co....10
Chicago Pneumatic Tool Co..11
Chicago Telephone Co....16
Columbia Incand. Lamp Co.—
Cope, T. J....1
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co....7
Crollius & Son, E. R....—
Crouse-Hinds Co....7
Cutler-Hammer Mfg. Co....9
Cutter Elec. & Mfg. Company 1

D. & W. Fuse Company....—
Davis Electric Mfg. Co....—
Dearborn Drug & Chem. Wks.15
Devine Co., Joseph P....15
Diamond Meter Company....14
Directory of Engineers....14
Dixon Crucible Co., Joseph..15
Doxsee-Barrere Elec. Co....12
Duncan Elec. Mfg. Co....21

Edison Decorative & Miniature Lamp Departm't....10
Edison Mfg. Company....10
Electric Appliance Co....10
Electric Storage Battery Co.. 3
Electrician Pub. Company...15

Faries Mfg. Co....—
"For Sale" Advertisements..12
Ft. Wayne Elec. Works, Inc..21
Fowler & Co., John H....18
French Battery Co....—

General Electric Co....9, 10
General Storage Battery Co..10
Gest, G. M....16
Gleason, John L....22
Gould Storage Battery Co.... 6
Gregory Electric Co....12

Haller Machine Co....—
Hart Mfg. Co....21
Hartford Steam Boiler Inspection & Insurance Co....—
Hazard Manufacturing Co....—
Hellos Mfg. Co....—
Hensel & Co., John A....5
Highland Park College....14
Hoffman, G. W....10
Hoffmann, Emil R....10
Holmes Fibre-Graph. Co....—
Holophane Glass Co....—
Humphrey, Henry H....14
Hunt & Co., Robt. W....14
Hydro-Elec. Development Co14

Illinois Central Ry....—
Indiana Rub. & Ins. W. Co....1
India Rubber & Gutta Percha Insulating Company....—
International Elec. Meter Co22
International Tel. Mfg. Co....17

Jackson, D. C. & W. B....14
Jeffrey Manufacturing Co....15

Kartavert Manufacturing Co.—
Kellogg Switchboard & Supply Company....17, 18
Klein & Sons, Mathias....16
Kohler Brothers....14
Kuhlman Electric Co....14

La Fayette Elect'l Mfg. Co...—
Leather Preserv. M. Corp....—
Leffel & Co., James....15
Loud's Sons Co., H. M....18
Ludlow Valve Co....15

Machado & Roller....10
Maine Hub Mfg. Co....18
Manhattan El. Supply Co... 22
Manross, F. N....11
Marion Ins. Wire & Rub. Co.—
Matthews & Bros., W. N...3, 11
McCandless, H. W. & Co....16
McLennan & Company, K....10
McRoy Clay Works....16
Mica Insulator Company....10
Michigan College of Mines..14
Miscellaneous Advs....12
Monarch Elec. Mfg. Co....7
Morse, Frank W....—
Mott Iron Wks., J. L....11
Mueller Company, William..18
Munsell & Co., Eugene....10

National Battery Co....5
National Brake & Elec. Co..13
National Carbon Co....7
National India Rubber Co.... 1
Nat'l. Stamp. & Elec. Wks. 5
New York Central Lines....—
New York Ins. Wire Co.... 1
Northern Elect'l Mfg. Co....12

Okonite Co., The....1
Oneida Community, Ltd....—
Osburn Flex. Conduit Co....16
Ostrander & Co., W. R....22
Otto Gas Engine Works....15

Pacific Coast Pole Co....18
Penn. R. R....19
Perrizo & Sons....18
Peru Elec. Mfg. Co....1
Phillips, Eugene F....11
Phillips Insulated Wire Co...11
Phoenix Glass Co....—
Phosphor-Bronze S. Co....15
Pignolet, L. M....10
Plume & Atwood Mfg. Co....—
Porter Cedar Company....18

Rail Joint Co., The....3
Reisinger, Hugo....7
Replogle Governor Works....—
Reynolds El. Flasher Mfg. Co. 1
Robbins & Myers Co....22
Robert Instrument Co., The..—
Robertson & Sons, Jas. L....—
Rock Island Battery Co....—
Roebling's Sons Co., J. A....21
Rose Polytechnic Institute..—
Rossiter, MacGovern & Co...12
Ruebel & Wells....14
Runzel-Lenz Elec Mfg. Co.—

Safety Ins. Wire & Cable Co..10
Samson Cordage Works....1
Sandwich Pole Changer Co....—
Sargent & Lundy....—
Schott, W. H....14
Schureman Co., J. L....3
Seymour Mfg. Co....15
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co....10
Smith Storage Battery Co....—
Sorensen, P....12
Speer Carbon Co....—
Spon & Chamberlain....—
St. Marys Incand. Lamp Co.. 8
Standard Elect'l. Mfg. Co....—
Standard Underg. Cable Co....—
Stanley—G. I. Elec. Mfg. Co.—
Star Expansion Bolt Co....14
Sterling & Son, W. C....18
Stewart Elec. Co., Frank H....—
Stow Mfg. Company....—
Stromberg-Carlson Tel. Mfg. Company....17
Sturgess Engineering Dept..15
Switchboard Equipment Co. 5

Torrey Cedar Company....18
Trumbull Elec. Mfg. Co....3
Turner Brass Works....10

Van Nostrand Co., D....—
Vulcanized Fibre Company..22

Wabash R. R....12
Wagner Electric Mfg. Co....22
Wesco Supply Co....10
Western Electric Company..22
Westinghouse Electric & Manufacturing Co....20
Westinghouse Machine Co....20
Weston Electrical Inst. Co.... 1
Willard Storage Bat. Co.... 5
Williamson & Co., R....11
Willis, G. M....14
Wilson, Co., Jas. I. M....18
Worcester Company, C. H....18
Wrigley Co., Thos....—

Yonkers Specialty Co.... 1

Zeller, Geo. A. Book Co.... 11

For Classified Index of Advertisements See Page 6.

Motors,
Switches,
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The WESTERN ELECTRICIAN of June 2, 9 and 16, 1906, will give much space to the National Electric Light Convention, which will be held at Atlantic City, N. J., June 5th to 8th.

The first or preliminary number will be dated June 2d, and will contain the full official program and all other obtainable advance information concerning the meeting and will be of the greatest value, therefore, to members attending the Convention and will be found in the hands of all delegates and visitors during convention week.

The issue of June 9th will contain a report of the proceedings of the early portion of the meeting, some of the papers read and other Convention news.

The issue of June 16th will contain the report of the final days of the Convention together with papers read, discussions, convention notes, etc.

These three numbers will be of great and permanent value, and manufacturers and dealers wishing to increase their business with the electric lighting industry are urged to be largely represented therein. We hope you will make your reservation for space NOW, so as to receive a choice location.

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse. Frank W.

Anchors, (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Anodes, Nickel and Copper
Seymour Mfg. Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Brake & Elec. Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Clusters.
Benjamin Elec. Mfg. Co.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Crolius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse-Hinds Co.
Electric Appliance Co.
Gest, G. M.
McRoy Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Maine Rub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Switchboard Equipment Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
Allis-Chalmers Company.
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Doxsee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Snow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Bylesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Brown Specialty Mchy. Co.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Nat'l Stamping & Elec. Wks.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Benton & Son.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Faries Mfg. Co.
McLeod, Ward & Co
Morse, Frank W.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg.Co.
Faries Mfg. Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Furnaces.
Burke, James V.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

German Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Faries Mfg. Co.
Haller Machine Co.
Holophane Glass Co.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Morse, Frank W.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
St. Marys Incand. Lamp Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W.

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Luemm's Climbers.
Klein & Sons, Mathias.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co, Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Brooks Hall L.
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Loud's Sons Co., H. M.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Perry Electric Mfg. Co.

Portables.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Bliss Electrical School.
Highland Park College.
Michigan College of Mines
Rose Polytechnic Institute.

Searchlights.
Benton & Son.

Second-Hand Machin'y.
Amber Electric Co.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.
Nat'l Stamping & Elec. Wks.
Rossiter, MacGovern & Co.

Signal Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Crolius & Son, E. R.
Western Electric Co.

Solenoids.
Schureman Co., J. L.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Springs.
Manross, F. N.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service.
Chicago Telephone Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Brake & Elec. Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 8.

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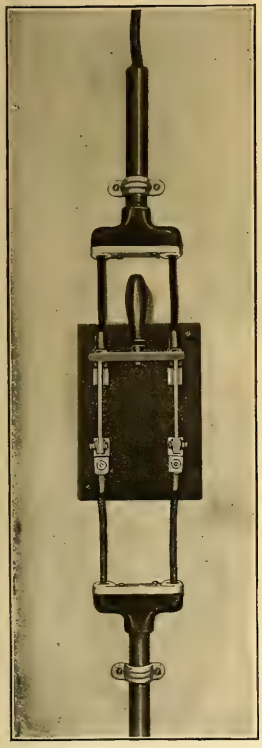

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C-W TRANSFORMERS

CHAPTER IV.

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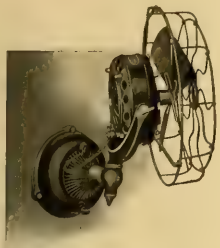

12-inch A. C. Wall Bracket Fan. 115 to 220 volts. Special windings to order.

The speed control of the fan is provided for by a switch on the base of all motors.

G. E. Bracket Fan Motors are convertible for use either on desk or wall.

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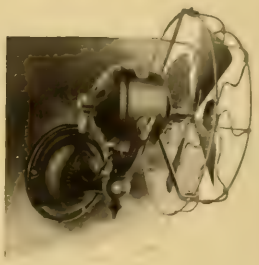

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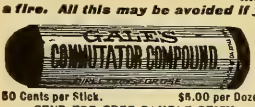

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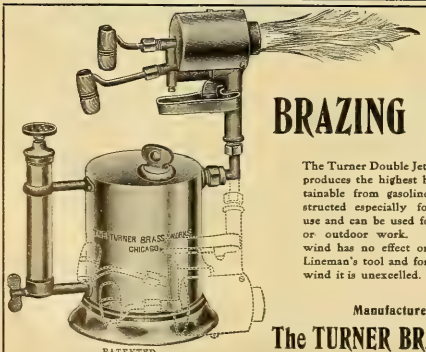

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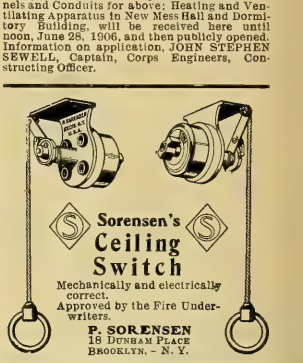

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ANNOUNCEMENT

MAY 1, 1906

The plant and other assets of the NATIONAL ELECTRIC COMPANY were this day formally transferred to the NATIONAL BRAKE & ELECTRIC COMPANY, a corporation of Wisconsin with a paid up capital of One Million Dollars.

The new Company as successor of the CHRISTENSEN ENGINEERING COMPANY and the NATIONAL ELECTRIC COMPANY will continue to manufacture air brakes and electrical machinery with extended facilities and abundant working capital. In soliciting a continuance of the patronage with which its predecessors in the business were favored, it takes pleasure in assuring prompt attention to orders, superior workmanship and reasonable prices.

As the pioneers in the manufacture of motor driven air compressors and in the adaption of air brakes for electric traction service, it proposes to maintain its leadership by the development of improved devices to meet the new conditions due to the more exacting demands of the present day trade.

To facilitate prompt attention to all inquiries referring to prices and sales of its product, the General Sales Office has been located at No. 519 First National Bank Building, Chicago, Ill., where all correspondence referring to same should be addressed.

Very truly yours,

National Brake & Electric Company

THE ARNOLD COMPANY
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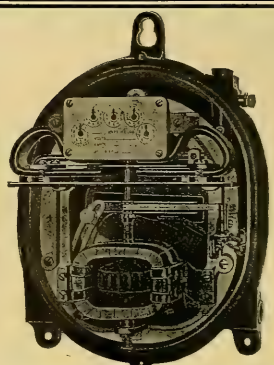
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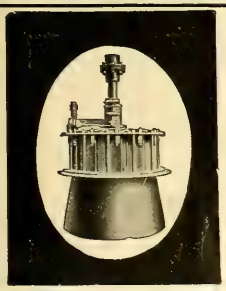

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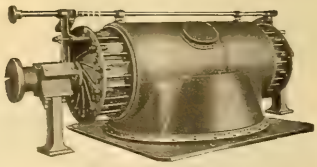

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Two-party line, 10 cents per day, including 1 call
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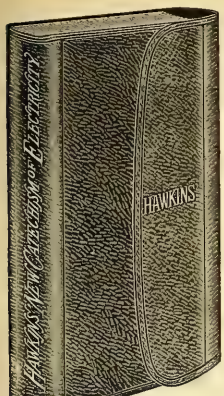

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The New Catechism of Electricity will be found to be surprisingly plain, and free from useless and ambiguous terms. The plan upon which it is arranged is unique.

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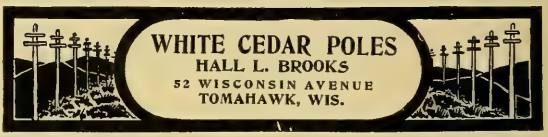

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TO THE

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ATLANTIC CITY, N. J.,

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For the exclusive use of delegates, supply men, their friends and ladies, via

Pennsylvania Short Lines.

This special train will leave Chicago 2 p. m. (Chicago time), Sunday, June 3rd, so as to reach Atlantic City in the middle of Monday afternoon. By this schedule the party from the West will reach Atlantic City in time perhaps for an ocean dip, or at any rate in ample time for supper and the evening's amusements.

It is proposed to make this train first class in every respect—in fact, equal to the "Pennsylvania Limited" in service, viz., it will be equipped with the same beautiful parlor smoker, dining car, sleepers and observation car. This N. E. L. A. train will be run east from Chicago over the Fort Wayne Route through Fort Wayne, Pittsburg, Harrisburg and Philadelphia, all rail to Atlantic City.

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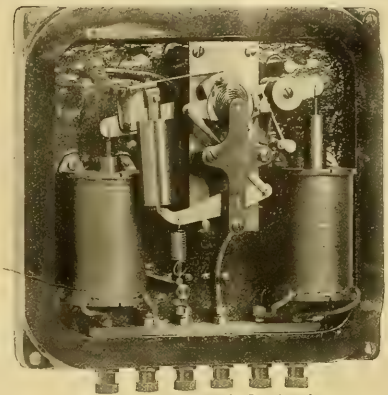
C. L. KIMBALL, Assistant General Passenger Agent,

ROOM 22, No. 2 SHERMAN ST., CHICAGO,

Who is handling all inquiries appertaining to reservations for Assistant Master of Transportation Frank L. Perry of the National Electric Light Association.



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Are Lamps Good Enough For You?

When we first brought out the "indicating synchroscopes" people said, "lamps are good enough for us," yet to-day our synchroscopes are in universal use.

Do not repeat the error, and say the "indicating synchroscope" is good enough. Be progressive.

Synchronize Automatically

and prevent accidents, save time and operating expenses

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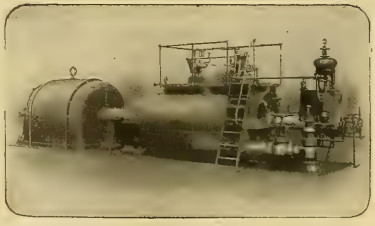

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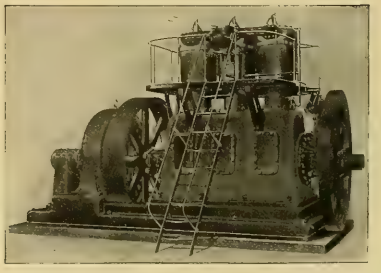

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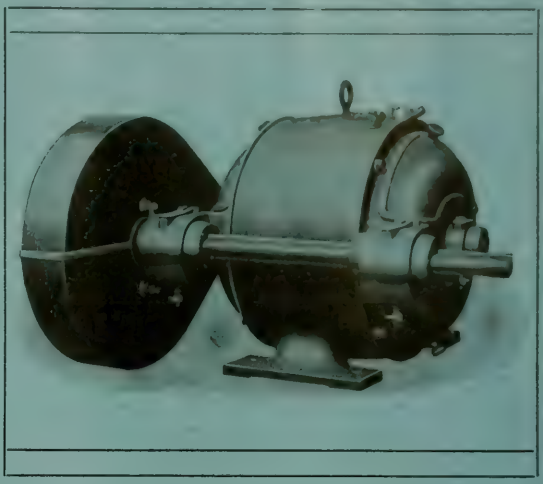

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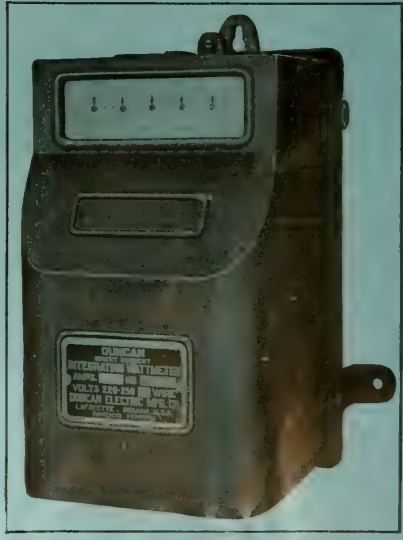

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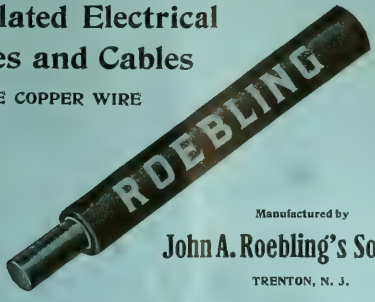

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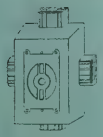
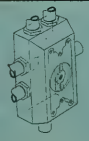
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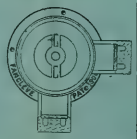
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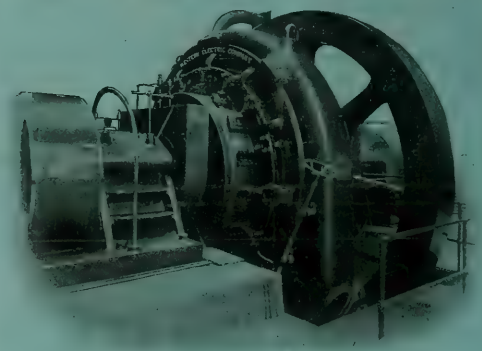
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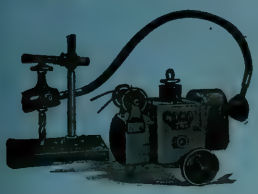

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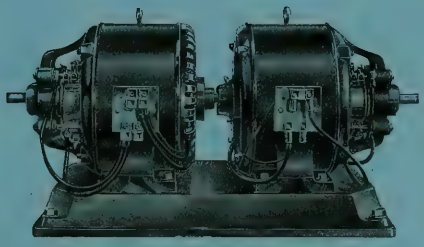

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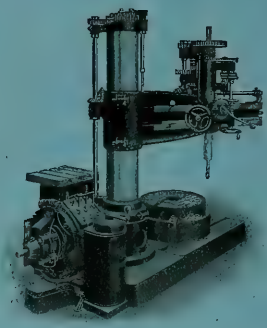

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Abeles & Taussig.....20
Aiton Machine Co.....4
Allis-Chalmers Company.....2
Amber Electric Co.....—
American Battery Co.....—
Amer. Circular Loom Co.....1
American Conduit Co.....18
American Diesel Engine Co.—
Amer. District Steam Co.....16
Amer. Elect'l. Supply Co.....—
Amer. El. Telephone Co.....19
American Electrical Works..13
Arnold Co., The.....16
Automatic Electric Co.....18

Babcock & Wilcox Co.....—
Badt, F. B.....16
Bain, Forée & May.....—
Baker & Co., Inc.....3
Baker & Co., W. E.....16
Beardslee Chandelier Mfg.Co.—
Belden Mfg. Co.....22
Benjamin Elec. Mfg. Co.....—
Benton & Son.....—
Berthold & Jennings.....20
Bissell Co., The F.....11, 20
Bliss Electrical School.....—
Bossert Electric Construction Co.....7
Brooks, Hall L.....20
Brown Specialty-Mchy. Co..7
Bruer, Will F.....20
Buckeye Electric Co.....—
Buckeye Engine Co.....17
Butterfield Construction Co.—
Byllesby & Co., H. M.....16

Central Electric Co.....5
Century Electric Co.....16
Chicago Edison Co.....4, 14
Chic. Fuse Wire & Mfg. Co...13
Chicago Ins. Wire & Mfg. Co.12
Chicago Mica Co.....12
Chicago Pneumatic Tool Co..21
Chicago Telephone Co.....18
Columbia Incand. Lamp Co.—
Cope, T. J.....18
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co.....5
Crollius & Son, E. R.....—
Crouse-Hinds Co.....24
Cutler-Hammer Mfg. Co.....11
Cutter Elec. & Mfg. Company—

D. & W. Fuse Company.....—
Davis Electric Mfg. Co.....—
Dearborn Drug & Chem. Wks.17
Devine Co., Joseph P.....16
Diamond Meter Company.....—
Directory of Engineers.....16
Dixon Crucible Co., Joseph..17
Doxsee-Barrere Elec. Co.....—
Duncan Elec. Mfg. Co.....23

Edison Decorative & Miniature Lamp Departm't..... 12
Edison Mfg. Company.....16
Electric Appliance Co.....12
Electric Storage Battery Co.. 3
Elect'l Trades Exposition Co. 8
Electrician Pub. Company...21

Faries Mfg. Co.....13
"For Sale" Advertisements..14
Ft. Wayne Elec. Works, Inc..23
Fowler & Co., John H.....20
French Battery Co..... .... —

General Electric Co.....11, 12
General Storage Battery Co..12
Gest, G. M.....18
Gleason, John L..... .....—
Gould Storage Battery Co....—
Gregory Electric Co.....14

Haller Machine Co.....7
Hart Mfg. Co..... ..23
Hartford Steam Boiler Inspection & Insurance Co....—
Hazard Manufacturing Co...24
Helios Mfg. Co.....24
Hensel & Co., John A.....—
Highland Park College. 16
Hoffman, G. W.....13
Hoffmann, Emil R.....—
Holmes Fibre-Graph. Co.....22
Humphrey, Henry H.....16
Hunt & Co., Robt. W.....16
Hydro Elec. Development Co16

Illinois Central Ry.....—
Indiana Rub. & Ins. W. Co.... 1
India Rubber & Gutta Percha Insulating Company..... 6
International Elec. Meter Co 5
International Tel. Mfg. Co...19

Jackson, D. C. & W. B.....16
Jeffrey Manufacturing Co....17

Kartavert Manufacturing Co.24
Kellogg Switchboard & Supply Company.....19, 20
Klein & Sons, Mathias.....18
Kohler Brothers.....16
Kuhlman Electric Co.... 1

La Fayette Elect'l Mfg. Co...12
Leather Preserv. M. Corp....14
Leffel & Co., James.....17
Loud's Sons Co., H. M.....20
Ludlow Valve Co.....—

Machado & Roller.....—
Maine Hub Mfg. Co.....—
Manhattan El. Supply Co....22
Manross, F. N.....—
Marion Ins. Wire & Rub. Co.13
Matthews & Bros., W. N...3, 13
McCandless, H. W. & Co.....18
McLennan & Company, K....12
McRoy Clay Works.....18
Mica Insulator Company.....12
Michigan College of Mines..—
Miscellaneous Advs.....14
Monarch Elec. Mfg. Co .....—
Morse, Frank W.....—
Mott Iron Wks., J. L.....16
Mueller Company, William..20
Munsell & Co., Eugene.....12

National Battery Co..... 4
National Brake & Elec. Co..15
National Carbon Co..... 4
National India Rubber Co....—
Nat'l. Stamp. & Elec. Wks 12
New York Ins. Wire Co.....16
Norfolk & Western R. R 20
North Electric Co..... 19
Northern Elect'l Mfg. Co.....14
Northern Pacific R. R.... 22

Okonite Co., The..... 1
Oneida Community, Ltd..... 1
Osburn Flex. Conduit Co.....18
Ostrander & Co., W. R 1
Otto Gas Engine Works.....—

Pacific Coast Pole Co.....20
Perrizo & Sons.....20
Peru Elec. Mfg. Co.....—
Phillips, Eugene F.....13
Phillips Insulated Wire Co...13
Phœnix Glass Co..... 1
Phosphor-Bronze S. Co.....17
Pignolet, L. M.....12
Plume & Atwood Mfg. Co.... 1
Porter Cedar Company.....20

Rail Joint Co., The..... 3
Reisinger, Hugo.....—
Replogle Governor Works...17
Reynolds El. Flasher Mfg. Co.14
Robbins & Myers Co..... 4
Robert Instrument Co., The..17
Robertson & Sons, Jas. L....—
Rock Island Battery Co 7
Roebling's Sons Co., J. A....24
Rose Polytechnic Institute..16
Rossiter, MacGovern & Co....14
Ruebel & Wells.....16
Runzel-Lenz Elec. Mfg. Co..19

Safety Ins. Wire & Cable Co.. 1
Samson Cordage Works..... 17
Sandwich Pole Changer Co...19
Sargent & Lundy.....—
Schott, W. H. 16
Schureman Co., J. L..... 3
Seymour Mfg. Co.....17
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co.....12
Smith Storage Battery Co.. . 4
Sorensen P.....—
Speer Carbon Co..... 4
Spon & Chamberlain.....17
St. Marys Incand. Lamp Co..10
Standard Elect'l. Mfg. Co...16
Standard Underg. Cable Co.. 1
Stanley—G. I. Elec. Mfg. Co. 7
Star Expansion Bolt Co.....22
Sterling & Son, W. C.....20
Stewart Elec. Co., Frank H...23
Stow Mfg. Company..... 1
Stromberg-Carlson Tel. Mfg. Company..... 19
Sturgess Engineering Dept. —
Switchboard Equipment Co 12

Torrey Cedar Company.....20
Trumbull Elec. Mfg. Co..... 3
Turner Brass Works..... —

Van Nostrand Co., D..... —
Vulcanized Fibre Company..24

Wabash R. R.....22
Wagner Electric Mfg. Co.....24
Wesco Supply Co.....—
Western Electric Company.. 9
Westinghouse Electric & Manufacturing Co.....22
Westinghouse Machine Co....—
Weston Electrical Inst. Co.... 1
Willard Storage Bat. Co.....—
Williamson & Co., R.....13
Willis, G. M.....16
Wilson Co., Jas. I. M.... 20
Worcester Company, C. H....20
Wrigley Co., Thos.....—

Yonkers Specialty Co..... 1

For Classified Index of Advertisements See Page 6.

Motors, Switches, Arc Lamps, Circuit Breakers, Etc., Etc.

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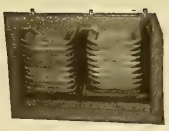

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Anchors, (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Anodes, Nickel and Copper
Seymour Mfg. Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Blow Torches.
Turner Brass Works

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Brake & Elec. Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Clusters.
Benjamin Elec. Mfg. Co.
Faries Mfg. Co
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Crollius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse-Hinds Co.
Electric Appliance Co.
Gest, G. M.
McRoy Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Maine Rub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Switchboard Equipment Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
Allis-Chalmers Company.
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Doxsee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Bylesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Brown Specialty Mchy. Co.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Nat'l Stamping & Elec. Wks.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Benton & Son.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Karlavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Faries Mfg. Co.
McLeod, Ward & Co
Morse, Frank W.

Fixtures, Gas and Elec.
Beardsley Chandelier Mfg.Co.
Faries Mfg. Co.
Williamson & Co., R

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

German Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Faries Mfg. Co.
Haller Machine Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Morse, Frank W.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Karlavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
St. Marys Incand. Lamp Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers.
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Brooks Rail L.
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Loud's Sons Co., H. M.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Peru Electric Mfg. Co.

Portables.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Bliss Electrical School.
Highland Park College.
Michigan College of Mines
Rose Polytechnic Institute.

Searchlights.
Benton & Son.

Second-Hand Machin'y.
Duncan Elec. Mfg. Co.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.
Nat'l Stamping & Elec. Wks.
Rossiter, MacGovern & Co.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Crollius & Son, E. R.
Western Electric Co.

Solenoids.
Schureman Co., J. L.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Springs.
Manross, F. N.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
North Electric Co.
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service.
Chicago Telephone Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Brake & Elec. Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Perchs Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 8.

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Reliable and inexpensive for auto-charging boards and small lighting plants.

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Drawn steel. One blow of a hammer gives clean round hole. No filing.
SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
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Our standard No. 8 is the best battery for higher class work. Standard No. 6 is the regular size for general purposes.

Department A will be glad to quote you prices.

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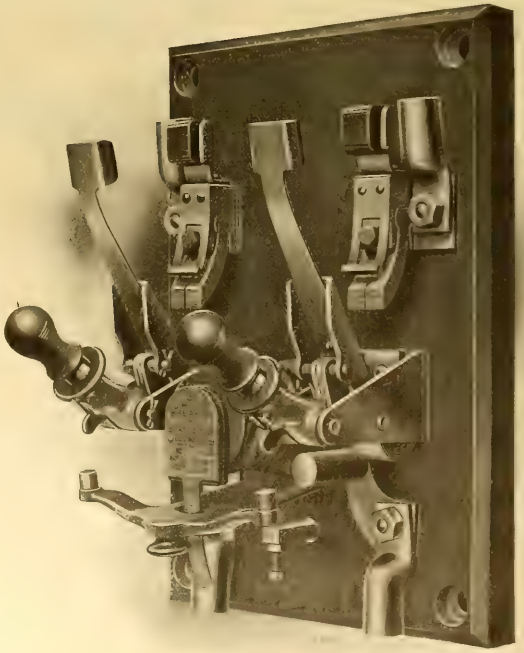
NINTH AND SYCAMORE STS., CINCINNATI, O.

Stanley-G. I. C-7 Circuit Breakers

effectively protect your motors and lines by automatically opening the circuit upon the occurrence of an overload. While the initial cost of a switch with fuses is somewhat less than the cost of a Circuit Breaker, the fuses must be replaced as often as they are blown. All that is necessary with a circuit breaker is to close the circuit by a pull on the handle.



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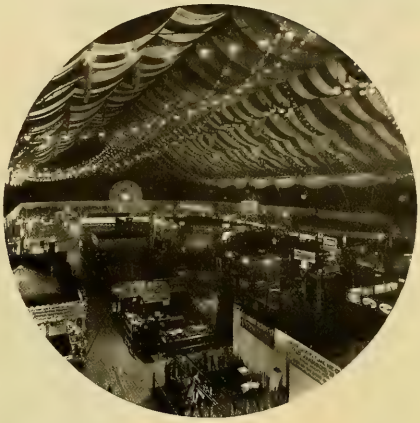
Second Annual Electrical Show

COLISEUM, CHICAGO, JANUARY 14-26, 1907



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Many manufacturers and dealers have already contracted for space. The exhibits in every line will be extensive and comprehensive. Apply for space now in order to secure best location.

ADDRESS

ELECTRICAL TRADES EXPOSITION COMPANY

HOMER E. NIESZ, Managing Director

139 Adams Street - - CHICAGO, ILL.

Electric Light Convention Numbers

The WESTERN ELECTRICIAN of June 2, 9 and 16, 1906, will give much space to the National Electric Light Convention, which will be held at Atlantic City, N. J., June 5th to 8th.

The first or preliminary number will be dated June 2d, and will contain the full official program and all other obtainable advance information concerning the meeting and will be of the greatest value, therefore, to members attending the Convention and will be found in the hands of all delegates and visitors during convention week.

The issue of June 9th will contain a report of the proceedings of the early portion of the meeting, some of the papers read and other Convention news.

The issue of June 16th will contain the report of the final days of the Convention together with papers read, discussions, convention notes, etc.

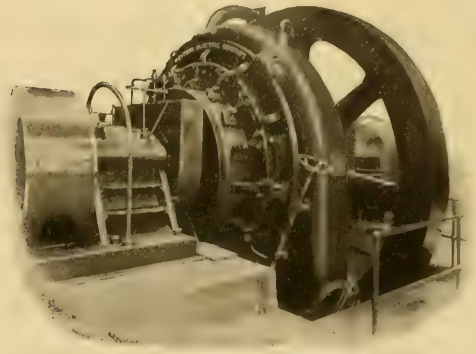
These three numbers will be of great and permanent value, and manufacturers and dealers wishing to increase their business with the electric lighting industry are urged to be largely represented therein. We hope you will make your reservation for space NOW, so as to receive a choice location.

WESTERN ELECTRICIAN

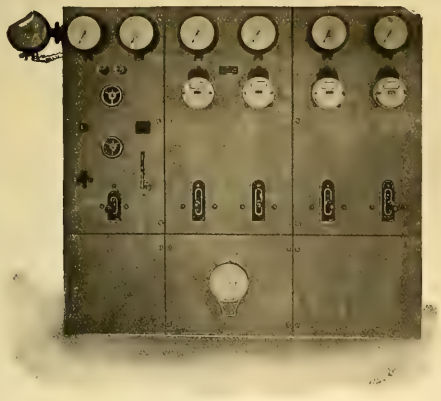
EASTERN OFFICE:
150 Nassau St., NEW YORK

507 Marquette Building, CHICAGO

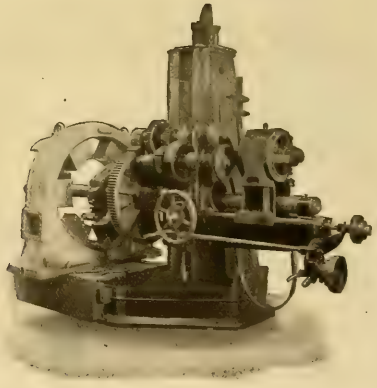
Complete Installations For Power and Lighting



Generators of any capacity



Switchboards of the latest designs



Motors for any service

Western Electric Co.

Chicago New York St. Paul Philadelphia
Saint Louis San Francisco Cincinnati
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FIGHTING THE LAMP TRUST!

CREATING A

"WIDE-OPEN" MARKET

THESE "MEETINGS" OF THE SO CALLED "LAMP TRUST" — 26 TO 30 OR SO COMPANIES TOGETHER — THE "HEADMEN" — ON A JUNKET — WHEREBY THE ORGANIZATION IS KEPT TOGETHER BY "JOLLYING" AND THE WEAVING OF VAST QUANTITIES OF "RED TAPE" ("THE TAPE THAT BINDS" — THEM AND YOU!) THESE REGULAR JUNKETS COST BIG MONEY — WHO REALLY "PAYS THE FREIGHT"?

YOU!

(AT 16¢ AND 18¢ "PER"!)

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WM M. ROTHSCHILD, PRES.

ST. MARYS, PA

LET US QUOTE YOU!

PS 6000 LAMPS DAILY CAPACITY — WE PROTECT BUYERS AGAINST LITIGATION

PENNA. CORPORATION — CAP. STOCK $100,000

General Electric Company

Electric Chafing Dishes

For Dainty Lunches

Safe—No flame for the wind to blow out. No danger from explosion.

Clean—No coal, gas or alcohol to cause smoke.

Convenient—Very simple to operate. No attention is required after turning on current. Connection can be made from an ordinary lamp socket.

Efficient—Heat is evenly distributed. Cost of operation lower than for any other.

Chafing Dish.
Outside made of aluminum and the inside of plated copper.

The Two-Heat Control

possible in this chafing dish is a guarantee of success with receipts requiring nice discrimination in the cooking.

Central stations operating or about to organize a heating department will profit by disposing of a stock of these.

973

Chicago Office:
Monadnock Bldg.

Principal Office, Schenectady, N. Y.

SALES OFFICES IN ALL LARGE CITIES

The "Carpenter" Type Printing Press Controller

Some of the largest printers in the country won't have any other controller for their motor driven flat bed presses but the "Carpenter." The reason is that it safeguards both the motor and press as far as is possible from damage, and gives every required speed in a natural and easy manner.

Our Bulletins 81 to 89½ give full information on this type.

THE

Cutler-Hammer Mfg. Co.

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Security, Convenience, Safety and Economy

SECURITY POLE SEATS are cheap notwithstanding the special machinery used in their construction or the quality of material.

Made of angle iron—bent corners.

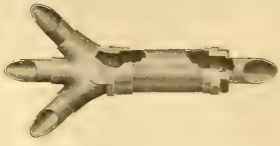
Iron cross bars machine riveted.

No rough edges to tear hands or clothing.

Weighs only 28 pounds and will carry a ton.

You will be pleased upon investigation.

Novelty Pot Heads and Sleeves



Made of selected brass.

No expert plumber needed to fit head or sleeve.

Always ready for inspection or removal.

Waterproof after inspection same as before.

Samples sent on trial.

Complete information and blanks for ordering upon request.

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THE F. BISSELL COMPANY · TOLEDO, O.

Sangamo D. C. Wattmeters

The ratio of Driving Torque to weight is several times greater than in any other D. C. Meter on the market.
Think what that means in revenue and decreased frictional losses!
Operate correctly under the most trying conditions.
Try them and you will be convinced.
For particulars and prices write us.

ELECTRIC APPLIANCE COMPANY
Electrical Supplies

CHICAGO SAN FRANCISCO DALLAS NEW ORLEANS

PUT

EDISON LAMPS

IN YOUR SOCKETS

And secure the maximum of Good Lighting Service.

Miniature Lamps. Street Series Lamps.
Regular Multiple Lamps.

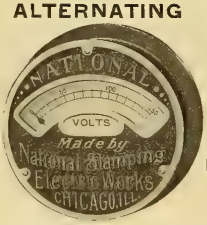
GENERAL ELECTRIC COMPANY
MAIN LAMP SALES OFFICE
Harrison, N. J.

(508)

HORNBERGER TRANSFORMERS

LAFAYETTE ELECTRICAL MFG. CO.
LAFAYETTE, IND.

MAGNETIC VANE
ALTERNATING AND DIRECT CURRENT



VOLT AND AMPERE METERS
NEAT IN DESIGN
DURABLE AND RELIABLE

The case is of the round metal pattern, baked enamel finish with nickel plated embossed front, black background. They are guaranteed to be AS GOOD AS ANY and CHEAPER THAN ALL OTHERS. Write for circular with full description and net prices.

NATIONAL STAMPING & ELECTRIC WORKS,
54-62 S. Clinton St., CHICAGO, ILL.

We carry in stock a full line of Alternators, Motor Generators and supplies, both new and secondhand

MICA INSULATION

Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
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MICABOND

will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.

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Electric Heating Apparatus
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MEASURING RESISTANCE

is easy with our special volt-ammeters. Take two readings. Divide one by the other and subtract the resistance of the instrument. That's all.
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"High-Duty" Storage Batteries

Send Your Plans and Specifications

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Cale's Commutator Compound.
The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
Sole Manufacturers,
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CIRCUIT BREAKERS

ALL STANDARD TYPES AND BUILT TO SPECIAL DESIGNS

The Switchboard Equipment Company
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CLEVELAND: Crosby, Craft & Co. CHICAGO: Francis Raymond

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Chicago Insulated Wire & Mfg Co.

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AMERICAN ELECTRICAL WORKS,

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BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
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MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 18 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

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TELEGRAPH, SIGNAL, MINING, MARINE AND SUBMARINE WIRES & CABLES

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SHOWING THE DETAIL of the NEW TYPE B ANCHOR AND WRENCH.

The upper part shows the new malleable eye.
The middle shows the square wrench and sliding handles locked to the anchor by the eye.
The lower part shows the square malleable key and the square shank of the anchor.

THE RODS OF
Stombaugh Guy Anchors

Are not weakened by welds or holes for pins and rivets

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STOMBAUGH GUY ANCHORS SCREW INTO THE GROUND

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An anchor is as strong as its weakest part
Stombaugh Guy Anchors have no weak parts

W. N. MATTHEWS & BRO.
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203 North 2d Street - ST. LOUIS
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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.
Office and Factory: PAWTUCKET, R. I.

THE NAME
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stands for the very best obtainable in the adjustable fixture line.
Proven by years of satisfactory service and constantly increasing sales.

CONSULT OUR CATALOGUE

FARIES MFG. CO.
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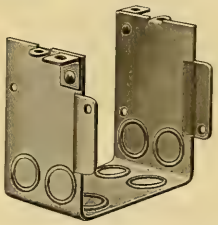

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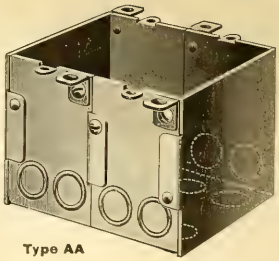
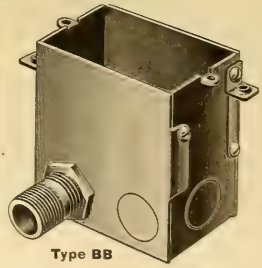


Type AA



Type BB

For New and Old Work

UNION OUTLET
COMBINATION SWITCH BOX
PATENTS PENDING

Approved by the Underwriters National Electrical Association.
Takes all Standard Switches and Receptacles.

Designed so that a **two-gang** box can be converted into any number of gangs by releasing the clamping screws and inserting "Spacers." These gangs are easily assembled with the aid of a screw-driver, and fit together snugly, making a perfect and solid gang box for any required number of switches.

CHICAGO FUSE WIRE & MFG. CO.
203 Fulton Street, NEW YORK
70 S. Clinton Street, CHICAGO Mutual Life Bldg. BUFFALO

N. E. L. A.
Convention
Numbers.

WESTERN ELECTRICIAN

June 2, 9, 16, 1906.

Reserve space

NOW

for your advertising announcement in these important issues and obtain a choice location.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

By an all around electrician in most all kinds of electrical work, such as construction, wiring, installing of dynamos, motors and plants and maintenance. 18 years' experience, practical and technical; 9 years in stationary engineering. Up-to-date in most all kinds of work. Steady place wanted. Address, with particulars, Box 602, care Western Electrician, 507 Marquette Bldg., Chicago.

POSITION WANTED

As engineer and electrician in an electric light plant. Nine years' experience with high and low speed engines, dynamos, motors, wiring, line work, arc lamp repairing, boilers, pumps and almost anything connected with a plant. Am 25 years of age, have best of references and can come on 10 days' notice. Am at present in charge of a light, heat and power plant. Address Box 604, care of Western Electrician, 507 Marquette Building, Chicago.

POSITION WANTED

By a young man, age 29, student of an electrical correspondence school, desires a situation with electrician, or electric construction, repairing or telephone company, or any branch of the electrical business where good chance is offered. State particulars and wages to begin with. S. P. DAUGHERTY, Edwardsburg, Mich.

WANTED

Incandescent Lamp Salesman. State age, experience, qualification, territory familiar with and salary expected. Address Box 599, care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

A technical graduate who has had practical experience in designing switchboards, as switchboard engineer; also, switchboard designers. Address Engineering Department, Stanley-G. I. ELECTRIC MFG. COMPANY, Pittsfield, Mass.

WANTED

Several young men to plan telephone toll line and cable construction. Preference will be given to men with good electrical educations. The work is located in western part of Pennsylvania. Necessary expenses paid when out of town. No applications considered unless age and salary expected are stated. Address Box 603, care of Western Electrician, 507 Marquette Bldg., Chicago.

WANTED

Assistant foreman of repair shop. Must be able to locate troubles on motors and generators, and direct the rewinding of same. Chance of advancement. Write, giving experience in full. Address Box 606, care of Western Electrician, 507 Marquette Building, Chicago.

WANTED

A man to take charge of armature room, electrical repair shop. Must understand alternating and direct current. First-class references are required. Address Box 605, care of Western Electrician, 507 Marquette Building, Chicago.

"Attention—Central Station Managers"

The Flint Light & Power Co., Flint, Mich., has, because of change in phase and frequency, for sale at bargain prices a large amount of second-hand equipment, generators, shafting, belting, etc. Write for list.

FOR SALE
Bargains in Alternators!

1 35 K. W. 125 Cycle S. P. Westinghouse.
1 35½ K. W. 125 Cycle S. P. T.-H.

Each equipped with switchboard instruments, with or without exciter. We guarantee these machines to be in good operating condition. Reason for selling—machines are too small for our service. Dept. of Fires and Lights, Iowa State College, Ames, Iowa.

Don't Stop! Keep On! Read! Improve!
ELECTRICIAN PUBLISHING CO.
507 MARQUETTE BLDG.
Publishers and dealers of electrical books

ROSSITER, MacGOVERN & CO.
(Incorporated)

OFFER

Direct-Connected A. C. Units.

1,500-KW. Westinghouse, 25-cycle, 3-phase, 15,000 volts, 80 RPM, direct-connected to Hamilton-Corliss horizontal cross-compound engine, 30 and 60 by 60 inches.
400-KW. Westinghouse, 1,150 volts, 2-phase, speed 150 RPM, 60-cycle, direct-connected to Williams vertical non-condensing engine, 15 by 25.
75-KW. Westinghouse, 60-cycle, single-phase, 440 volts, 260 RPM, direct-connected to Fischer 125-HP. engine.

Belted A. C. Generators, 60 Cycle, 3 Phase.

700-KW. Westinghouse, 7,200 volts, 220-440-volt, MF, 18-700-460.
150-KW. G. E., 2,300 volts, type AT, class 12-150-600.
75-KW. Westinghouse, 220-440 volt, 720 RPM.

Belted A. C. Generators, 60 Cycle, 2 Phase.

2—250-KW. Westinghouse, 2,200 volts, class 16-250-450.
120-KW. Westinghouse, 2,200 volts, class 10-120-720.
2—60-KW. Westinghouse, 1,100 volts, class 8-60-900.

Belted A. C. Generators, 60 Cycle, Single Phase.

200-KW. G. E., 2,300 volts, type AM, class 6-200-450.
100-KW., 1,050 volts, type AM, class 8-100-900.
2 -75-KW. Westinghouse, 2,200 volts, class 10-75-900.
60-KW. Westinghouse, 1,100 volts, type AM, class 8-60-900.
50-KW. G. E., 2,300 volts, type AM, class 8-50-900.
45-KW. Westinghouse, 1,150 volts, class 3-45-900.

Belted A. C. Generators, 125-133 Cycle, Single Phase.

300-KW. Westinghouse, 1,100-2,300 volts.
180-KW. G. E., 1,150 volts, type AS, 750 RPM.
2 120-KW. G. E., 2,300 volts, type AS, 14-110-1,070.
60-KW. G. E., 1,040-1,150 volts, type A, class 10-80-1,500.

A. C. Motors, 25 Cycle, 3 Phase.

200-HP. Westinghouse, 200 volts, type C, 575 RPM.
2—150-HP. Westinghouse, 200 volts, type C, 575 RPM.
100-HP. G. E., 2,200 volts, class 6-100-500, Form L.
50-HP. Westinghouse, 220-440 volts, 480 RPM.
20-HP. Westinghouse, 220-440 volts, type C, 720 RPM.
3—5-HP. G. E., 220-440 volt, type I, 750 RPM.

A. C. Motors, 25 Cycle, 2 Phase.

2—200-HP. Westinghouse, 400 volts, type C, 480 RPM.
75-HP. Westinghouse, 400 volts, 480 RPM.
2—30-HP. Westinghouse, 400 volts, 720 RPM.
6—1-HP. Westinghouse, 110 volts, type C, 1,700 RPM.

A. C. Motors, 60 Cycle, 3 Phase.

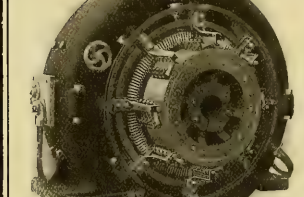
150-HP. G. E., 550 volts, type I, class 8-150-900.
75-HP. G. E., 2,080 volts, type I, class 12-75-600.
50-HP. G. E., 2,080 volts, class 10-50-720.
30-HP. G. E., type I, class 8-30-900.

A. C. Motors, 60 Cycle, 2 Phase.

300-HP. Westinghouse, 400 volts, type C, 490 RPM.
150-HP. Westinghouse, 200 volts, type C, 580 RPM.
50-HP. Westinghouse, 400 volts, type C, 850 RPM.
30-HP. Westinghouse, 400 volts, type C, 850 RPM.
15-HP. Stanley, 500 volts, 1,152 RPM.
5-HP. G E., 200 volts, type C, 1,200 RPM.

This is only a PARTIAL LIST. We have the standard sizes of nearly all the larger manufacturing companies. Send us your specifications.

84 State St. BOSTON, MASS. **17 Battery Place, NEW YORK** **709 Pine St. ST. LOUIS, MO.**



NORTHERN RINGTYPE ENGINE TYPE GENERATOR

NORTHERN EQUIPMENTS FOR INDUSTRIAL PLANT WORK

Note description of Electrical Equipments in plant of North American Cold Storage Co., Chicago, on page 413.

Northern Equipments save power and labor.

Get Leaflet No. 25115.

Northern Electrical Mfg. Co.
ENGINEERS MANUFACTURERS
MADISON, WIS., U.S.A.

425 Monadnock Block, Chicago, Ill.; 67 Blake Block, San Francisco, Cal. (temporary office); 21 East 8th St., St. Paul, Minn.; 29 Broadway, New York; 1239 Wells Bldg., Milwaukee, Wis.; 301 Land Title Bldg., Philadelphia, Pa.; 209 Equitable Bldg., Boston, Mass.

707

ELECTRICITY MADE SIMPLE.

233 Pages. 108 Illustrations. **By CLARK CARYL HASKINS.** **Paper .50.**

A BOOK DEVOID OF TECHNICALITIES—SIMPLE, PLAIN AND UNDERSTANDABLE.

There are many elementary books about electricity upon the market, but this is the first one presenting the matter in such shape that the layman may understand it, and, at the same time, not written in a childish manner.

This little work is not intended for the instruction of experts, nor as a guide for professors. The author has endeavored to bring the matter down to the level of those whose opportunities for gaining information on the branches treated have been limited.

Four chapters are devoted to Static Electricity; three each to Chemical Batteries and Light and Power; two each to Terrestrial Magnetism and Electro-Magnetism; one each to Atmospheric Electricity; Lightning Rods; Electro-Chemistry; Applied Electro-Magnetism; Force, Work and Energy; Practical Application of Ohm's Law; also a chapter upon Methods of Developing Electricity, other than Chemical.

The large number of examples that are given to illustrate the practical application of elementary principles is gaining for it a reputation as a text-book for schools and colleges.

FOR ENGINEERS, DYNAMO MEN, FIREMEN, LINEMEN, WIREMEN AND LEARNERS. FOR STUDY OR REFERENCE.

ELECTRICIAN PUBLISHING CO., 507 MARQUETTE BLDG., CHICAGO.

New and 2nd Hand LEATHER BELTS

WE CLEAN, REPAIR AND RENEW OLD BELTS.

LEATHER PRESERVER MFG. CORP.
27 W. MONROE ST., CHICAGO

Guaranteed bargains in second-hand dynamos and motors. Send for "Monthly Bargain Sheet," showing complete stock of machines in stock with net prices. **GREGORY ELECTRIC CO., Offices and Works, 16th & Lincoln Sts., Chicago.**

OFFICE OF CONSTRUCTING OFFICER U. S. SOLDIERS HOME, Washington, D. C., May 10, 1906. Sealed proposals for erection of Power House, installation of Boiler Plant, Generating Machinery, Main Switchboard, Steam Laundry Equipment, Refrigeration Plant and Power House piping; also for Tunnels and Conduits for hot water distribution from Central Station, also for steam, refrigeration and electricity; construction of Pipes and Mains in Tunnels and Conduits for above; Heating and Ventilating Apparatus in New Mess Hall and Dormitory Building, will be received here until noon, June 28, 1906, and then publicly opened. Information on application. JOHN STEPHEN SEWELL, Captain, Corps Engineers, Constructing Officer.

PROPOSALS FOR EQUIPMENT FOR ELECTRIC LIGHT PLANT, Line Material, Boiler Plate, Wire Rope, Horseshoes and Nails, Lead Pipe, Metals, Disinfecting Materials, Charcoal, Hospital Furnishings, Shoes, Rubber Boots, and General Miscellaneous Supplies. Office Isthmian Canal Commission, Washington, D. C., May 19, 1906. Sealed proposals, in triplicate, will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10:30 a. m., June 8, 1906, at which time they will be opened in public, for furnishing the above-mentioned articles. Blanks and full information (Circular No. 310) may be obtained from this office or the offices of the Assistant Purchasing Agents, 24 State Street, New York City; Custom House, New Orleans, La.; 36 New Montgomery Street, San Francisco, Cal.; and 410 Chamber of Commerce Building, Tacoma, Wash.; also from Chief Quartermaster, Department of the Lakes, Chicago; Depot Quartermaster, St. Louis; Depot Quartermaster, Jeffersonville, Ind.; Chief Quartermaster, Department of the Gulf, Atlanta, Ga.; and the Commercial Club, Mobile, Ala.—D. W. ROSS, General Purchasing Officer.

RECO FLASHERS

Are easy to sell. You make a fine profit. Everybody with an electric sign wants one. Write us today for particulars and prices. Also pointers on electric signs.

Reynolds Electric Flasher Mfg. Co.
221 Fifth Ave., CHICAGO

FOR SALE

Switchboard and apparatus outgrown and displaced by automatic equipment.

Kellogg switchboard—twenty 8-panel, 3-position, mahogany, equipped for 5200 main lines, ultimate capacity, 6,000 lines.

Kellogg toll board of 9 positions.

Kellogg telephones—4064 wall and 2136 desk.

Sterling terminal rack, with protection.

Power plant, with charging and ringing machines and storage batteries.

Offered for sale in whole or in part.

For particulars, see description in WESTERN ELECTRICIAN of January 20, Electrical Review of January 27, Telephony and Sound Waves for February; or address

The Columbus Citizens' Telephone Company
COLUMBUS, OHIO

The more a man advertises, the greater his business. The greater his business, the more he advertises.

CHICAGO EDISON COMPANY REPAIR SHOPS

76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280

FIRST CLASS EQUIPMENT THROUGHOUT

High-Grade Machine Work of All Kinds Correspondence Solicited.

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

ANNOUNCEMENT

MAY 1, 1906

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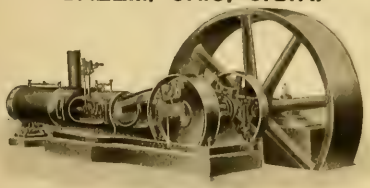

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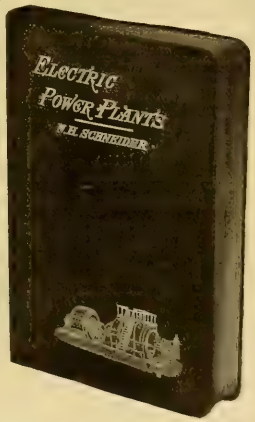

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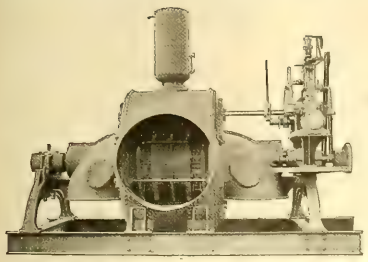

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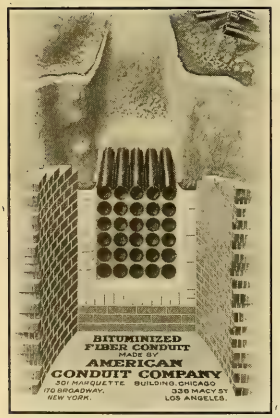

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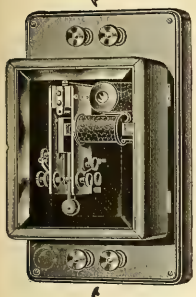

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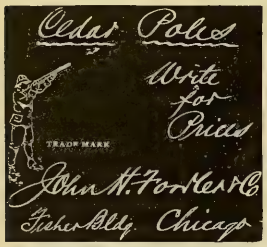

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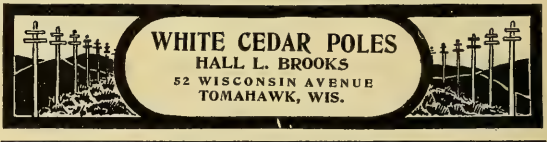

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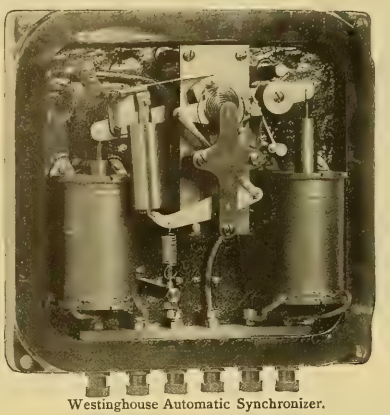

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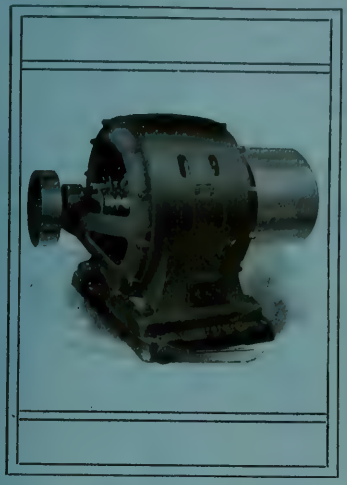

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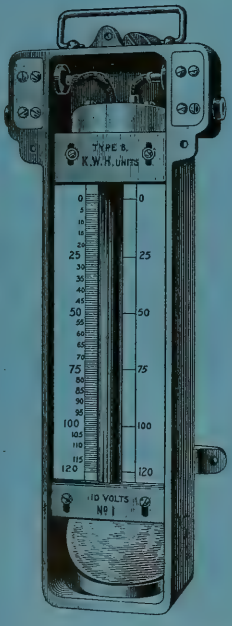

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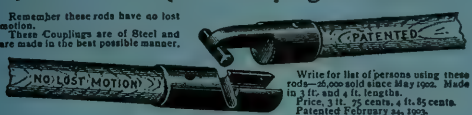

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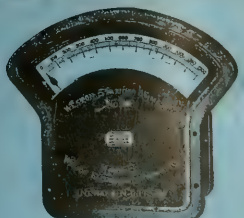
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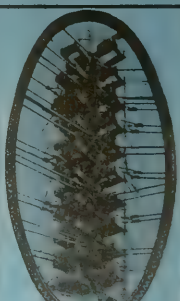
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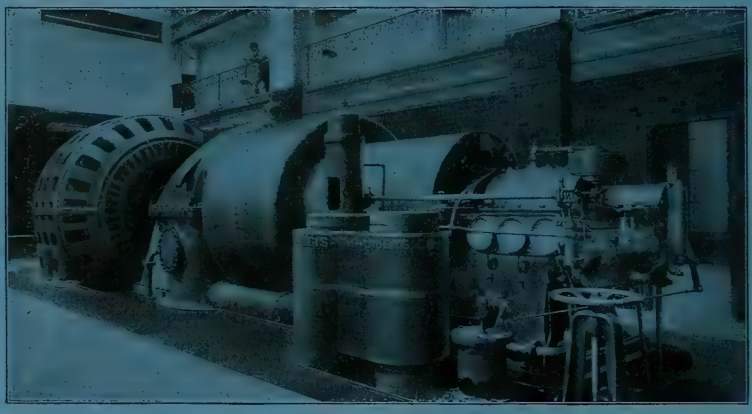
(SHOWN BELOW)

Installed in the Williamsburg Station of the Brooklyn Rapid Transit Co.

Note the Partial Description Given Below and Then Read the More Complete Accounts Given in the "Western Electrician"



The Starting of a Large Steam Turbine Generating Unit—A Notable Record.

A large steam turbo-alternator built by the Allis-Chalmers Company has recently been started successfully under peculiar circumstances. The turbine and its direct-connected alternator were ready for operation on February 1st, but the boilers, condensing apparatus, piping, etc., were not completed until late in March.

Sudden Call for Current in Consequence of Mishap at Another Power House of the Company.

While lying idle for nearly two months in an uncompleted station, the insulation of the generator windings naturally became damp, and, therefore, as soon as steam was available for running the turbine, it was started up at part speed to dry out the generator. This drying-out process was going on when, on the morning of March 27th, a mishap at another power house left the railway company short of power. The urgency of the situation was explained to the Allis-Chalmers representatives at about 10 o'clock, and they were asked whether they could help out with the afternoon load, and it was decided to put the turbine into regular operation, notwithstanding the fact that it had never been under load, nor had it even been up to speed except when running unloaded at the West Allis shops.

Hurried Preparations for Starting the Allis-Chalmers Turbine.

Additional boilers were therefore fired up and other hurried preparations made for starting. The turbine continued to run slowly until 12 o'clock to dry out the generator. It was then shut down and the engineers proceeded with progressive tests of the insulation, testing up to such a point as they considered safe for the radiated voltage of 6,600, but not considering it wise to risk too high a test in view of the damp state of the generator.

How It Responded.

The insulation tests were completed at 1:56 p. m., and the turbine was again started up and run up to the full speed of 750 revolutions per minute for the first time since installation at the power house. At 2:20 p. m. the engineers, after carefully assuring themselves that everything was working well, reported that they were ready, and an increasing load was immediately put on, until at 3:05 the turbine was carrying a little over 3,000 kilowatts, which was all that the railway company needed at that time.

Heavy Overloads Carried.

As more load was called for it was put on, and at 3:45 p. m. the unit was carrying over 4,000 kilowatts. On the following day the load ran up to over 5,000 kilowatts, and on the succeeding day it reached 7,000 kilowatts, the turbine taking heavy loads during the morning and afternoon peaks and running until late each night.

Performance of the Generator.

Not only has the steam end of this outfit realized all the expectations of the builders, but the generator has been equally successful, carrying large overloads each day with ease.

On April 9th from five to six p. m. the load averaged about 6,000 kilowatts, and from six to seven p. m. 6,600 kilowatts, while from six to 6:30 p. m. it averaged nearly 7,700 kilowatts, with swings up to 9,300 kilowatts. On April 21st for 1½ hours the load averaged over 8,000 kilowatts, following a run at rated load, with a temperature rise of only 22° C. On April 19th a load averaging 7,500 kilowatts was carried from 5:40 to 6:40 p. m. with swings up to 9,800. One swing of 9,000 kilowatts was carried for 45 seconds and one of 9,800 kilowatts for 15 seconds, this being 78 per cent. over rated load. The highest temperature rise so far met with during any run, notwithstanding heavy overloads, is 25.5° C.

Perfect Balance of the Rotating Parts.

Points about the operation of this turbine which have attracted considerable attention are the perfect balance of the rotating parts, both of turbine and generator, resulting in a minimum of vibration, quiet operation of the generator and the remarkable coolness of the bearings.

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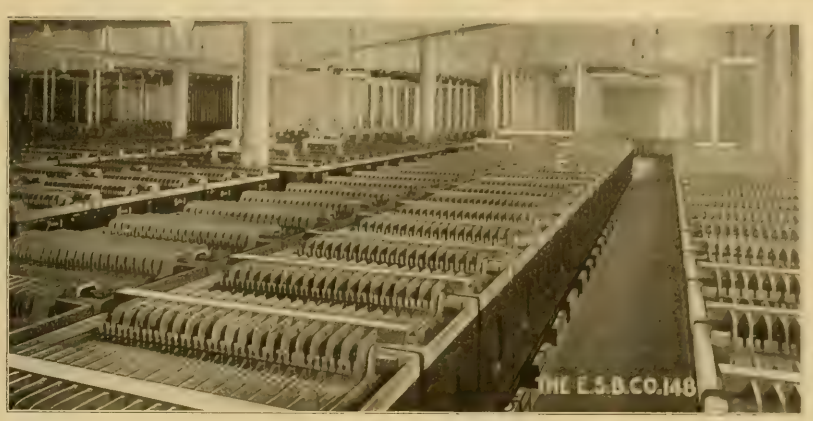

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig.....54
Alton Machine Co.....4
Allis-Chalmers Company.....2
Amber Electric Co.....—
American Battery Co.....52
Amer. Circular Loom Co...1, 34
American Conduit Co.....52
American Diesel Engine Co.51
Amer. District Steam Co.....9
Amer. Elect'l. Supply Co.....47
Amer. El. Telephone Co.....53
American Electrical Works..31
American Silk Mfg. Co.....22
Arnold Co., The.....50
Automatic Electric Co.....52

Babcock & Wilcox Co.....50
Badt, F. B.....50
Bain, Forée & May.....34
Baker & Co., Inc.....3
Baker & Co., W. E.....50
Banner Electric Co.....37
Beardslee Chandelier Mfg.Co.—
Belden Mfg. Co.....—
Benjamin Elec. Mfg. Co.....—
Benton & Son.....50
Berthold & Jennings.....54
Bissell Co., The F.....19, 54
Blakely Printing Co.....56
Bliss Electrical School.....50
Bossert Electric Construction Co.....27
Brown Specialty-Mchy. Co.. 6
Bruer, Will F.....54
Buckeye Electric Co.....41
Buckeye Engine Co.....51
Butterfield Construction Co.50
Byllesby & Co., H. M.....50

Central Electric Co.....5
Century Electric Co.....4
Chicago Edison Co.....4, 18, 32
Chic. Fuse Wire & Mfg. Co...19
Chicago Ins. Wire & Mfg. Co.30
Chicago Mica Co.....30
Chicago Pneumatic Tool Co..8
Chicago Telephone Co.....52
Colonial Electric Co.....40
Columbia Incand. Lamp Co..35
Cope, T. J.....1
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co.....46
Crollius & Son, E. R.....31
Crouse-Hinds Co.....12, 13
Cutler-Hammer Mfg. Co...10, 20
Cutter Elec. & Mfg. Company 1

D. & W. Fuse Company.....—
Dale Company.....45
Davis Electric Mfg. Co.....31
Dearborn Drug & Chem. Wks 51
Devine Co., Joseph P.....30
Diamond Meter Company....46
Directory of Engineers.....55
Dixon Crucible Co., Joseph..51
D'Olier, Jr., Co., Henry.....5
Doxsee-Barrere Elec. Co.....46
Driver-Harris Wire Co.....5
Duncan Elec. Mfg. Co.....15

Economy Electric Co.....38
Edison Decorative & Miniature Lamp Departm't.....30
Edison Mfg. Company.....33
Electric Appliance Co.....30
Electric Storage Battery Co.. 3
Elect'l Trades Exposition Co.47
Electrician Pub. Company...31

Faries Mfg. Co.....—
"For Sale" Advertisements..32
Ft. Wayne Elec. Works, Inc..59
Fowler & Co., John H.....54
French Battery Co.....—

General Electric Co....28, 29, 30
General Storage Bat. Co..19, 30
Gest, G. M.....53
Gleason, John L.....22
Goodrich Steamship Lines..32
Gould Storage Battery Co....33
Gregory Electric Co.....32

Haller Machine Co.....—
Hart Mfg. Co.....14
Hartford Steam Boiler Inspection & Insurance Co....51
Hazard Manufacturing Co...—
Helios Mfg. Co.....—
Hensel & Co., John A.....22
Highland Park College.....50
Hoffman, G. W.....22
Hoffmann, Emil R.....32
Holmes Fibre-Graph. Co.....—
Holophane Glass Co.....33
Humphrey, Henry H.....50
Hunt & Co., Robt. W.....50
Hunter Fan & Motor Co.....16
Hydro Elec. Developmeat Co50

Illinois Central Ry.....—
Indiana Rub. & Ins. W. Co.... 1
India Rubber & Gutta Percha Insulating Company.....—
International Elec. Meter Co11
International Tel. Mfg. Co...33

Jackson, D. C. & W. B.....50
Jandus Electric Co.....60
Jeffrey Manufacturing Co....51

Kartavert Manufacturing Co.—
Kellogg Switchboard & Supply Company.....53, 54
Klein & Sons, Mathias.....31
Kohler Brothers.....30
Kuhlman Electric Co.....56

La Fayette Elect'l Mfg. Co...—
Leather Preserv. M. Corp.....—
Leffel & Co., James.....51
Lindsley Bros. Co., The.....55
Loewenthal, Max.....50
Loud's Sons Co., H. M.....54
Ludlow Valve Co.....32

Machado & Roller.....30
Maine Hub Mfg. Co.....54
Manhattan El. Supply Co...52
Manross, F. N.....31
Marion Ins. Wire & Rub. Co...
Matthews & Bros., W. N...1, 31
McCandless, H. W. & Co.....32
McLennan & Company, K...20
McRoy Clay Works.....52
Mica Insulator Company....30
Michigan College of Mines..50
Miscellaneous Advs.....32
Mississippi Glass Co.....17
Monarch Elec. Mfg. Co.....4
Morse, Frank W.....50
Moss Tie Co., T. J.....54
Mott Iron Wks., J. L.....46
Mueller Company, William..54
Munsell & Co., Eugene.....30

National Battery Co.....22
National Brake & Elec. Co..44
National Carbon Co.....38
National India Rubber Co.... 1
Nat'l. Stamp. & Elec. Wks —
New York Edison Co.....24
New York Ins. Wire Co.....1
Niagara Tachometer & Instrument Co.....22
Norfolk & Western R. R.....—
North Electric Co.....—
Northern Elect'l Mfg. Co...32
Novelty Incand. Lamp Co...49

Okonite Co., The.....1, 25
Oliver Iron & Steel Co.....6
Oneida Community, Ltd.....—
Osburn Flex. Conduit Co.....52
Ostrander & Co., W. R.....56
Otto Gas Engine Works.....51

Pacific Coast Pole Co.....54
Pass & Seymour.....24
Perrizo & Sons.....54
Peru Elec. Mfg. Co.....46
Phelps Co., The.....56
Phillips, Eugene F.....3
Phillips Insulated Wire Co..3
Phœnix Glass Co.....—
Phosphor-Bronze S. Co.....51
Pignolet, L. M.....20, 30
Plume & Atwood Mfg. Co....—
Porter Cedar Company.....54

Rail Joint Co., The.....46
Reisinger, Hugo.....19
Replogle Governor Works...—
Reynolds El. Flasher Mfg.Co. 1
Robbins & Myers Co.....22
Robert Instrument Co., The..—
Robertson & Sons, Jas. L.....—
Rock Island Battery Co.....—
Roebling's Sons Co., J. A....56
Rose Polytechnic Institute...—
Rossiter, MacGovern & Co ..32
Ruebel & Wells.....59
Runzel-Lenz Elec. Mfg. Co...—

Safety Ins. Wire & Cable Co..52
Samson Cordage Works..46, 49
Sandwich Pole Changer Co...—
Sargent & Lundy.....50
Schott, W. H.....7, 59
Schureman Co., J. L.....46
Seymour Mfg. Co.....51
Shelby Electric Co.....42
Shultz Belting Co.....20
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co. ..38
Smith Storage Battery Co....—
Sorensen, P.....31
Southern Exchange Co.....35
Speer Carbon Co.....—
Spon & Chamberlain.....—
St. Marys Incand. Lamp Co 39
Standard Elect'l. Mfg. Co... —
Standard Underg. Cable Co....—
Stanley—G. I. Elec. Mfg. Co—
Star Expansion Bolt Co.....56
Sterling & Son, W. C.....54
Stewart Elec. Co., Frank H. —
Stow Mfg. Company.....—
Stromberg-Carlson Tel. Mfg Company.....53
Sturgess Engineering Dept. 32
Switchboard Equipment Co 46

Torrey Cedar Company.....54
Trumbull Elec. Mfg. Co.....22

Van Loan Co., I. S.....33
Van Nostrand Co., D.....—
Vulcanized Fibre Company.. 1

Wagner Electric Mfg. Co.....26
Warren Elec. & Specialty Co.36
Wesco Supply Co.....30
Western Electric Company . 44
Westinghouse Electric & Manufacturing Co.....57, 58
Westinghouse Machine Co....57
Weston Electrical Inst. Co... 1
Willard Storage Bat. Co.....22
Williamson & Co., R.....31
Willis, G. M.....50
Wilson Co., Jas. I. M.....54
Worcester Company, C. H... 54
Wrigley Co., Thos.....31

Yonkers Specialty Co..... 1

Zeller, Geo. A. Book Co .... —

For Classified Index of Advertisements See Page 6.

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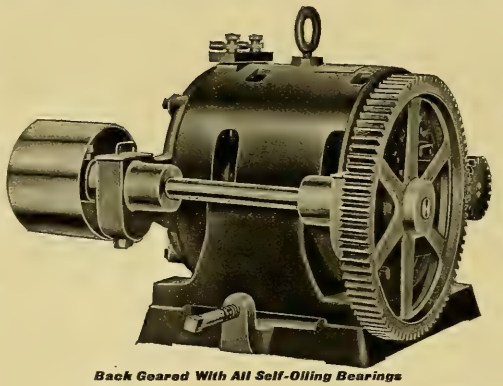

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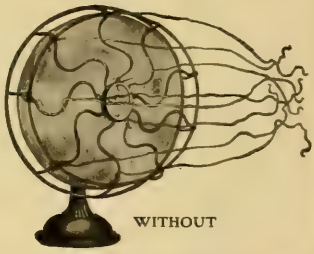

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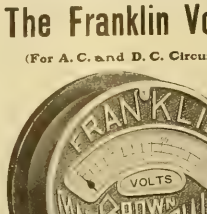

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Air Deflector.
D'Olier, Jr., Henry

Anchors, (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Anodes, Nickel and Copper
Seymour Mfg. Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Brake & Elec. Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutler Elec. & Mfg. Co.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Croilius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse Hinds Co.
Electric Appliance Co.
Gest, G. M.
McRoy Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Reods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Counters.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Oliver Iron & Steel Co.
Wesco Supply Co.
Western Electric Company.

Current Taps.
Dale Company, The

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Switchboard Equipment Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
Allis-Chalmers Company.
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Dodge-Sarrere Elec. Co.
Ft. Wayne Elec. Wks. inc.
General Elec. Co.
Gregory Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Bylesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Loewenthal, Max.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Brown Specialty Mchy. Co.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Nat'l Stamping & Elec. Wks.
Niagara Tachometer & Instrument Co.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
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Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Cent. Ohio Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Hunter Fan & Motor Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Karlavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Faries Mfg. Co.
McLeod, Ward & Co
Morse, Frank W.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg.Co.
Faries Mfg. Co.
Williamson & Co., R

Flashers.
Bissell Co., The F.
Haller Machine Co.
Phelps Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

German Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Faries Mfg. Co.
Haller Machine Co.
Holophane Glass Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Morse, Frank W.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Jandus Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Morse, Frank W.

Lamps, Incandescent.
Banner Elec. Co.
Bissell Co., The F.
Bukeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Colonial Elec. Co.
Columbia Incan. Lamp Co.
Economy Electric Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Novelty Incand. Lamp Co.
Shelby Elec. Co.
St. Marys Incand. Lamp Co.
Standard Elect'l. Mfg. Co.
Warren Elec. & Specialty Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers and Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Misc.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers.
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Linsley Bros. Co., The
Loud & Sons Co., H. M.
Moss Tie Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Southern Exchange Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Peru Electric Mfg. Co.

Portables.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rosettes.
Pass & Seymour.

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Bliss Electrical School.
Highland Park College.
Michigan College of Mines
Rose Polytechnic Institute.

Search Lights.
Benton & Son.

Second-Hand Machin'y.
Amber Electric Co.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.
Nat'l Stamping & Elec. Wks.
Rossiter, MacGovern & Co.
Van Loan Co., I. S.

Signs, Electric.
Haller Machine Co.

Silk.
American Silk Mfg. Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Croilius & Son, E. R.
Western Electric Co.

Solenoids.
Schureman Co., J. L.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Springs.
Manross, F. N.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
North Electric Co.
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service.
Chicago Telephone Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Brake & Elec. Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., James

Vacuum Drying.
Devine Co., Joseph P.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

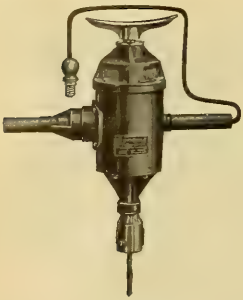
Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Driver-Harris Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Rockling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

Wire Glass.
Mississippi Glass Co.

For Alphabetical Index of Advertisements See Page 3.

IT IS NOT HOW MUCH YOU PAY
BUT WHAT YOU GET FOR YOUR MONEY
THE SCHOTT BALANCED COLUMN HOT WATER SYSTEM
THE SCHOTT SYSTEMS
THE SCHOTT REGULATED VACUUM STEAM SYSTEM
CENTRAL STATION HEATING PLANTS
W.H.SCHOTT ENGINEER
MARQUETTE BLDG. CHICAGO, ILL.

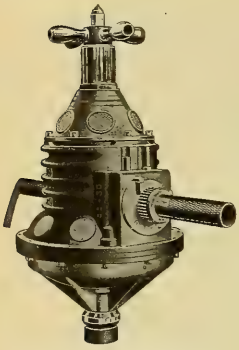
AIR COMPRESSORS AIR & ELECTRIC PORTABLE TOOLS



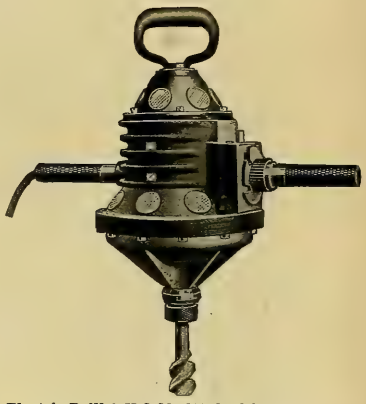
Air Cooled DUNTLEY Electric Breast Drill.
Cap ⅜ in. Wt. 13 lbs.

Electric Drill 1-M-1-10
Cap ¼ in. Wt. 16 lbs.

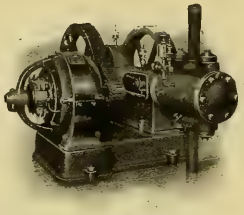
For the central station and repair shop; also for rail bonding, etc.



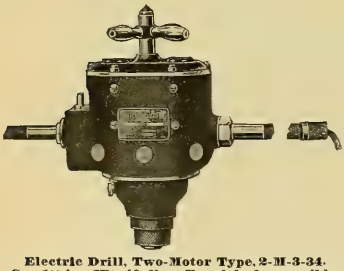
Electric Drill 1-M-3-20, fitted with telescopic feed screw.
Cap 1½ in. Wt. 35 lbs. Furnished reversible when desired.



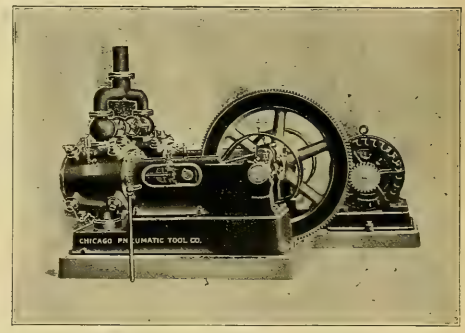
Electric Drill 1-M-3-20, fitted with spade handle and reversible switch for wood boring.
Cap 2½ in. in oak.



Franklin Air Compressor
Class G-SE.



Electric Drill, Two-Motor Type, 2-M-3-34.
Cap 1½ in. Wt. 40 lbs. Furnished reversible when desired.



Franklin Air Compressor. Class G-D.E.

WE have manufactured and sold portable tools for ELEVEN consecutive years and our experience is certainly worth something. Let us know your requirements, and we will quote you on an installation to fully meet the same.

CHICAGO PNEUMATIC TOOL CO.

CHICAGO--NEW YORK

BRANCH OFFICES:

Portland, San Francisco, Seattle, Los Angeles, Salt Lake City, Butte, Denver, St. Louis, St. Paul, Detroit, Cleveland, Boston, Pittsburg, Philadelphia

Money Saved

By *UTILIZING* all the *HEAT UNITS* contained in the steam you manufacture.

THIS is accomplished by installing *OUR* underground steam heating system in connection with your electric light, power or railway plant and heating offices, business blocks, schools, churches, public buildings, residences, etc.

WRITE FOR STORY

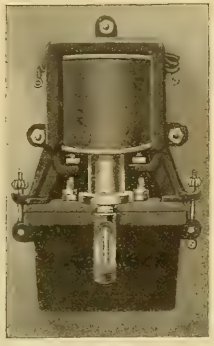
"District Steam Heating"

AMERICAN DISTRIOT STEAM CO.

1101 ELM ST.
LOCKPORT N. Y

MONADNOCK BLDG.
CHICAGO, ILL.

SELF STARTERS FOR A. C. MOTOR DRIVEN PUMPS AND COMPRESSORS



Cut 1. A. C. Self Starter for Small Motors

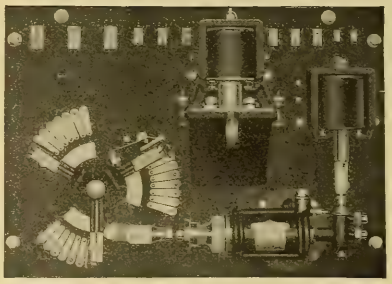
The A. C. self starters shown in the cuts can be used for either an open tank or compression tank system and automatically controlled by a float switch or pressure regulator to start and stop at the minimum and maximum quantity of water or at the two limits of pressure for which the regulator is adjusted.

Either water or air can be used to operate the device which actuates the contact lever, this device being controlled by the alternating current solenoid shown at the extreme right of cut No. 2.

The motor is started by the closing of the main line oil immersed switch shown in center of cut, which in turn closes the circuit to the motor through the resistance.

The solenoid shown on the extreme right gradually raises and admits water or air under pressure to the valve of the mechanical device at the bottom of the cut, which operates the lever, cutting out the starting resistance and bringing the motor up to speed.

When the main line switch is opened by the float switch or pressure regulator to stop the motor, the valve solenoid is de-energized, the valve is shifted to the reverse position, and the rheostat lever is returned to the starting position. By reason of an electrical interlock between the main line switch and the rheostat lever the circuit to the motor cannot be closed unless the lever is in the starting position.



Cut 2. A. C. Self Starter for Squirrel Cage Type Motor.

Bulletin 33 describes a self starter for small single, two or three phase motors, Bulletin 34 self starter for squirrel cage type motors, and Bulletin 35 self starter for slip ring type motors.

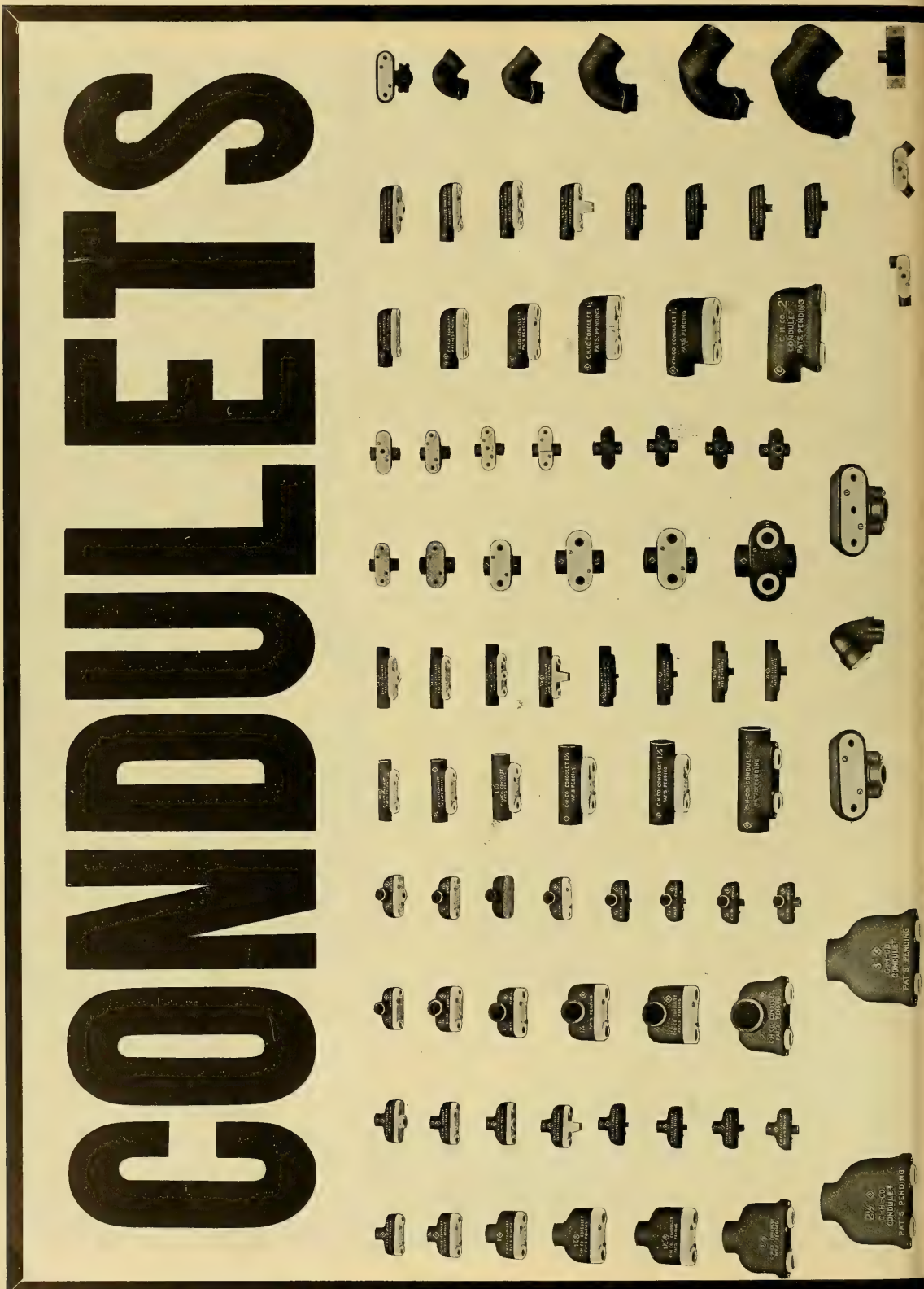
We have built a large number of A. C. controllers for various other purposes, and would be pleased to design and quote upon receipt of your requirements.

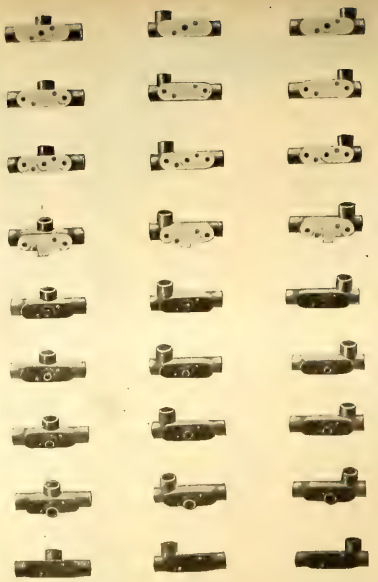
CUTLER-HAMMER MFG. CO.

MILWAUKEE

New York Boston Chicago Pittsburg

INTERNATIONAL

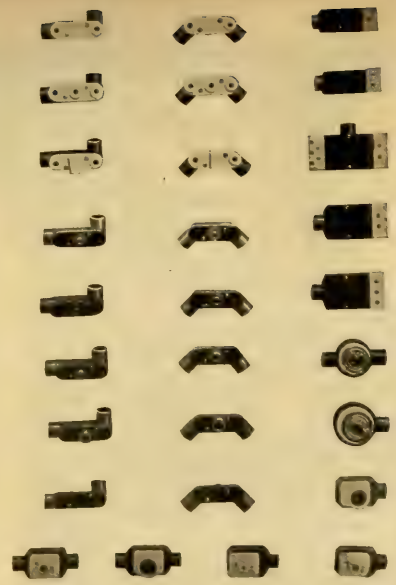

CONDULETS



This is a facsimile of our 32x44-inch Wall-Hanger, which shows all types of the Crouse-Hinds Condulets.

The hanger is especially valuable as a guide in selecting the proper type of condulet for whatever job you are doing.

We will send you a copy by express, prepaid, free of charge, upon request.



CONDULETS MAKE THE JOB

The Modern Line of Conduit Outlet Boxes and Fittings

Manufactured and Sold by

CROUSE-HINDS CO.

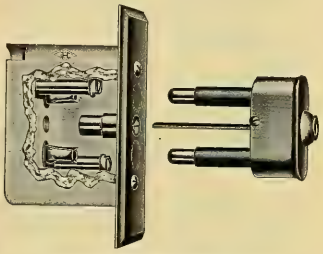
SYRACUSE, NEW YORK, U. S. A.

Chicago: 70 W. Jackson Boul. | New York: 25 Dey St. | Cincinnati: 234 W. 4th St.

For sale by all supply houses | *Write for catalogue*

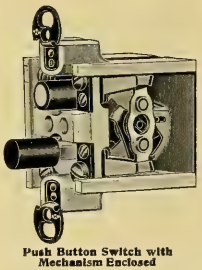
"DIAMOND H" SWITCHES AND RECEPTACLES

ARE WORTHY OF A THOROUGH INVESTIGATION



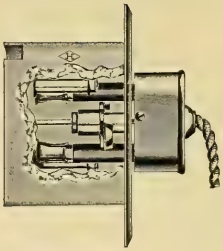
Receptacle with Plug Ready to Insert

All "Diamond H" Switches are made of the finest material obtainable and are assembled by experts. In construction and design they are superior to all others.



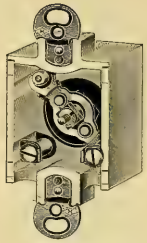
Push Button Switch with Mechanism Enclosed

Rotary Flush Switch in Single Wall Case



Receptacle with Plug Inserted

"Diamond H" Receptacles are fitted with plates which open automatically at the insertion of the plugs and are the only ones made with this unique feature.



5 Amp. S. P. Rotary Flush No. .0105

"MADE IN ONE QUALITY ONLY"

BY

HART MFG. CO.
HARTFORD, CONN.

The Central Station Man's Toast

The following toast on "Meters" was recently offered at a dinner at which a number of central station owners, managers and superintendents were present.

It shows, beyond any possible doubt, the high esteem in which the Duncan meter is held, and the popularity which it enjoys.

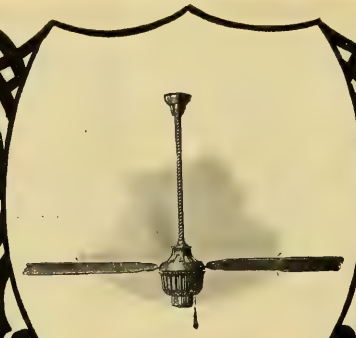
"The Gourmet is a meat-er
Loves his viands and his wine;
And the Poet uses meter
In his verse for every line;
The Gas man has a meter
For his product volatile;
And the Waterworks a meter
For its fluid—pure or vile.
The Lover loves to meet 'er
In the pleasant summer's night;
And all use the Duncan Meter
For to measure Power and Light."

It must be admitted that the author of the foregoing displayed excellent judgment in his choice of an electric meter; and, after the banquet, he admitted that he had tried all makes of meters and found the DUNCAN the "Gibraltar" of his defense against loss of money on small load customers—by virtue of its extreme accuracy.

It's the "Meter of equity." Let us send a sample to you on 30 or 60 days' trial. This is all we ask, as the meter will do the rest.

Duncan Electric Manufacturing Co.

LAFAYETTE, INDIANA



TUERK FANS

RICH IN APPEARANCE, SIMPLE IN CONSTRUCTION, RIGID, SMOOTH RUNNING AND ALL OTHER REQUISITES THAT ARE NECESSARY IN A CEILING FAN ARE FOUND IN THE TUERK. MADE IN FIVE DIFFERENT TYPES

SEND FOR OUR NEW ART CATALOGUE

HUNTER FAN & MOTOR CO., Fulton, N. Y.

Eastern Agents
E. B. LATHAM & CO.,
39 Vesey St., New York City.

Western Agents
WESTERN ELECTRIC CO., Chicago, St. Louis, Kansas City, Denver.
AMERICAN ELECTRIC CO., St. Paul, Minn.
STANDARD ELECTRIC CO., Cincinnati, Ohio.

NOW

Send in your order and copy for an attractive advertising announcement for the

Western Electrician's National Electric Light Convention Report Issues

to be dated June 9th and 16th.

The first report number will go to press June 6th.

The final report number will go to press June 13th.

PLEASE FORWARD COPY TO-DAY.

Western Electrician, 507 Marquette Bldg., Chicago

Received From San Francisco

49 letters detailing the excellent behavior of Mississippi Wire Glass in the few buildings left standing after the great conflagration. Of the number, including the Shreve, Wells-Fargo, Telephone, Pacific States Telegraph and California Electrical Buildings, the latter was referred to in the telegram dated April 21st—to the Western Electric Co., Chicago:

"Our Building stands like a monument in a desert — saved by WIRE GLASS, watchman and water tanks."

As also in the following telegram dated 6 days later:

San Francisco, April 27th, 1906.

Mississippi Wire Glass Co., Chicago:

"Western Electric Building not damaged. Everything around it destroyed by fire. All window frames are metal with MISSISSIPPI WIRE GLASS."

Joseph F. Forderer.

Messages of similar purport were addressed us after the great conflagrations at Baltimore, Rochester, Toronto, Winnipeg, Minneapolis, etc., the following coming from Baltimore:

"Your wire glass in metal frames saved the United Electric Light and Power Company's new Transformer Station with $150,000 worth of delicate machinery and prevented the spread of fire to the West. No trace of fire in our building. All other buildings in track of fire completely destroyed."

(Signed) Parker & Thomas.

More than ten million square feet of Mississippi Wire Glass is installed for fire protection in Electrical Works and Power Stations in the United States.

Mississippi wire glass stands until the walls fall.

Samples and Printed Matter, Descriptive and Illustrative, on request

MISSISSIPPI WIRE GLASS CO.

277 BROADWAY, NEW YORK, or 72 MADISON STREET, CHICAGO

Central Station Service
going in; Private Plants coming out

As a result of the installation of our Central Station Service in buildings which formerly operated their own plants, we find it necessary to market large quantities of

Second-Hand Electrical and Steam Machinery

These machines are in excellent operating condition and are offered at very low prices. The following is a partial list. Prices on these and other sizes and types will be quoted on request.

LIST OF MACHINERY

Direct Current Generators

One 30 KW., 125 Volt, General Electric generator; Class 4; Form H; Type M. P.; 240 Amperes; Speed 1050.

One 30 KW., 120 Volt, Eddy Dynamo; 250 Amperes; Speed 900; 4 pole; compound wound.

One 50 KW, 400 Amperes, 125 Volt, Triumph Generator; Speed 615; Compound wound; Type M. P.

One 55 KW., 125 Volt, General Electric generator; Speed 875; Type M. P.

One 100 KW. double current Excelsior Electric Dynamo; 400 Amperes, 250 Volts, Speed 500, Churchward multipolar type.

One 100 KW., 500 Volt, General Electric generator; Type M. P.; Class 4,180 Amp., Speed 650.

One 250 KW., motor generator set. (One 60 cycle 4150-2400 V. Synchronous machine direct connected to one 250 V. shunt wound D. C. machine, both mounted on common cast iron base, with three bearings.)

Direct Connected D. C. Units

Three 15½x15 Ideal engines direct connected to 100 KW., 125 Volt, 800 Ampere, M. P., Westinghouse generators. Flywheel 10x60.

One 14½x12 Ball & Wood engine direct connected to one 75 KW., 125 Volt, Westinghouse generator; 265 RPM. Flywheel 13x60.

One 12x16 side crank throttling engine (made by I. & E. Greenwald), direct connected to a 12-ton Kroeschell Brothers hydro carbonic acid gas refrigerating machine.

Engines

One horizontal tandem compound McIntosh & Seymour 125 H. P. engine; cylinders 11x19 with 15-inch stroke; RPM 213.

One 13x20x15 Dick & Church horizontal tandem compound engine; shaft governor; center crank; flywheel 72x16.

One 11x22 Buckeye engine; side crank; outboard bearing; shaft governor.

One 500 H. P. tandem compound Porter Allen (Southwark) engine 20x30x24; 200 RPM; flywheel 99x26; 130 lbs. steam pressure.

One 100 H. P. central valve Williams engine; 8x12x6; three cylinders; 150 RPM; 150 lbs. steam pressure.

One 21x36 Williams horizontal tandem compound engine; 600 H. P.; 140 RPM.

One 12x24 Williams horizontal tandem compound engine; 250 H. P.

TELEPHONE MAIN 1280

CHICAGO EDISON COMPANY

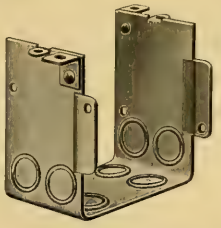
Edison Building **139 Adams Street** **Chicago**

ELECTRA CARBONS

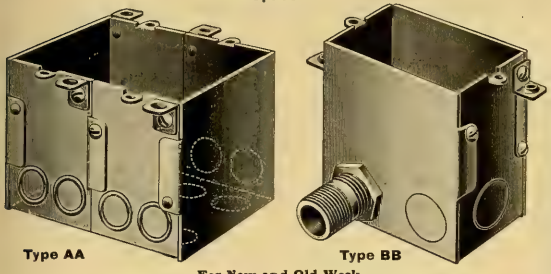
"ELECTRA" CARBONS ARE MADE OF THE BEST MATERIAL.
"ELECTRA" CARBONS ARE ALWAYS UNIFORM IN QUALITY, DIAMETER AND STRAIGHTNESS.
"ELECTRA" CARBONS ALWAYS GIVE SATISFACTION.

HUGO REISINGER 11 BROADWAY **NEW YORK**

NEW NEW



Spacer



Type AA Type BB

For New and Old Work

UNION OUTLET

COMBINATION SWITCH BOX

PATENTS PENDING

Approved by the Underwriters National Electrical Association.
Takes all Standard Switches and Receptacles.

Designed so that a **two-gang** box can be converted into any number of gangs by releasing the clamping screws and inserting "Spacers." These gangs are easily assembled with the aid of a screw-driver, and fit together snugly, making a perfect and solid gang box for any required number of switches.

CHICAGO FUSE WIRE & MFG. CO.

203 Fulton Street, NEW YORK

170 S. Clinton Street, CHICAGO Mutual Life Bldg. BUFFALO

Security, Convenience, Safety and Economy

SECURITY POLE SEATS are cheap notwithstanding the special machinery used in their construction or the quality of material.

Made of angle iron—bent corners.

Iron cross bars machine riveted.

No rough edges to tear hands or clothing.

Weighs only 28 pounds and will carry a ton.

You will be pleased upon investigation.

Novelty Pot Heads and Sleeves

Made of selected brass.

No expert plumber needed to fit head or sleeve.

Always ready for inspection or removal.

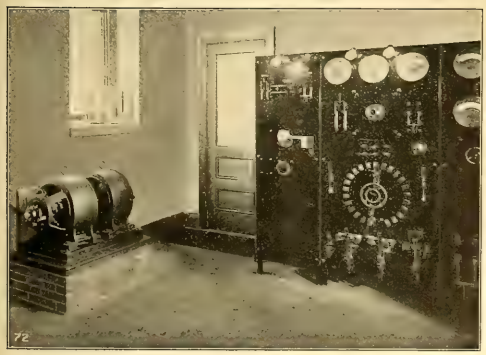
Waterproof after inspection same as before.

Samples sent on trial.

Complete information and blanks for ordering upon request.

TOLEDO, OHIO · THE F. BISSELL COMPANY

THE F. BISSELL COMPANY · TOLEDO, O.



BIJUR System of Booster Control and Regulator

"HIGH DUTY" Batteries

At National Electric Light Association Convention
Atlantic City, N. J.

General Storage Battery Co.

General Offices: 42 Broadway, N. Y.
Works: Boonton, N. J.

Boston Chicago Cleveland San Francisco Washington, D. C. Mexico City

PORTABLE *and* SWITCHBOARD INSTRUMENTS

Our New Switchboard Instrument

is 5 inches in diameter, specially designed for small installations. Accurate and low in cost.

Our Portable Instruments

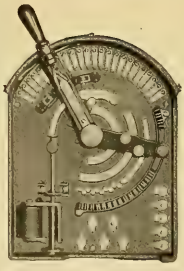
Small enough to be carried in your pocket and accurate enough to be used as a standard.

Write for Catalogue

LOUIS M. PIGNOLET

78-80 Cortlandt Street **NEW YORK, N. Y.**

The "Carpenter" Type Printing Press Controller



Some of the largest printers in the country won't have any other controller for their motor driven flat bed presses but the "Carpenter." The reason is that it safeguards both the motor and press as far as is possible from damage, and gives every required speed in a natural and easy manner.

Our Bulletins 81 to 89½ give full information on this type.

THE

Cutler-Hammer Mfg. Co.

Milwaukee

New York Boston Chicago Pittsburg

SHULTZ SABLE

Remember those two words, remember to write them in your order, and you can forget your belting troubles. Shultz Sable is a

RAWHIDE BELTING, SURFACE TANNED

by a process that is exclusively ours. The surface tanning produces a kid-like surface that clings and pulls where oak-tanned leather belting slips and burns; and the long, unbroken, unseparated rawhide fibres underneath insure the long life that makes Shultz Sable the cheapest belting you can buy, measured by length and efficiency of service.

To prove that it has 33 per cent more pulling power than any oak-tanned belt, we will send you a Shultz Sable Rawhide Belt

ON SIXTY DAYS' TRIAL

with the distinct understanding that if it disappoints you in any way, it is not to cost you a cent.

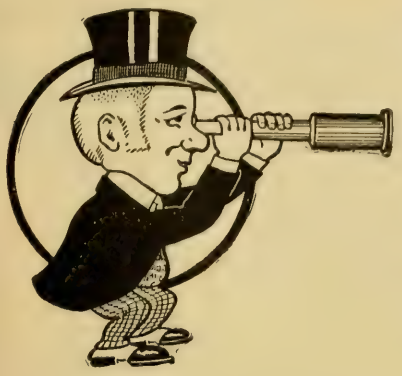
Send NOW for the Sable Booklet, and remember, in buying, that Sable Belting is BLACK.

SEND FOR BOOKLET No. 40.

Shultz Belting Co.

ST. LOUIS, MO.

NEW YORK, 111 Chambers St. BOSTON, 114 High St.
PHILADELPHIA, 116 N. Third St.



They All Look Alike From a Distance But Get Up Close

Our No. 703
Fuseless Rosette

All fuseless rosettes look well enough from a distance, but it takes a critical examination by an expert who knows to tell what's what.

P and S No. 703 Fuseless Rosette should interest you because the price is only 4c net in any quantity and no charge is made for packing or cartage.

But besides this we want you to know the porcelain is of superior quality, and expert examination will prove we have the most indestructible rosette yet produced.

By processes all our own and unknown to others we make the finest porcelain for electrical specialties in the world.

From beginning to shipping room our porcelain specialties are closely inspected, scientifically handled every step, and when they come to you packed 10 in a paper box, the P and S way, ready for use, you can be sure they will give entire satisfaction to everyone.

This Fuseless Rosette No. 703 at 4c flat should interest you.

Before you turn the page drop us a line.

PASS AND SEYMOUR

SOLVAY, N. Y.

Branches: NEW YORK CITY, CHICAGO, SAN FRANCISCO

WILLARD STORAGE BATTERIES

FOR ALL PURPOSES
Manufactured by
THE WILLARD STORAGE BATTERY CO.
CLEVELAND, OHIO

RELIABLE "Unit Accumulator"
National Battery Company
ELECTRIC STORAGE BATTERIES
BUFFALO, N. Y.

Branch Offices:
NEW YORK, CHICAGO

TYPE B
For belt drive from horizontal and vertical shafts

Niagara Tachometer and Instrument Co.'s Recording and Indicating Instruments

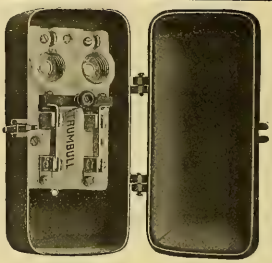
For direct connection.
For **belt** drive from horizontal and vertical shafts.
Adaptable to all classes of rotary machinery.
Permanent accuracy guaranteed.
Catalogue sent upon request.

NIAGARA TACHOMETER AND INSTRUMENT CO.
NIAGARA FALLS, N. Y.

SUPERIOR TO COTTON WASTE
Endorsed by Fire Underwriters
Safe, Durable, Cheaper
Agents Wanted

RAW SILK MACHINERY WIPERS

Beware of loose woven imitations
AMERICAN SILK MFG. CO.
311 WALNUT STREET, PHILADELPHIA, PA.



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Cat. No.		Price
1210	110-v. 2-wire	$3.12
1212	250-v. 2 "	3.75
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Discount 50 per cent
Special prices in quantities

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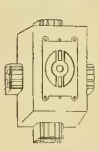

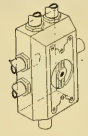

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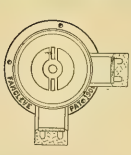

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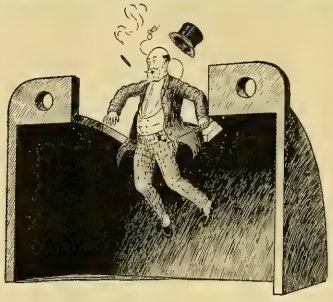

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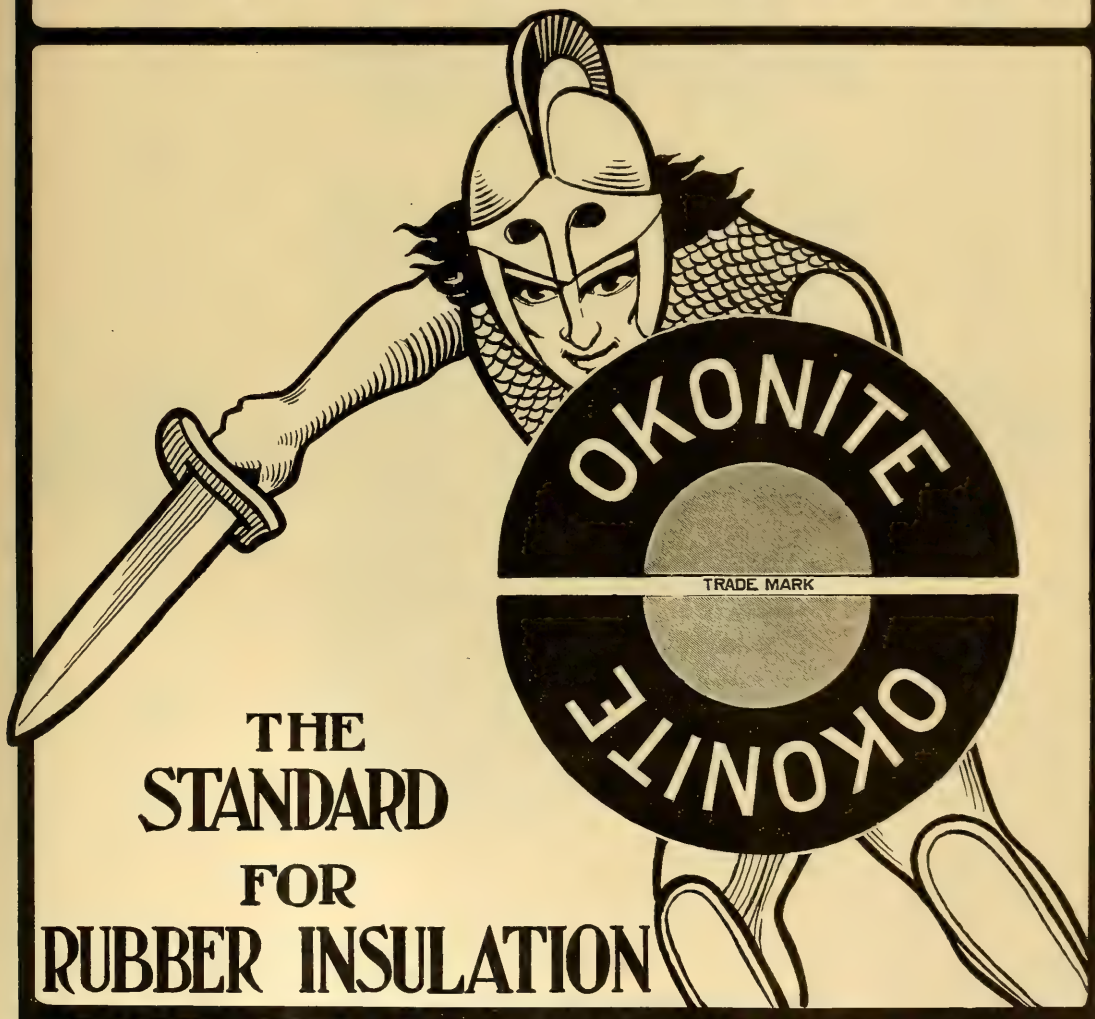

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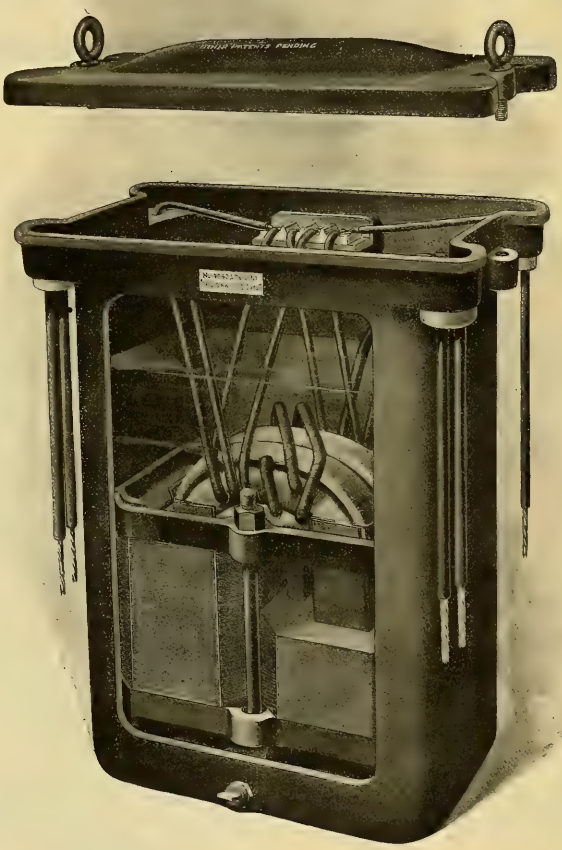

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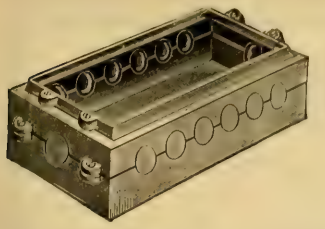

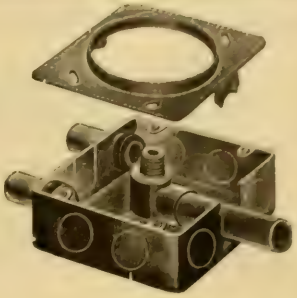

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Times and conditions have changed with a marked improvement in all lines. Steel has replaced iron to a marvelous extent, especially in building material. The formerly used old-fashioned cast-iron outlet box is not what the up-to-date contractor uses. He always specifies the only drawn steel box made,

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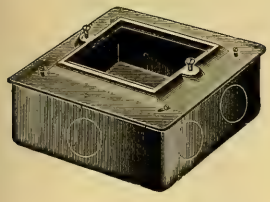

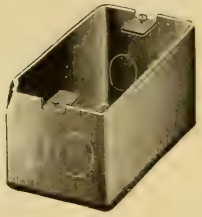

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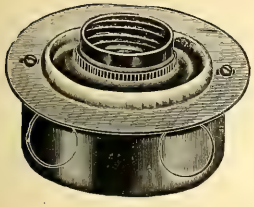

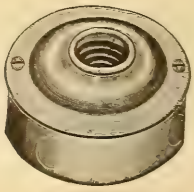

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Novelty Lamps

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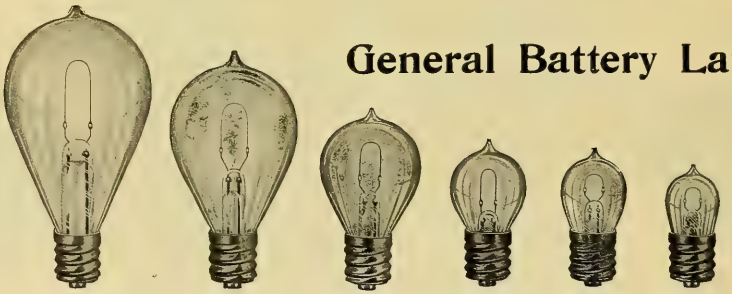

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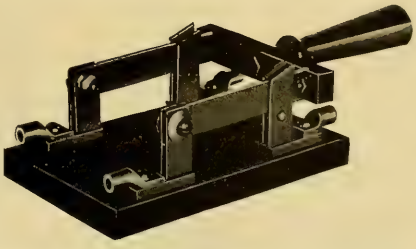

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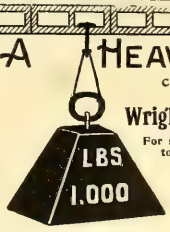

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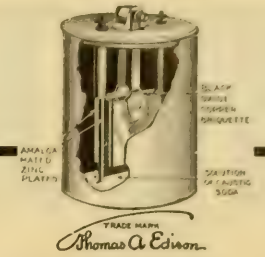

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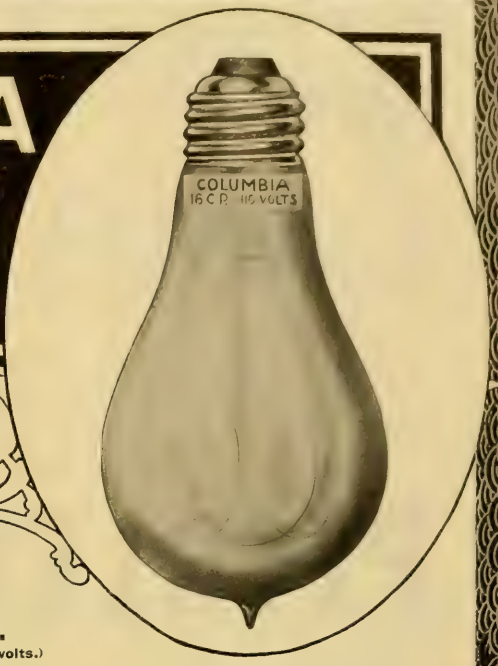

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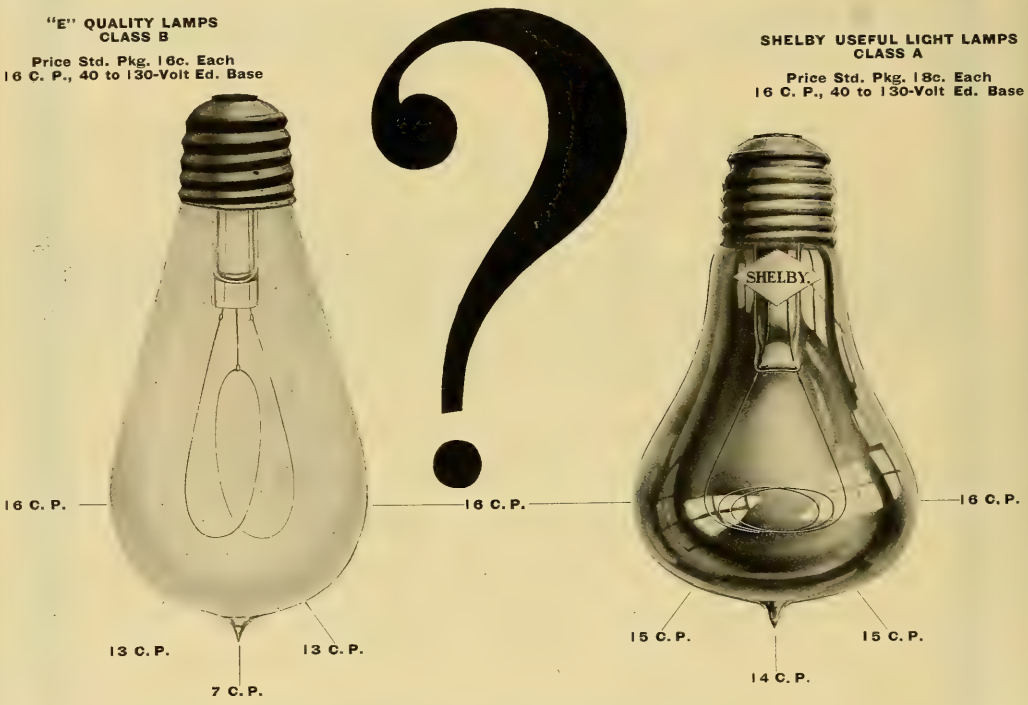

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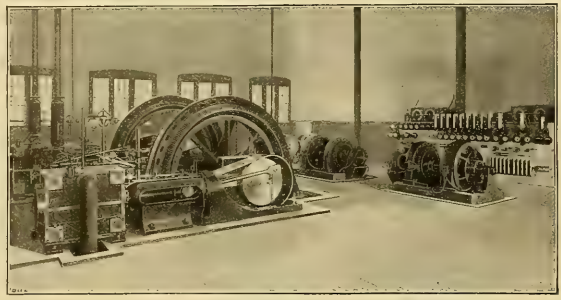

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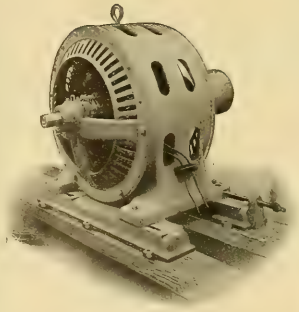

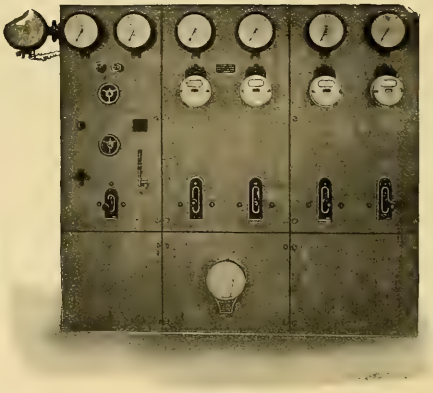

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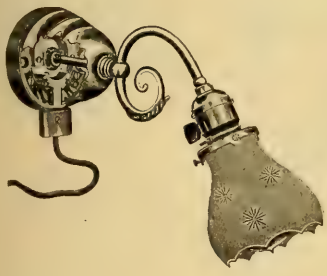

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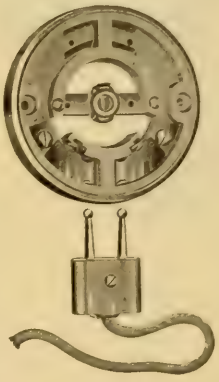

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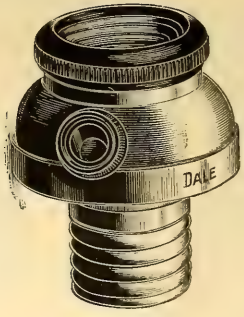

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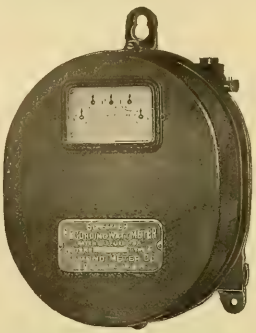

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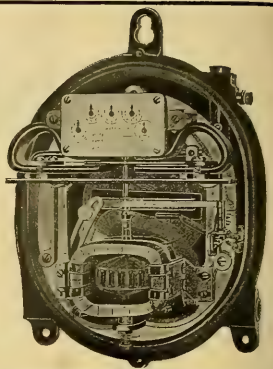

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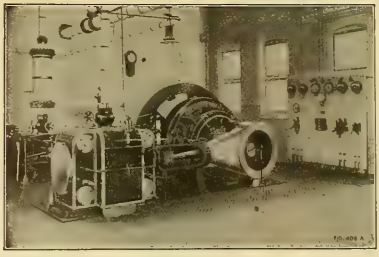

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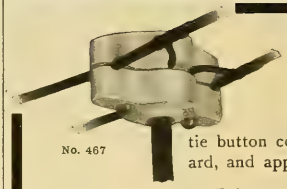

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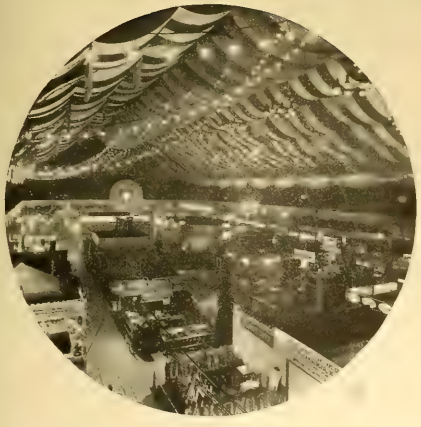

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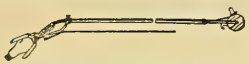

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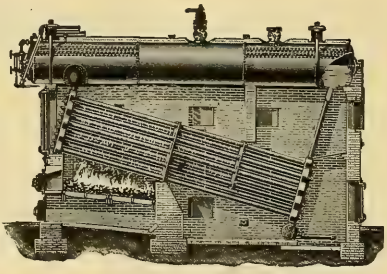

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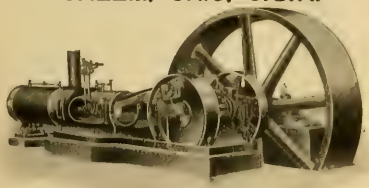

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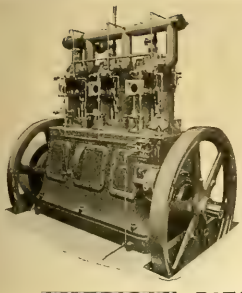

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39th ANNUAL STATEMENT

JANUARY 1, 1906

CAPITAL	$ 500,000.00
SURPLUS	1,261,459.69
RESERVES	1,926,686.81
ASSETS	3,688,146.50

The **Hartford** is the only company which makes a specialty of, and does exclusively, a steam boiler inspection and insurance business.

The **Hartford** is the only company whose entire talent and energies are applied to the study of steam, to the scientific construction and installation of boilers, and to their periodical inspection by expert mechanics.

The **Hartford** is the only company whose entire assets and resources are held exclusively for the protection of steam users, and the payment of losses occasioned by the explosion of steam boilers, and for no other hazard whatsoever.

The **Hartford** is now doing nearly nine-tenths of the Inspection and Insurance of Steam Boilers in the New England States, and nearly two-thirds of the entire amount done throughout the United States.

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Gateage	Head	R. P. M.	Cu. Ft. per Sec.	H. P.	Efficiency
Full	13.27	109	247	310	83.58%
15-16	13.50	104	235	304	84.60%
¾	13.79	101	223	296	85.01%
13-16	14.18	100	209	280	83.66%
⅞	14.69	100	189	254	81.06%
11-16	15.12	102	174	239	80.36%

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IN CHICAGO

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50 calls per month : :	$5.00
Next additional 50 calls in the month	5 cents each
Third 50 calls in the month : :	4 cents each
All calls in the month beyond 150 :	3 cents each

RESIDENCE RATES WITH UNLIMITED SERVICE:

Single line : : : :	$75.00 per annum
Two-party line : : :	60.00 per annum

NICKEL SERVICE:

Direct line, 20 cents per day, including 4 calls
Direct line, 15 cents per day, including 2 calls
Two-party line, 15 cents per day, including 3 calls
Two-party line, 10 cents per day, including 1 call
Two-party line, residences only, 10 cents per day
Four-party line, residences only, 5 cents per day
Extension telephones : : : $1.00 per month

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Why doesn't it pay you as well as the best of your investments?
Is the reason bad management or bad equipment? More likely the latter.
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It costs a fixed price per hundred lines to enlarge the automatic exchange, instead of an increased price per each hundred lines, as in the manual equipment.
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Allentown, Pa.	Havana, Cuba.	Princeton, N. J.
Auburn, Me.	Hazleton, Pa.	Riverside, Cal.
Auburn, N. Y.	Hopkinsville, Ky.	San Diego, Cal.
Battle Creek, Mich.	Jonesboro, Ark.	Santa Monica, Cal.
Bellingham, Wash.	Lake Benton, Minn.	Sawtelle, Cal.
Berlin, Germany.	Lewiston, Me.	Sioux City, Iowa.
Buxton, Iowa.	Lincoln, Neb.	South Bend, Ind.
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Chicago, Ill.	Manchester, Iowa.	Tacoma, Wash.
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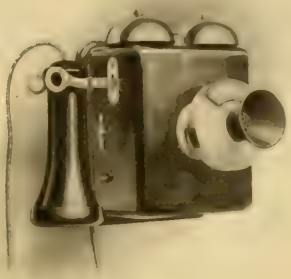

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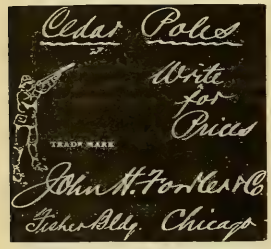

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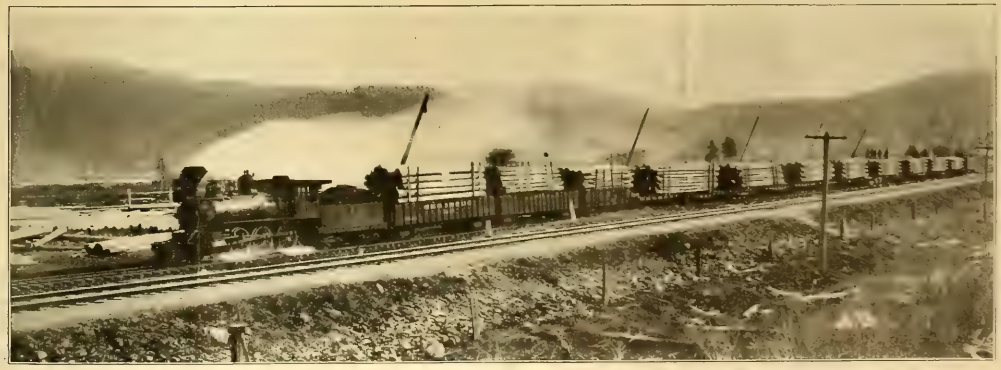

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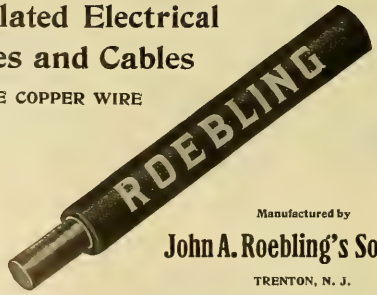

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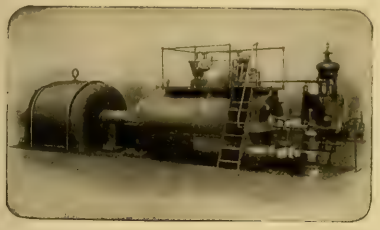

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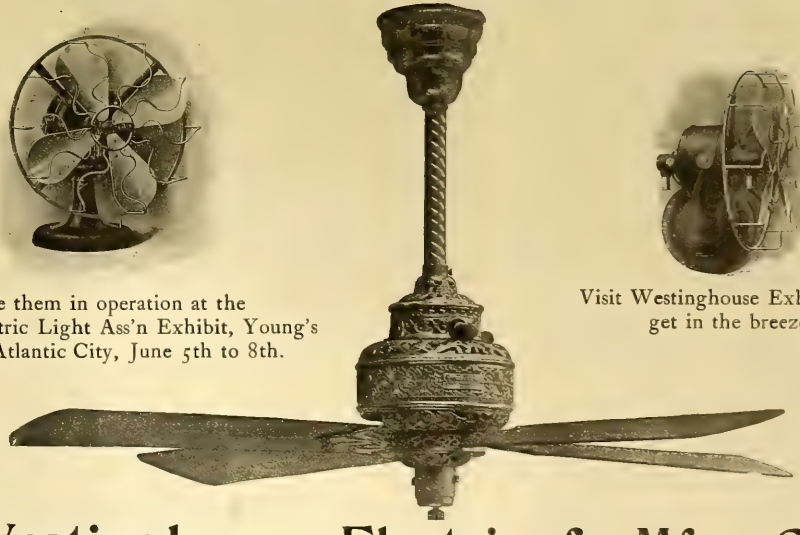

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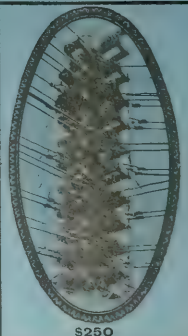

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YOU should certainly give the Kearney Cable Clamp a trial. You may think you can do without them by using the old method. You can—but once using the Kearney Cable Clamp, you save time, labor, material and money, don't you think it would be to your advantage to do so?
If you will send us a list of 25 or more feeders supported on [illegible] we will show you how to save [illegible] or the money. You can't lose. Let us [illegible]
Send for Handsome 1906 Catalog.
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MANUFACTURERS
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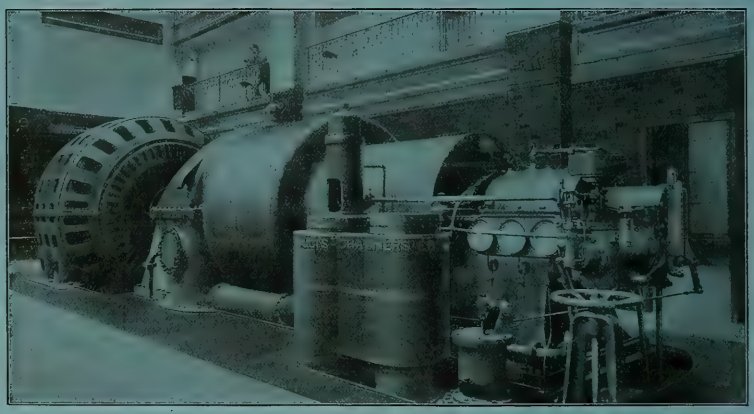
ALLIS-CHALMERS CO
MILWAUKEE WIS U S A

Engineers and Owners of Power Plants Cannot Fail To Be Greatly Interested in the Record

Made at the Starting Up of the Allis-Chalmers Company's 5,500 K. W. Steam Turbine Generating Unit
(SHOWN BELOW)

Installed in the Williamsburg Station of the Brooklyn Rapid Transit Co.

Note the Partial Description Given Below and Then Read the More Complete Accounts Given in the "Western Electrician"



The Starting of a Large Steam Turbine Generating Unit—A Notable Record.

A large steam turbo-alternator built by the Allis-Chalmers Company has recently been started successfully under peculiar circumstances. The turbine and its direct-connected alternator were ready for operation on February 1st, but the boilers, condensing apparatus, piping, etc., were not completed until late in March.

Sudden Call for Current in Consequence of Mishap at Another Power House of the Company.

While lying idle for nearly two months in an uncompleted station, the insulation of the generator windings naturally became damp, and, therefore, as soon as steam was available for running the turbine, it was started up at part speed to dry out the generator. This drying-out process was going on when, on the morning of March 27th, a mishap at another power house left the railway company short of power. The urgency of the situation was explained to the Allis-Chalmers representatives at about 10 o'clock, and they were asked whether they could help out with the afternoon load, and it was decided to put the turbine into regular operation, notwithstanding the fact that it had never been under load, nor had it even been up to speed except when running unloaded at the West Allis shops.

Hurried Preparations for Starting the Allis-Chalmers Turbine.

Additional boilers were therefore fired up and other hurried preparations made for starting. The turbine continued to run slowly until 12 o'clock to dry out the generator. It was then shut down and the engineers proceeded with progressive tests of the insulation, testing up to such a point as they considered safe for the radiated voltage of 6,600, but not considering it wise to risk too high a test in view of the damp state of the generator.

How It Responded.

The insulation tests were completed at 1:56 p. m., and the turbine was again started up and run up to the full speed of 750 revolutions per minute for the first time since installation at the power house. At 2:20 p. m. the engineers, after carefully assuring themselves that everything was working well, reported that they were ready, and an increasing load was immediately put on, until at 3:05 the turbine was carrying a little over 3,000 kilowatts, which was all that the railway company needed at that time.

Heavy Overloads Carried.

As more load was called for it was put on, and at 3:45 p. m. the unit was carrying over 4,000 kilowatts. On the following day the load ran up to over 5,000 kilowatts, and on the succeeding day it reached 7,000 kilowatts, the turbine taking heavy loads during the morning and afternoon peaks and running until late each night.

Performance of the Generator.

Not only has the steam end of this outfit realized all the expectations of the builders, but the generator has been equally successful, carrying large overloads each day with ease.

On April 9th from five to six p. m. the load averaged about 6,000 kilowatts, and from six to seven p. m. 6,600 kilowatts, while from six to 6:30 p. m. it averaged nearly 7,700 kilowatts, with swings up to 9,300 kilowatts. On April 21st for 1½ hours the load averaged over 8,000 kilowatts, following a run at rated load, with a temperature rise of only 22° C. On April 19th a load averaging 7,500 kilowatts was carried from 5:40 to 6:40 p. m. with swings up to 9,800. One swing of 9,000 kilowatts was carried for 45 seconds and one of 9,800 kilowatts for 15 seconds, this being 78 per cent. over rated load. The highest temperature rise so far met with during any run, notwithstanding heavy overloads, is 25.5° C.

Perfect Balance of the Rotating Parts.

Points about the operation of this turbine which have attracted considerable attention are the perfect balance of the rotating parts, both of turbine and generator, resulting in a minimum of vibration, quiet operation of the generator and the remarkable coolness of the bearings.

ALLIS-CHALMERS COMPANY HAS OFFICES IN ALL THE LARGE CITIES

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig.....26
Alton Machine Co.....4
Allis-Chalmers Company.....2
Amber Electric Co.....18
American Battery Co.....—
Amer. Circular Loom Co.....1
American Conduit Co.....24
American Diesel Engine Co.—
Amer. District Steam Co.....22
Amer. Elect'l. Supply Co.....22
Amer. El. Telephone Co.....25
American Electrical Works..17
Arnold Co., The.....22
Automatic Electric Co.....24

Babcock & Wilcox Co.....—
Badt, F. B.....22
Bain, Forée & May.....—
Baker & Co., Inc.....3
Baker & Co., W. E.....21
Beardslee Chandelier Mfg.Co.—
Belden Mfg. Co.....17
Benjamin Elec. Mfg. Co.....—
Benton & Son.....—
Berthold & Jennings.....26
Bissell Co., The F.....7, 26
Bliss Electrical School.....—
Bossert Electric Construction Co.....3
Bruer, Will F.....26
Buckeye Electric Co.....—
Buckeye Engine Co.....23
Butterfield Construction Co.—
Byllesby & Co., H. M.....22

Central Electric Co.....5
Century Electric Co.....17
Chicago Edison Co.....4, 18
Chic. Fuse Wire & Mfg. Co...4
Chicago Ins. Wire & Mfg. Co.16
Chicago Mica Co.....16
Chicago Pneumatic Tool Co..22
Chicago Telephone Co.....24
Columbia Incand. Lamp Co.—
Cope, T. J.....24
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co.....13
Crolius & Son, E. R.....—
Crouse-Hinds Co.....32
Cutler-Hammer Mfg. Co.....4
Cutter Elec. & Mfg. Company—

D. & W. Fuse Company.....—
Davis Electric Mfg. Co.....—
Dearborn Drug & Chem. Wks.23
Devine Co., Joseph P.....22
Diamond Meter Company.....—
Directory of Engineers.....22
Dixon Crucible Co., Joseph..23
D'Olier, Jr., Co., Henry.....5
Doxsee-Barrere Elec. Co.....—
Driver-Harris Wire Co.....11
Duncan Elec. Mfg. Co.....19

Edison Decorative & Miniature Lamp Departm't.....16
Edison Mfg. Company.....17
Electric Appliance Co.....16
Electric Storage Battery Co.. 3
Elect'l Trades Exposition Co.—
Electrician Pub. Company...28

"For Sale" Advertisements..20
Ft. Wayne Elec. Works, Inc..31
Fowler & Co., John H.....—
French Battery Co.....—

General Electric Co....14, 15, 16
General Storage Bat. Co.....16
Gest, G. M.....24
Gleason, John L.....—
Goodrich Steamship Lines..—
Gould Storage Battery Co.... 6
Gregory Electric Co.....18

Haller Machine Co.....11
Hart Mfg. Co.....19
Hartford Steam Boiler Inspection & Insurance Co....—
Hazard Manufacturing Co...32
Hellos Mfg. Co.....13
Hensel & Co., John A.....—
Highland Park College.....22
Hoffman, G. W.....17
Hoffmann, Emil R.....—
Holmes Fibre-Graph. Co.....11
Humphrey, Henry H.....22
Hunt & Co., Robt. W.....22
Hunter Fan & Motor Co.....5
Hydro-Elec. Development Co22

Illinois Central Ry.....23
Indiana Rub. & Ins. W. Co.... 1
India Rubber & Gutta Percha Insulating Company.....11
International Elec. Meter Co32
International Tel. Mfg. Co...25

Jackson, D. C. & W. B.....22
Jeffrey Manufacturing Co....23

Kartavert Manufacturing Co.32
Kellogg Switchboard & Supply Company.....25, 26
Klein & Sons, Mathias.....17
Kohler Brothers.....22
Kuhlman Electric Co.....1

La Fayette Elect'l Mfg. Co...16
Leather Preserv. M. Corp....18
Leffel & Co., James.....23
Lindsley Bros. Co., The.....27
Loud's Sons Co., H. M.....26
Ludlow Valve Co.....—

Machado & Roller.....—
Maine Hub Mfg. Co.....—
Manhattan El. Supply Co.11-23
Manross, F. N.....—
Marion Ins. Wire & Rub. Co.17
Matthews & Bros., W. N....1-17
McCandless, H. W. & Co.....17
McLennan & Company, K....16
McRoy Clay Works.....24
Mica Insulator Company.....16
Michigan College of Mines..—
Miscellaneous Advs.....18
Monarch Elec. Mfg. Co.....—
Morse, Frank W.....—
Moss Tie Co., T. J.....26
Mott Iron Wks., J. L.....23
Mueller Company, William..26
Munsell & Co., Eugene.....16

National Battery Co.....7
National Brake & Elec. Co..32
National Carbon Co.....—
National India Rubber Co....—
New York Ins. Wire Co.....3
Niagara Tachometer & Instrument Co.....16
Norfolk & Western R. R.....—
North Electric Co.....25
Northern Elect'l Mfg. Co....18
Northern Pacific R. R.....28

Okonite Co., The.....1
Oliver Iron & Steel Co.....—
Oneida Community, Ltd.....1
Osburn Flex. Conduit Co.....24
Ostrander & Co., W. R.....1
Otto Gas Engine Works.....—

Pacific Coast Pole Co.....26
Pass & Seymour.....—
Perrizo & Sons.....26
Peru Elec. Mfg. Co.....—
Philadelphia Electric Co....21
Phillips, Eugene F.....17
Phillips Insulated Wire Co...17
Phoenix Glass Co.....1
Phosphor-Bronze S. Co.....23
Pignolet, L. M.....16
Plume & Atwood Mfg. Co....17
Porter Cedar Company.....26

Rail Joint Co., The.....11
Reisinger, Hugo.....7
Replogle Governor Works...23
Reynolds El. Flasher Mfg. Co.18
Robbins & Myers Co.....11
Robert Instrument Co., The..18
Robertson & Sons, Jas. L.....—
Rock Island Battery Co.....13
Roebling's Sons Co., J. A.....7
Rose Polytechnic Institute..22
Rossiter, MacGovern & Co...18
Ruebel & Wells.....22
Runzel-Lenz Elec. Mfg. Co..25

Safety Ins. Wire & Cable Co.. 1
Samson Cordage Works.....18
Sandwich Pole Changer Co..25
Sargent & Lundy.....—
Schott, W. H.....22
Schureman Co., J. L.....18
Seymour Mfg. Co.....23
Shelby Electric Co.....—
Simplex Electrical Co., The.. 1
Simplex Elec. Heating Co....16
Smith Storage Battery Co.... 7
Sorensen, P.....—
Southern Exchange Co.....27
Speer Carbon Co.....3
Spon & Chamberlain.....13
St. Marys Incand. Lamp Co.. 9
Standard Elect'l. Mfg. Co.... 4
Standard Underg. Cable Co.. 1
Stanley—G. I. Elec. Mfg. Co 2
Star Expansion Bolt Co.....18
Sterling & Son, W. C.....26
Stewart Elec. Co., Frank H..32
Stow Mfg. Company.....1-12
Stromberg-Carlson Tel. Mfg. Company.....25
Sturgess Engineering Dept....—
Switchboard Equipment Co.19

Torrey Cedar Company.....26
Trumbull Elec. Mfg. Co.....16

Van Lean Co., I. S.....19
Van Nostrand Co., D.....10
Vulcanized Fibre Company..32

Wagner Electric Mfg. Co.....6
Wesco Supply Co.....—
Western Electric Company ..20
Westinghouse Electric & Manufacturing Co.....29, 30
Westinghouse Machine Co....—
Weston Electrical Inst. Co... 1
Willard Storage Bat. Co.....—
Williamson & Co., R.....17
Willis, G. M.....22
Wilson Co., Jas. I. M.....26
Worcester Company, C. H....26
Wrigley Co., Thos.....—

Yonkers Specialty Co.....1

Zeidler Lamp & Brass Co.....7
Zeller, Geo. A. Book Co.....—

For Classified Index of Advertisements See Page 6.

Motors,
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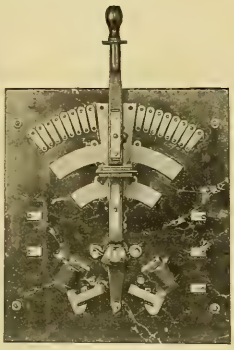

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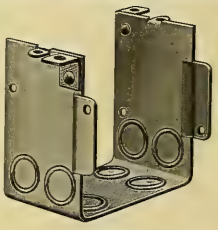
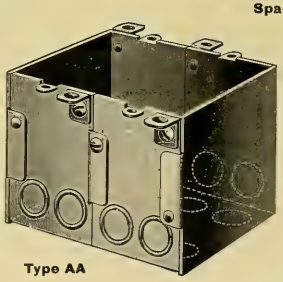
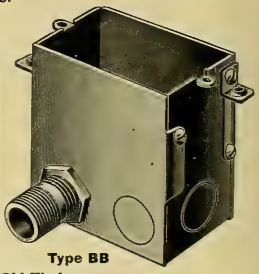


Spacer



Type AA



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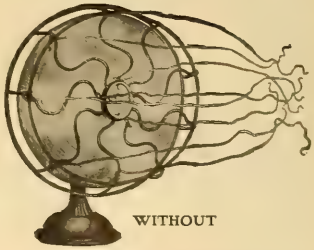

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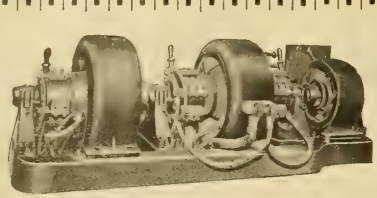

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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Air Deflector.
DOliet, Jr., Henry

Anchors, (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Anodes, Nickel and Copper
Seymour Mfg. Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician & Electrical Pub. Co
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Box, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Brake & Elec. Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Clusters.
Benjamin Elec. Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Crolius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse-Hinds Co.
Electric Appliance Co.
Gest, G. M.
McRoy Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Hurlbut & Jennings.
Central Electric Co.
Electric Appliance Co.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Oliver Iron & Steel Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Switchboard Equipment Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
Allis-Chalmers Company.
Benton & Son.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Doxsee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
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Badt, F. B.
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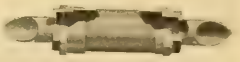

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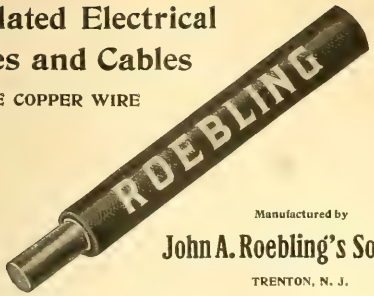

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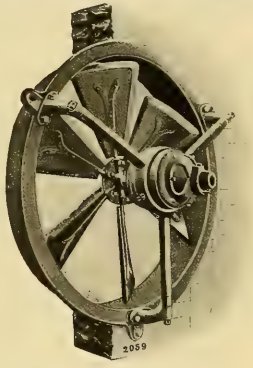

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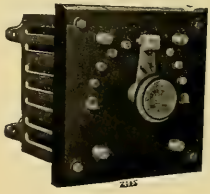

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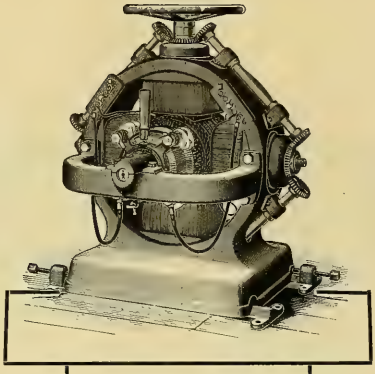

The only motor with which any conceivable speed within a wide range is obtainable.

Nothing to get out of order.

No controller or controlling resistances.

Constant and high efficiency at all speeds.

Steadiness of speed under load changes.

Only one voltage required to operate.

No auxiliary wiring or machinery.

Full rated H. P. capacity at all speeds.

Any imaginable speed within a very wide range.

Speed adjustable to a fraction of a revolution by turning hand wheel.

Speed variable from 100 to 500 per cent at practically constant efficiency.

Speed changes are not made by jumps or steps, but by a steady gliding process, which permits securing any speed to a fraction of a revolution.

Commutation is sparkless, and the speed, once set, is constant under all loads or load changes.

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Our Standard No. 8 is the best battery for higher class work. Standard No. 6 is the regular size for general purposes.

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CAPABLE OF HEAVY

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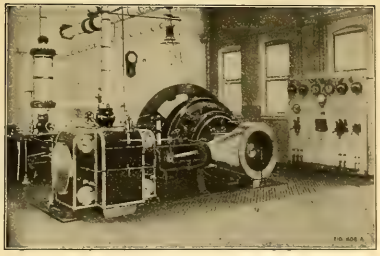

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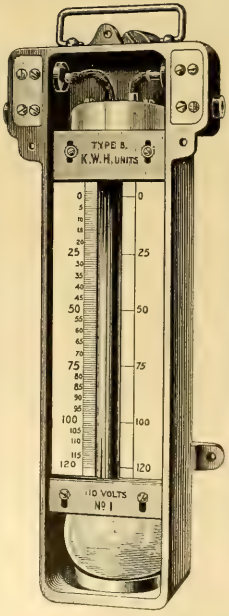

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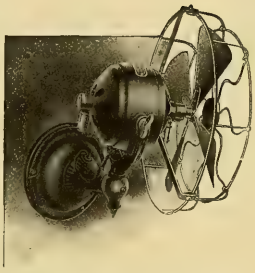
For Cooling and Heating Purposes



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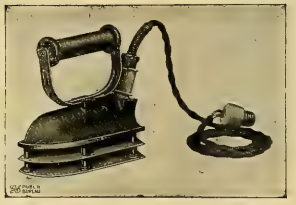

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Require Little Floor Space and Foundations

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Are not weakened by welds or holes for pins and rivets.
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1,500-KW. Westinghouse, 25-cycle, 3-phase, 15,000 volts, 80 RPM, direct-connected to Hamilton-Corliss horizontal cross-compound engine, 30 and 60 by 60 inches.

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A. C. Motors, 25 Cycle, 3 Phase.

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3—5-HP. G. E., 220-440 volt, type I, 750 RPM.

A. C. Motors, 25 Cycle, 2 Phase.

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75-HP. Westinghouse, 400 volts, 480 RPM.

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50-HP. G. E., 2,080 volts, class 10-50-720.

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30-HP. Westinghouse, 400 volts, type C, 850 RPM.

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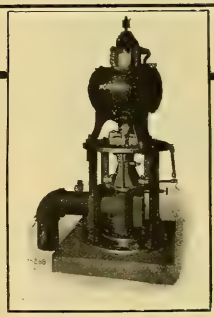

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When a man's electrical ideas flow freely; when he discusses electrical subjects intelligently and glibly, you will be pretty safe in assuming that he keeps in touch with electrical progress by perusing the Western Electrician 52 times a year.

OFFICE OF CONSTRUCTING OFFICER U. S. SOLDIERS HOME, Washington, D. C., May 10, 1906. Sealed proposals for erection of Power House, installation of Boiler Plant, Generating Machinery, Main Switchboard, Steam Laundry Equipment, Refrigeration Plant and Power House piping; also for Tunnels and Conduits for hot water distribution from Central Station, also for steam, refrigeration and electricity; construction of Pipes and Mains in Tunnels and Conduits for above; Heating and Ventilating Apparatus in New Mess Hall and Dormitory Building, will be received here until noon, June 28, 1906, and then publicly opened. Information on application. JOHN STEPHEN SEWELL, Captain, Corps Engineers, Constructing Officer.

DEPARTMENT OF THE INTERIOR, Washington, D. C., June 4, 1906. Sealed proposals will be received at the office of the United States Reclamation Service, Williston, North Dakota, until 10 o'clock a. m., July 9, 1906, for the installation of steam and electric pumping plants, and electric generating and transmission apparatus, including three pumping stations containing centrifugal pumps of 20 and 30 cubic feet per second capacity under heads of from 30 to 50 feet, driven by steam engines and electric motors aggregating 1,200 horsepower; also two 300 K. W. steam turbine generating units, a 1,000-horsepower boiler plant, and accessories, the necessary buildings and 3-mile transmission line, located in the vicinity of Williston, N. D. Particulars may be obtained from the Chief Engineer, U. S. Reclamation Service, Washington, D. C., or from H. A. Storrs, Electrical Engineer, Williston, N. D. E. A. Hitchcock, Secretary.

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OR SCRAPS, ANY SIZE OR CONDITION.

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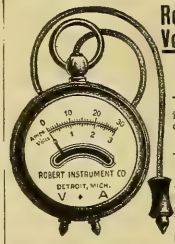

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List Price, $6.00 including leather case.

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3 Volts
30 Amperes

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RECO FLASHERS

Are easy to sell. You make a fine profit. Everybody with an electric sign wants one. Write us today for particulars and prices. Also pointers on electric signs.

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We are the real manufacturers of 75 per cent. of the Enameled Rings used in this country. Try us and see.

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"Practical and to the Point"

IS ALL THAT NEED BE SAID OF

THE TELEPHONE HAND-BOOK

By HERBERT LAWS WEBB.

160 Pages, 133 Illustrations, Cloth, Price $1.00.

The book for those interested in telephony.

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FIRST CLASS EQUIPMENT THROUGHOUT

High-Grade Machine Work of All Kinds
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Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

Direct-Connected Electric Lighting Units

Ready for Immediate Shipment

One (1) 100-K. W. General Electric Generator, Type M. P. Class 8-100-250, 120 volts, 8 poles, 250 R. P. M., amperes 813; direct-connected to 14½ x 15 McIntosh & Seymour horizontal automatic Engine. Mounted on one heavy iron bed plate.

One (1) 25-K. W. General Electric Generator, Type M. P. Class 6-25-275, 120 volts, 6 poles, 275 R. P. M., amperes 202; direct-connected to McIntosh & Seymour horizontal automatic Engine. Mounted on one heavy iron bed plate.

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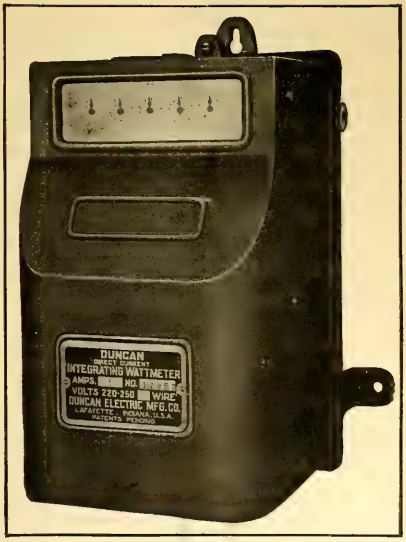

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CONTENTS

CHAPTER	
	Preface
I	The Electric Current
II	The Electric Battery
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IV	The Effects of Electric Flow Outside the Circuit—Magnetism and Induction—The Electrical Units
V	Electromagnets—The Telegraph
VI	Electric Signaling Apparatus
VII	The Relations Between Magnets and Electric Currents
VIII	Induction and Reactive Coils
IX	The Telephone
X	Telephone Accessories
XI	The Mechanical Generation of Electricity
XII	The Dynamo Machine
XIII	Various Types of Dynamo Machines
XIV	Alternators—Polyphase Currents
XV	The Electric Motor
XVI	The Electric Railway
XVII	Polyphase Currents and Motors
XVIII	Electrical Power Transmission
XIX	The Incandescent Light
XX	The Arc Light
XXI	Electrochemistry—Storage Batteries
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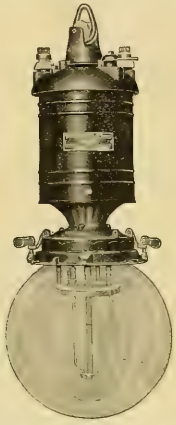

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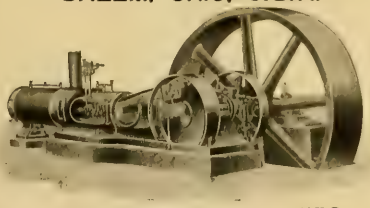

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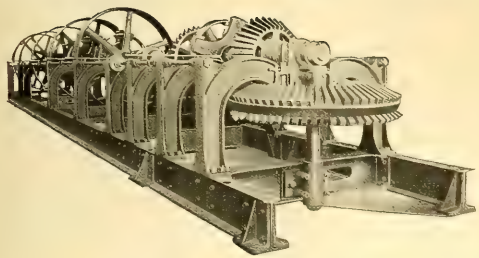

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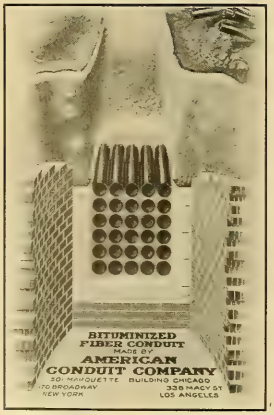

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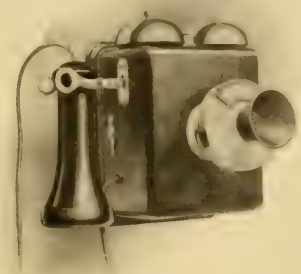

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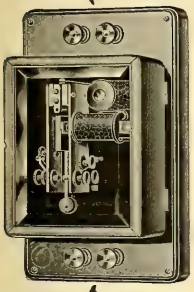

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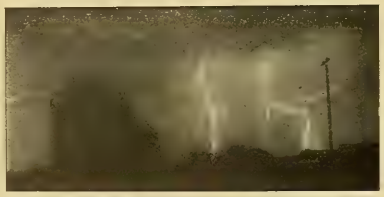

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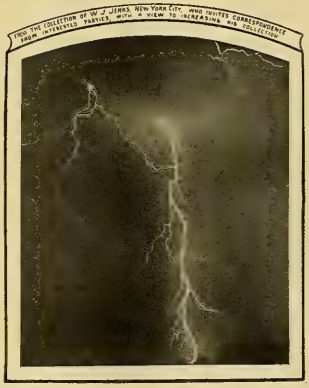

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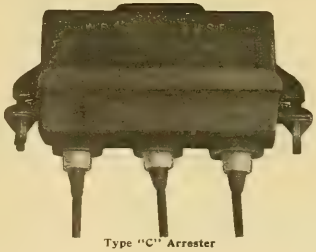

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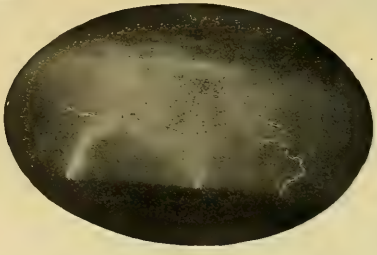

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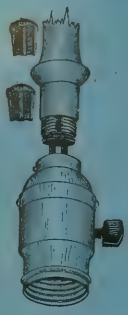

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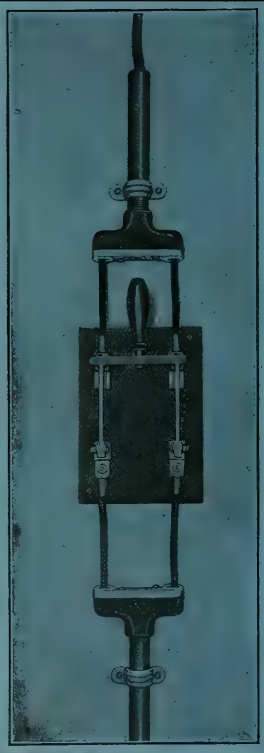

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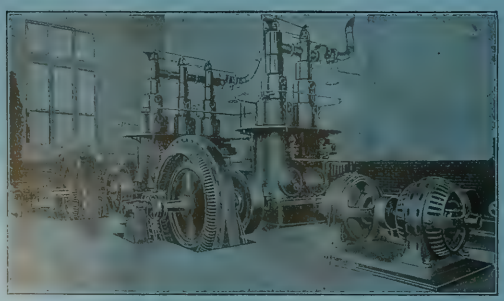

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Western Electrician

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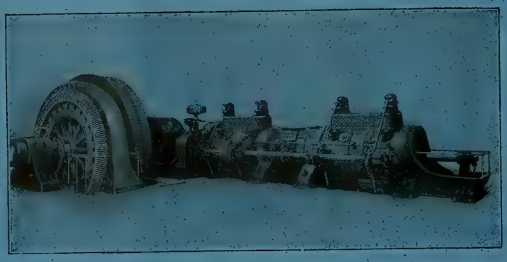
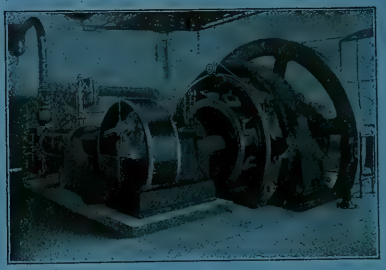
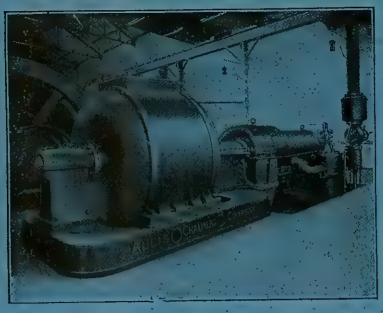


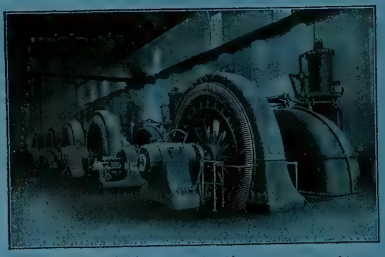
Allis-Chalmers Gas Engine driving Allis-Chalmers Alternating Current Generator.



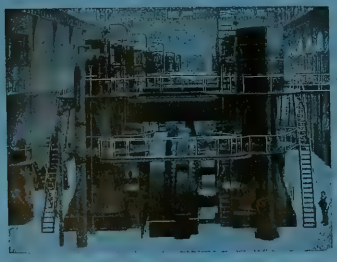
Allis-Chalmers Heavy Duty Engine direct connected to Allis Chalmers Generator.



Allis-Chalmers Steam Turbine direct connected to Allis-Chalmers Generator.



Allis-Chalmers Alternating Current Generators connected to Hydraulic Turbines.



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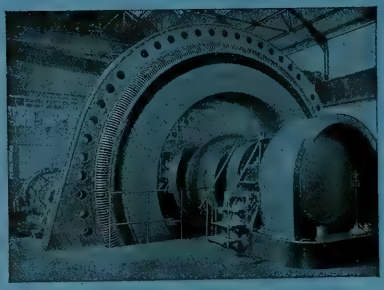

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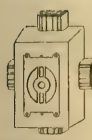

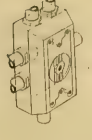

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig....38
Alton Machine Co....4
Allis-Chalmers Company....2
Amber Electric Co....—
American Battery Co....14
Amer. Circular Loom Co....1
American Conduit Co....36
American Diesel Engine Co.10
Amer. District Steam Co....11
Amer. Elect'l. Supply Co....23
Amer. El. Telephone Co....37
American Electrical Works..23
Arnold Co., The....34
Automatic Electric Co....36

Babcock & Wilcox Co....—
Badt, F. B....34
Bain, Forée & May....23
Baker & Co., Inc....3
Baker & Co., W. E....34
Beardslee Chandelier Mfg.Co.26
Belden Mfg. Co....—
Benjamin Elec. Mfg. Co....44
Berthold & Jennings....38
Bissell Co., The F....19, 38
Bliss Electrical School....—
Bossert Electric Construction Co....3
Bowser & Co., S. F....18
Bruer, Will F....38
Buckeye Electric Co....—
Buckeye Engine Co....35
Butterfield Construction Co.34
Bylesby & Co., H. M....34

Central Electric Co....5
Century Electric Co....34
Chicago Edison Co....4, 24
Chic. Fuse Wire & Mfg. Co....44
Chicago Ins. Wire & Mfg. Co 22
Chicago Mica Co....22
Chicago Pneumatic Tool Co.. 8
Chicago Telephone Co....36
Columbia Incand. Lamp Co.—
Cope, T. J....1
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co....34
Crolius & Son, E. R....—
Crouse-Hinds Co....18
Cutler-Hammer Mfg. Co....1
Cutter Elec. & Mfg. Company 1

D. & W. Fuse Company....30
Davis Electric Mfg. Co....—
Dearborn Drug & Chem. Wks.35
De La Vergne Machine Co. .32
Devine Co., Joseph P....22
Diamond Meter Company....34
Directory of Engineers....34
Dixon Crucible Co., Joseph..35
D'Olier, Jr., Co., Henry....14
Doxsee-Barrere Elec. Co....23
Driver-Harris Wire Co....14
Duncan Elec. Mfg. Co....12

Economical Elec. Lamp Co..26
Edison Decorative & Miniature Lamp Departm't....22
Edison Mfg. Company....36
Electric Appliance Co....22
Electric Storage Battery Co.. 3
Elect'l Trades Exposition Co.—
Electrician Pub. Company....40
Evans, Almirall & Co....9
Excello Arc Lamp Co....18

"For Sale" Advertisements..24
Ft. Wayne Elec. Works, Inc..43
Fostoria G'sss Spec. Co....17
Fostoria Incand. Lamp Co..28
Fowler & Co., John H....38
French Battery Co....—

General Electric Co....20, 21, 22
General Storage Bat. Co....22
Gest, G. M....36
Gleason, John L....3
Goodrich Steamship Lines..34
Gould Storage Battery Co.... 6
Gregory Electric Co....24

Haller Machine Co....—
Hart Mfg. Co....37
Hartford Steam Boiler Inspection & Insurance Co....—
Hazard Manufacturing Co....—
Helios Mfg. Co....—
Hemingray Glass Co....15
Hensel & Co., John A....14
Highland Park College....34
Hoffman, G. W....35
Hoffmann, Emil R....24
Holmes Fibre-Graph. Co....—
Humphrey, Henry H....34
Hunt & Co., Robt. W....34
Hunter Fan & Motor Co.... 5
Hydro Elec. Developmeat Co34

Illinois Central Ry....24
Indiana Rub. & Ins. W. Co.... 1
India Rubber & Gutta Percha Insulating Company....—
International Elec. Meter Co 4
International Tel. Mfg. Co....37

Jackson, D. C. & W. B....34
Jeffrey Manufacturing Co....35

Kartavert Manufacturing Co.—
Kellogg Switchboard & Supply Company....37, 38
Klein & Sons, Mathias....44
Kohler Brothers....34
Kuhlman Electric Co....14

La Fayette Elect'l Mfg. Co.—
Leather Preserv. M. Corp....—
Leffel & Co., James....35
Lindsley Bros. Co., The....39
Loud's Sons Co., H. M....38
Ludlow Valve Co....35

Machado & Roller....22
Maine Hub Mfg. Co....38
Manhattan El. Supply Co....44
Manross, F. N....23
Marion Ins. Wire & Rub. Co.—
Matthews & Bros., W. N....1, 23
McCandless, H. W. & Co....23
McLennan & Company, K....32
McRoy Clay Works....36
Mica Insulator Company....22
Michigan College of Mines. 34
Miscellaneous Advs....24
Monarch Elec. Mfg. Co....4
Morse, Frank W....—
Moss Tie Co., T. J....38
Mott Iron Wks., J. L....22
Mueller Company, William..38
Munsell & Co., Eugene....22

National Battery Co....14
National Brake & Elec. Co..19
National Carbon Co....26
National India Rubber Co.... 1
New York Ins. Wire Co.... 1
Niagara Tachometer & Instrument Co....25
Norfolk & Western R. R....—
North Electric Co....—
Northern Elect'l Mfg. Co....24

Okonite Co., The....1, 13
Oneida Community, Ltd....—
Osburn Flex. Conduit Co....36
Ostrander & Co., W. R....3
Otto Gas Engine Works....35

Pacific Coast Pole Co....28
Pass & Seymour....—
Perrizo & Sons....38
Peru Elec. Mfg. Co....19
Phelps Co., The....19
Phillips, Eugene F....23
Phillips Insulated Wire Co...23
Phoenix Glass Co....16
Phosphor-Bronze S. Co....35
Pignolet, L. M....22
Plume & Atwood Mfg. Co....—
Porter Cedar Company....38

Rail Joint Co., The....23
Reisinger, Hugo....19
Replogle Governor Works....—
Reynolds El. Flasher Mfg.Co. 1
Robbins & Myers Co....37
Robert Instrument Co., The..—
Robertson & Sons, Jas. L....—
Rock Island Battery Co....—
Roebling's Sons Co., J. A....44
Rose Polytechnic Institute..—
Rossiter, MacGovern & Co...24
Ruebel & Wells....34
Runzel-Lenz Elec. Mfg. Co.—

Safety Ins. Wire & Cable Co..36
Samson Cordage Works....23
Sandwich Pole Changer Co.—
Sargent & Lundy....—
Schott, W. H....7, 34
Schureman Co., J. L....1
Seymour Mfg. Co....35
Shelby Electric Co....25
Shelton Electric Co....18
Simplex Electrical Co., The... 1
Simplex Elec. Heating Co..9, 14
Smith Storage Battery Co....—
Sorensen, P....44
Southern Exchange Co....39
Speer Carbon Co....—
Spon & Chamberlain....—
St. Marys Incand. Lamp Co..27
Standard Elect'l Mfg. Co....—
Standard Underg. Cable Co....—
Stanley—G. I. Elec. Mfg. Co —
Star Expansion Bolt Co....3
Sterling & Son, W. C....38
Sterling Electric Mfg. Co... 31
Stewart Elec. Co., Frank H..—
Stow Mfg. Company....—
Stromberg-Carlson Tel. Mfg. Company....37
Sturgess Engineering Dept..35
Switchboard Equipment Co.19

Torrey Cedar Company....38
Trumbull Elec. Mfg. Co....18

Van Loan Co., I. S....—
Van Nostrand Co., D....—
Vulcanized Fibre Company..44

Wagner Electric Mfg. Co....—
Wesco Supply Co....22
Western Electric Company .30
Westinghouse Electric & Manufacturing Co....41, 42
Westinghouse Machine Co....41
Weston Electrical Inst. Co.... 1
Willard Storage Bat. Co....14
Williamson & Co., R....23
Willis, G. M....34
Wilson Co., Jas. I. M....38
Worcester Company, C. H....38
Wrigley Co. Thos....3

Yonkers Specialty Co.... 1

Zeidler Lamp & Brass Co....—
Zeller, Geo. A., Book Co....24

For Classified Index of Advertisements See Page 6.

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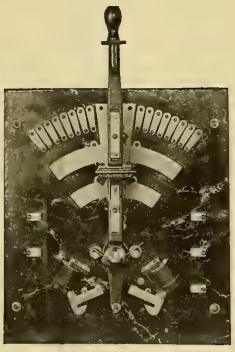

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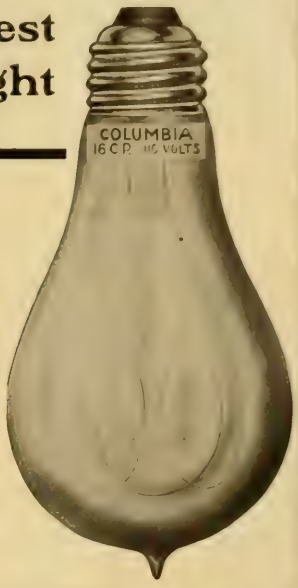

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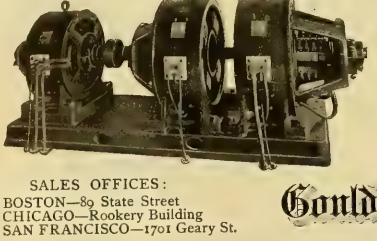

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1 West 34th Street
New York City
Works: Depew, N. Y.

CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Air Deflector.
O'Die Jr., Henry

Anchors, (Tel. & Tel.)
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Anodes, Nickel and Copper
Seymour Mfg. Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec Supply Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Spon & Chamberlain.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elec. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Kelsinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Brake & Elec. Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Clusters.
Benjamin Elec. Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Crolius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse-Hinds Co.
Electric Appliance Co.
Gest, G. M.
McKay Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co
Schureman Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Herrnold & Jennings.
Central Electric Co.
Electric Appliance Co.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Switchboard Equipment Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
Allis-Chalmers Company.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Dorsee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Bylesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Niagara Tachometer & Instrument Co.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
De La Vergne Machine Co.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Hunter Fan & Motor Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Karavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
McLeod, Ward & Co
Morse, Frank W.

Fixtures, Gas and Elec.
Beardsley Chandelier Mfg.Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

Germ'n Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Fostoria Glass Spec. Co.
Haller Machine Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.
Replogle Governor Works.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.
Evans, Almirall & Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Morse, Frank W.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Heminway Glass Co.
Indiana Rub. & ins. Wire Co.
Johns-Manville Co., H. W.
Karavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Excello Arc Lamp Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Economical Elec. Lamp Co.
Fostoria Incand. Lamp Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Phelps Co., The
Shelby Elec. Co.
St. Marys Incand. Lamp Co.
Standard Electric Mfg. Co.
Sterling Electric Mfg. Co.
Warren Elec. & Specialty Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil B.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Oil Cabinets.
Bowser & Co., S. F.

Patent Attorneys.
Bain, Fores & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Herrnold & Jennings.
Bruce, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The
Louis & sons Co., H. M.
Moss Tie Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Southern Exchange Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Potash (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Peru Electric Mfg. Co.

Portables,
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Benton & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rosettes.
Pass & Seymour.

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Bliss Electrical School.
Highland Park College.
Michigan College of Mines
Rose Polytechnic Institute.

Second-Hand Machin'y.
Amber Electric Co.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.
Nat'l Stamping & Elec. Wks.
Rossiter, MacGovern & Co.
Van Loan Co., I. S.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Soldering, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Crolius & Son, E. R.
Western Electric Co.

Solenoids.
Schureman Co., J. L.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst.Co.

Springs.
Manross, F. N.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elec'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
North Electric Co.
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service,
Chicago Telephone Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Torches,
Zeidler Lamp & Brass Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Brake & Elec. Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Vibrators.
Shelton Electric Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Driver-Harris Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 8.

CENTRAL STATION HEATING PLANTS

The Execution of an Entire Contract
Under One Management
INSURES SUCCESS

Originality of Design and Superiority of Construction
are Features in which We have no Competition

THE
SCHOTT
SYSTEMS

THE SCHOTT
BALANCED COLUMN
HOT WATER SYSTEM

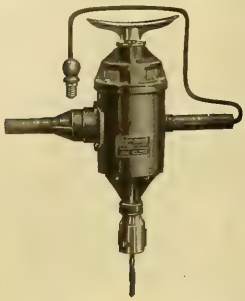
NO BACK PRESSURE
NO NOISE
GREATEST CAPACITY
PERFECT REGULATION

THE SCHOTT
AUTOMATIC VACUUM
STEAM SYSTEM

LEAST BACK PRESSURE
AUTOMATIC VACUUM CIRCULATION
GREATEST PIPE LINE CAPACITY
PERFECT REGULATION

W. H. SCHOTT
ENGINEER
American Trust Building, Chicago

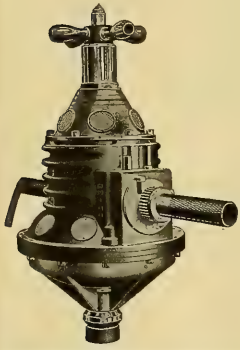
AIR COMPRESSORS AIR & ELECTRIC PORTABLE TOOLS



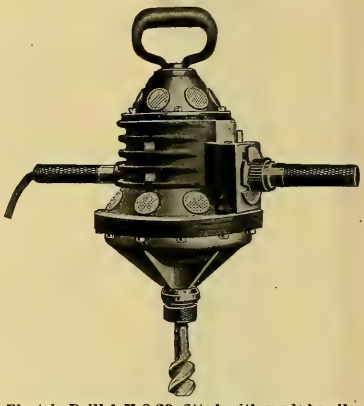
Air Cooled DUNTLEY Electric Breast Drill.
Cap ⅜ in. Wt. 13 lbs.

Electric Drill 1-M-1-10
Cap ¼ in. Wt. 16 lbs.

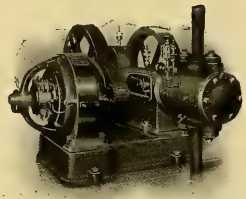
For the central station and repair shop; also for rail bonding, etc.



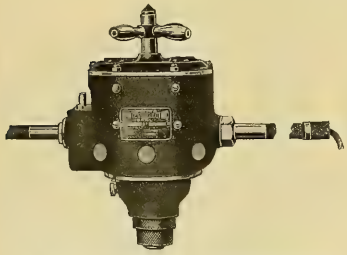
Electric Drill 1-M-3-20, fitted with telescopic feed screw.
Cap 1½ in. Wt. 35 lbs. Furnished reversible when desire .



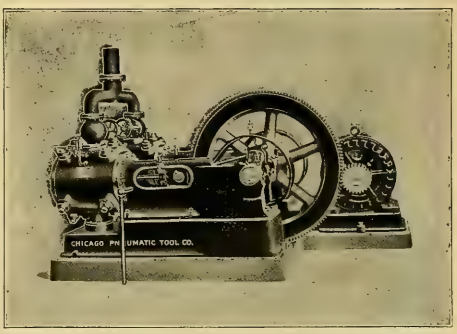
Electric Drill 1-M-3-20, fitted with spade handle and reversible switch for wood boring.
Cap 2½ in. in oak.



Franklin Air Compressor
Class G-SE.



Electric Drill, Two-Motor Type, 2-M-3-34.
Cap 1½ in. Wt. 40 lbs. Furnished reversible when desired.



Franklin Air Compressor. Class G-D.E.

WE have manufactured and sold portable tools for ELEVEN consecutive years and our experience is certainly worth something. Let us know your requirements, and we will quote you on an installation to fully meet the same.

CHICAGO PNEUMATIC TOOL CO.

CHICAGO--NEW YORK

BRANCH OFFICES:

Portland, San Francisco, Seattle, Los Angeles, Salt Lake City, Butte, Denver, St. Louis, St. Paul, Detroit, Cleveland, Boston, Pittsburg, Philadelphia

SOMETHING FOR NOTHING

"He who can make two blades of grass grow where one grew before is a benefactor to the whole human race."

WE CAN SHOW YOU HOW TO GROW THE SECOND BLADE

Central Station Heating as an adjunct to Electric Service has proven its worth. Electric Service alone is only one blade of grass; make Central Station Heating grow the second blade. By utilizing exhaust steam you are making something out of nothing—making dividends. The profit from heating **PUTS YOU ON VELVET.**

BUT Central Station Heating must be properly **designed** and **installed.** Our fundamental patents cover the **best features** and are **essential to economy** in operation.

THAT'S WHY our equipment is selected by the best properties in this country.

AGAIN, WE'VE SOMETHING NEW—The only central station heating system UTILIZING EXHAUST from steam turbines RUNNING CONDENSING. EXHAUST STEAM from non-condensing engines used with NO BACK PRESSURE. PERFECT TEMPERATURE CONTROL.

DO YOU KNOW ABOUT IT? If Not, GET POSTED

COSTS YOU NOTHING TO FIND OUT. We'll send you catalogue, list of installations and hints **"How to Make Your Plant Pay."** Write us.

EVANS, ALMIRALL & CO.

281-3 Water St., NEW YORK 1413 G St., N. W. WASHINGTON, D. C. 1057-8 Monadnock Bldg., CHICAGO

Our Exhibit at Atlantic City N. E. L. A. Convention

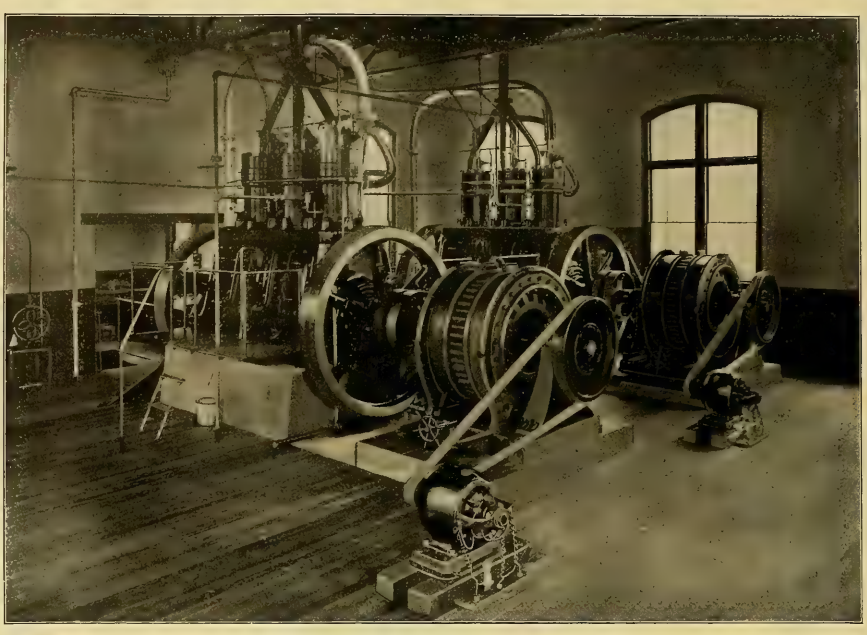
SIMPLEX SERVICE QUALITY IN ELECTRIC HEATING DEVICES stands for the very highest state of the art of making such things.

The advantages of Simplex Apparatus are real and tangible, and we'll have no difficulty in proving this to be the case, if you'll let us talk to you or read our illustrated catalog.

DROP US A LINE

SIMPLEX ELECTRIC HEATING CO.

CHICAGO: Monadnock Block ***CAMBRIDGE, MASS.***



DIESEL OIL ENGINE PLANT, CITIZENS ELECTRIC LIGHT AND ICE COMPANY, LEBANON, INDIANA

Actual Performances

daily prove every claim we have made for the capacity, reliability and unparalleled economy of the Diesel Engine. No reciprocating steam engine, no steam turbine, no gas or other oil engine can even approach, under test, the regular daily performances of Diesel Engines under service conditions and in the customers' hands.

Observe these comparative efficiencies:

A good slide valve steam engine utilizes only	5%	A reheating compound or a triple expansion utilizes only	12%
A plain Corliss engine utilizes only	6%	The best oil engines (explosion type) utilize only	16%
A compound condensing engine utilizes only	8%	The best gas engines (explosion type) utilize only	19%

The Diesel Engine Utilizes Fully 38% of the Fuel Consumed

The Diesel Engine burns the cheapest grades of fuel and crude oil and petroleum distillates, costing, as a rule, less than 3½ cents per gallon delivered at your plant.

The following condensed reports are offered as specific proofs in support of our unchallenged claim that the Diesel engine is the most economical prime mover on earth.

Location of Plant	Average Load	Average Load Factor	Cost of Power
Tyrolean Alps, World's Fair, St. Louis	250 Kw.	50 per cent	3 mills per Kw. hour
Terminal Traction Bldg. Indianapolis	74.3 Kw.	30.54 per cent	3⅜ mills per Kw. hour
Citizens Electric Light & Ice Co. Lebanon, Ind.	63.6 Kw.	27 per cent	3 6 10 mills per Kw. hour
Effingham Light & Power Company Effingham, Ill.	28 Kw.	16 per cent	4½ mills per Kw. hour
Wayne Paper Mills Hartford City, Ind.	233⅓ Kw.	78.8 per cent	2 9-10 mills per Kw. hour

There are many other plants doing as well or still better. These are average plants selected so as to show the remarkable economy of this engine under all conditions of load.

TO THOSE INTERESTED

a valuable new catalogue has just been issued. It contains a full description of the Diesel Engine, with data and records of actual daily performances. Copies free.

AMERICAN DIESEL ENGINE CO.

11 BROADWAY, NEW YORK

29 YEARS EXPERIENCE

UNDERGROUND STEAM HEATING MAINS

FROM CENTRAL STATIONS

"NUFF SED"

WRITE FOR "STORY"
District Steam Heating

AMERICAN DISTRICT STEAM CO.

1101 ELM ST
LOCKPORT N. Y

MONADNOCK BLDG.
CHICAGO, ILL.

The Central Station Man's Toast

The following toast on "Meters" was recently offered at a dinner at which a number of central station owners, managers and superintendents were present.

It shows, beyond any possible doubt, the high esteem in which the Duncan meter is held, and the popularity which it enjoys.

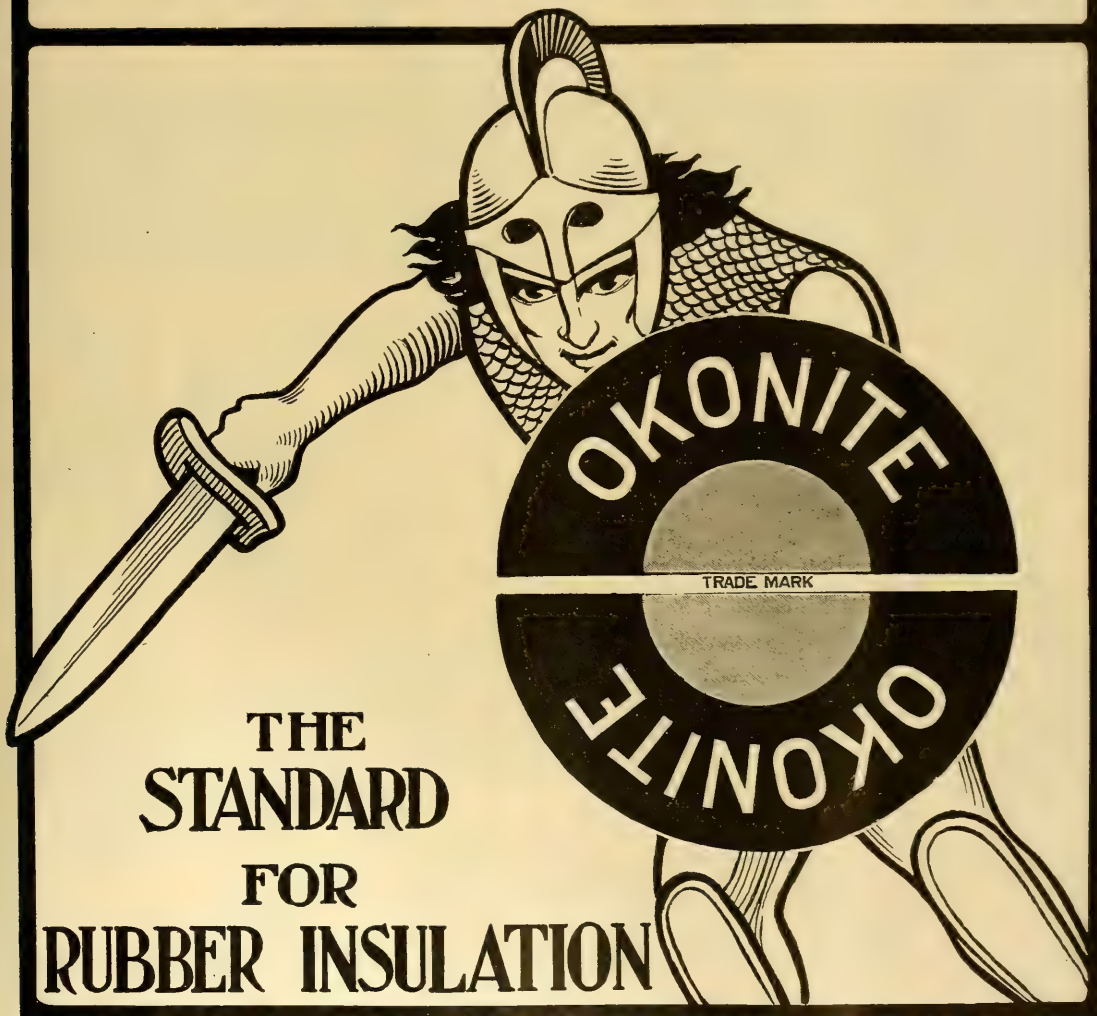
"The Gourmet is a meat-er
Loves his viands and his wine;
And the Poet uses meter
In his verse for every line;
The Gas man has a meter
For his product volatile;
And the Waterworks a meter
For its fluid—pure or vile.
The Lover loves to meet 'er
In the pleasant summer's night;
And all use the Duncan Meter
For to measure Power and Light."

It must be admitted that the author of the foregoing displayed excellent judgment in his choice of an electric meter; and, after the banquet, he admitted that he had tried all makes of meters and found the DUNCAN the "Gibraltar" of his defense against loss of money on small load customers—by virtue of its extreme accuracy. It's the "Meter of equity." Let us send a sample to you on 30 or 60 days' trial. This is all we ask, as the meter will do the rest.

Duncan Electric Manufacturing Co.

LAFAYETTE, INDIANA

PERFECT PROTECTION



THE STANDARD FOR RUBBER INSULATION

The OKONITE COMPANY *Ltd*

Manufacturers of Insulated Wires and Cables

253 BROADWAY NEW YORK CITY.

Man'fg's Adv. Bureau

WILLARD STORAGE BATTERIES

FOR ALL PURPOSES

Manufactured by

THE WILLARD STORAGE BATTERY CO.

CLEVELAND, OHIO

RELIABLE "Unit Accumulator"

National Battery Company

ELECTRIC STORAGE BATTERIES

Branch Offices:
NEW YORK, CHICAGO

BUFFALO, N. Y.

IF YOU ARE INTERESTED IN STORAGE BATTERIES IT WILL PAY YOU TO

WRITE! WRITE!! WRITE!!!

And Learn the Merits and Details of the MUCH CONTESTED BUT VICTORIOUS

HENSEL STORAGE BATTERY

JOHN A. HENSEL & CO., 11 and 13 ELDREDGE COURT, Near Michigan Avenue CHICAGO

"Ribbons Show Which Way the Wind Blows"

You Get the AIR, but NOT the Direct DRAFT

WITH

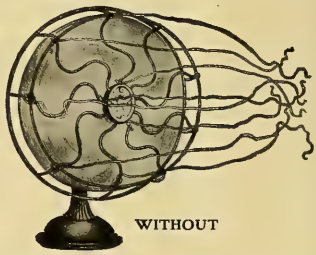
From the Electric Fan that is equipped with the D'Olier Air Deflector.

MADE IN TWO SIZES

For 12-inch Guard, - $1.50 each

For 16-inch Guard, - $2.50 each

You can attach them to the Fan Guards with no trouble whatever. Simple. Neat. And last the life of the Fan. They keep the Air Circulating throughout the entire room.



WITHOUT

HENRY D'OLIER, JR., COMPANY, 119-121 South Eleventh Street, Philadelphia, Pa.

Electric Heating Apparatus

SEND FOR 82-PAGE CATALOGUE

"UNIT" ENAMELED RHEOSTATS

SIMPLEX ELECTRIC HEATING CO.

Cambridgeport, Mass.

TRANSFORMERS

KUHLMAN ELECTRIC CO., - - ELKHART, IND.

"AMERICAN" STORAGE CELLS

ARE THE BEST. Send for descriptive Circular.

AMERICAN BATTERY CO.,

ESTD 1889. 171 S. Clinton St., Chicago.

FOR BEST RESULTS IN

ARC LAMP WORK

USE

HIGH-RESISTANCE
UNIFORMITY

"CLIMAX"
RESISTANCE
WIRE

DURABILITY
ACCURACY

DRIVER-HARRIS WIRE CO.

OFFICE AND WORKS:

HARRISON, NEW JERSEY

SCREW GLASS INSULATORS

For All Purposes

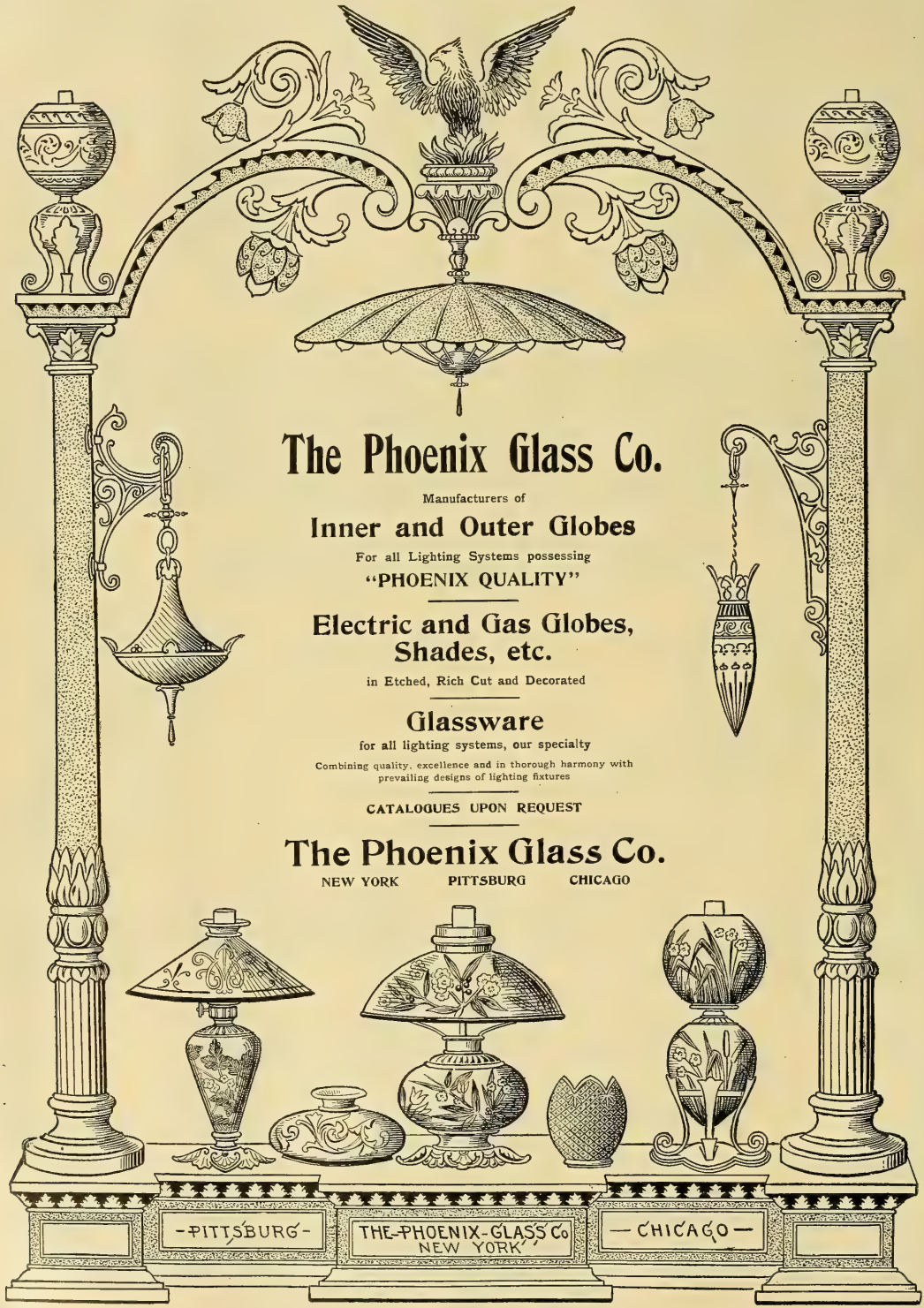
LIGHT
POWER
TELEPHONE

"See the Teats on the Petticoats"

HEMINGRAY GLASS CO.

FACTORIES

ESTABLISHED 1848 MUNCIE, INDIANA. COVINGTON, KY.



The Phoenix Glass Co.

Manufacturers of

Inner and Outer Globes

For all Lighting Systems possessing

"PHOENIX QUALITY"

Electric and Gas Globes, Shades, etc.

in Etched, Rich Cut and Decorated

Glassware

for all lighting systems, our specialty

Combining quality, excellence and in thorough harmony with prevailing designs of lighting fixtures

CATALOGUES UPON REQUEST

The Phoenix Glass Co.

NEW YORK PITTSBURG CHICAGO

FOSTORIA NOBLAC

TO USERS OF INNER GLOBES

The enormous demand for NOBLAC Inner Globes, both ordinary and heat resisting, is only one of the many reasons which have convinced the shrewd buyer that they are the best on the market.

There is no guess work about NOBLAC Inner Globes.

They are made accurately, honestly and perfectly.

They fill all requirements.

They do not blacken, and require cleaning much less frequently than any other make.

The glass of which heat resisting NOBLAC Inner Globes are made does not soften under the fiercest heat.

The heat resisting NOBLAC are longer lived than any others, due to the fact that they withstand greater and more sudden variations of temperature. This fits them for especially severe conditions of service.

They can be operated without an outer globe at a considerable saving to the lighting company and with increased light to the public.

We guarantee a high standard of uniformity.

We have three large factories with adjacent warehouses aggregating 127,000 square feet of available floor space.

We make an aggregate of twenty million pieces of special high-grade heat resisting glassware annually.

Send for "THE STORY OF FOSTORIA"—It contains much valuable information for Inner Globe users.

The FOSTORIA Glass Specialty Co.

MIXERS of GLASS and SCIENCE

FOSTORIA, OHIO

The

Shelton Vibrator

No Vibration in the HANDLE

LIGHT
POWERFUL
PORTABLE
DURABLE

The SHELTON Portable VIBRATOR ready for use can be regulated while in motion to any degree of vibration.

Manufactured by

The Shelton Electric Co.

511 Atlas Block, Chicago

EXCELLO

"Sunray"
and "Snowball"

LUMINOUS ARC LAMPS

CURRENT CONSUMPTION GUARANTEED

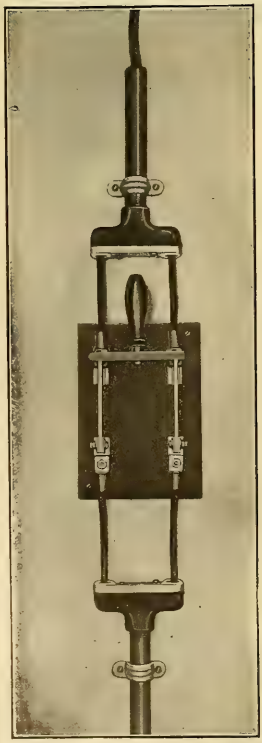
.265 WATTS PER C. P.

Mechanism and durability fully warranted for one year. Write for Catalogue.

THE

Excello Arc Lamp Company

24 and 26 East 21st St., New York



THE

SENSIBLE

AND

CHEAP

way of getting your wires

OUT OF OR INTO CONDUIT

is to use

CONDULETS

CATALOGUE DESCRIBES SEVERAL HUNDRED KINDS

GET IT

CROUSE-HINDS CO.

MANUFACTURERS

70 W. Jackson Blvd., CHICAGO.

Every Central Station

Needs a Bowser for Lubricating Oils

One of many styles

The only way to keep the oils pure, clean and free from dirt and grit.

The only way to keep the oil from off the floors.

The only way to prevent all waste of oil is found in

The Bowser Adjustable Measure Oil Cabinet

Exactly fills the oiler at one stroke, no slop, drip or odor

S. F. BOWSER & CO., Inc, FORT WAYNE, IND.

EASTERN OFFICE, 255 Atlantic Ave., Boston, Mass. *Send for Catalog 33*

Iron Clad Service Switch

Cat. No.		Price
1210	110-v. 2-wire	$3.12
1212	250-v. 2 "	3.75
1214	250 v. 3 "	4.50

Discount 50 per cent

Special prices in quantities

This device was designed for use in locations exposed to dampness, corrosive fumes, or mechanical injury.

The case is of cast-iron, having a closely fitting door with spring latch, which can be sealed or pad-locked.

In the box is mounted a 25-ampere combined switch and cut-out on a porcelain base. The three following styles are now furnished:

The Trumbull Electric Mfg. Co.

606 Woodford Ave., Plainville, Conn

ELECTRA CARBONS

"ELECTRA" CARBONS ARE MADE OF THE BEST MATERIAL.
"ELECTRA" CARBONS ARE ALWAYS UNIFORM IN QUALITY, DIAMETER AND STRAIGHTNESS.
"ELECTRA" CARBONS ALWAYS GIVE SATISFACTION.

HUGO REISINGER 11 BROADWAY **NEW YORK**

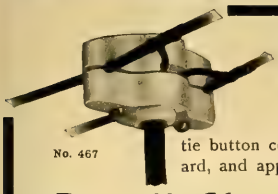
TRADE SE MARK

CIRCUIT BREAKERS

ALL STANDARD TYPES AND BUILT TO SPECIAL DESIGNS

The Switchboard Equipment Company
BETHLEHEM, PA.

CLEVELAND: Crosby, Craft & Co. CHICAGO: Francis Raymond



No. 467

The Safest Job

Is the result of using "Peru" Cleat-Tie Buttons, a cleat and tie button combined. National Code Standard, and approved by your city inspector.

"Peru" Cleat-Tie Button

Saves a pair of cleats, two screws, and half the time in wiring, and guarantees the neatest and safest job, passing every inspection. Specify "Peru" to your jobber or order direct.

PERU ELECTRIC MFG. CO., Peru, Indiana

SECURITY CABLE COMPOUND
IS THE BEST AND CHEAPEST

Get our prices and send us a trial order.

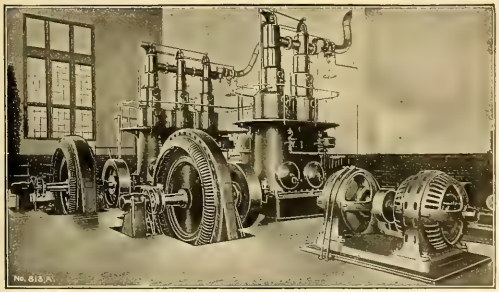
Security Compound used in connection with **Novelty Potheads** make a fine combination. Anyone able to handle a soldering iron can do the work now. No high priced man necessary to make joints absolutely watertight. It is economy to buy them.

Our **Novelty Sleeves** are made straightaway, two way and three way. Bulletin No. 125 tells all about the ease and convenience of installing. Alterations quickly made. Can be opened and restored without trouble.

Security Double End Wrenches cost little, are handy, and are furnished to fit any pothead.

TOLEDO, OHIO THE F. BISSELL COMPANY

THE F. BISSELL COMPANY · TOLEDO, O.



Independent Light and Power Co.'s Plant, Quincy, Ill.

Direct and Alternating Current

Motors and Generators

BULLETINS SENT ON REQUEST

National Brake & Electric Company
MILWAUKEE

GENERAL SALES OFFICE: 519 First National Bank Bldg., Chicago

The General Electric Company

Desires to Announce

The Tantalum Lamp

Highest efficiency of any form of commercial incandescent lamp requiring only 2 w. p. c.

Secures a saving of 35% over present 3.1 w. p. c. lamps.

Maximum brilliancy of light.

Supplied in units consuming about 44 watts, averaging 22 c.p. (mean horizontal—English Parliamentary), and giving an average life of 700 hours on direct current.

Supplied with suitable Holophane Pagoda Reflectors to give concentrated and distributed downward values.

Maximum efficiency.

THE G. E. TANTALUM LAMP

(ACTUAL SIZE)

22 c. p.—44 WATTS

2 Watts per Candle (Mean Horizontal—English Parliamentary Standard)

The General Electric Company

Main Lamp Sales Office,

HARRISON, N. J.

Sales Offices in all Large Cities

CHICAGO OFFICE, Monadnock Block

General Electric Company

Porcelain Sockets

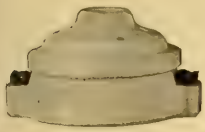
Strong and Durable

Spring Center Contacts

Copper Screw Shells

Approved by Underwriters

Unequalled for service where subject to acid fumes
All live parts rigidly attached to single porcelain shell



For cleat work

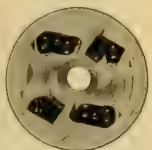
For concealed work

For moulding work

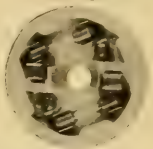
Ceiling Rosettes

These G. E. Ceiling Rosettes are specially designed to meet all requirements of proper wiring. The base of the concealed type is extra deep and a recess is provided in the back for the projecting ends of tubes or flexible conduit.

The caps of either the 125-volt link or 250-volt glass tube fused rosettes are interchangeable on any form of base.



Cap with link fuses for 125-volt circuit



Cap with glass tube fuses for 250-volt circuits

Principal Office: SCHENECTADY, N. Y.
Chicago Office: MONADNOCK BLDG.
Sales offices in all large cities

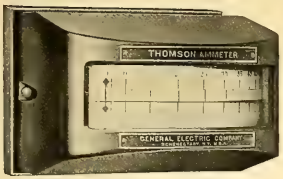
939

General Electric Company

Thomson A. C. Switchboard Instruments

Horizontal Edgewise Type

Ammeters, Voltmeters, Single and Polyphase Wattmeters, Frequency and Power Factor Indicators



Horizontal Edgewise Ammeter—Exterior

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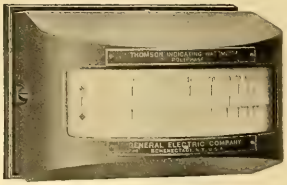
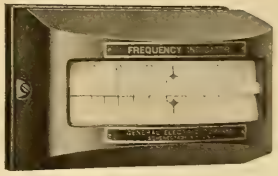
Vertical Suspension of moving parts minimizes friction and maintains perfect balance.



Horizontal Edgewise Polyphase Wattmeter

Effectively Damped

Aluminum sector swinging in permanent magnetic field prevents overrunning of pointer.



Horizontal Edgewise Frequency Indicator—Exterior

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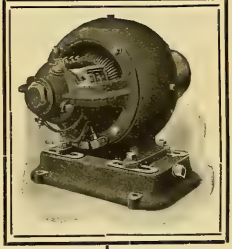

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DEPARTMENT OF THE INTERIOR, Washington, D. C., June 4, 1906. Sealed proposals will be received at the office of the United States Reclamation Service, Williston, North Dakota, until 10 o'clock a. m., July 9, 1906, for the installation of steam and electric pumping plants, and electric generating and transmission apparatus, including three pumping stations containing centrifugal pumps of 20 and 30 cubic feet per second capacity under heads of from 30 to 50 feet, driven by steam engines and electric motors aggregating 1,200 horsepower; also two 300 K. W. steam turbine generating units, a 1,000-horsepower boiler plant and accessories, the necessary buildings and 3-mile transmission line, located in the vicinity of Williston, N. D. Particulars may be obtained from the Chief Engineer, U. S. Reclamation Service, Washington, D. C., or from H. A. Storrs, Electrical Engineer, Williston, N. D. E. A. Hitchcock, Secretary.

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WHICH LAMP WILL YOU BUY?

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You never heard of the Red Tape Factory? No, because they do not list it with the other 26 to 30 or so lamp factories. But it is running just the same. And it is weaving daily vast quantities of the "tape" that binds you and their salesmen together (at "16 to 18 cents per)."

Now, you see it is this way. Each rapid-fire, hustling little lamp salesman has tied to his coat-tail a narrow but very long piece of red tape. This tape reaches back to his district manager's office; and, would you believe it, the district manager, too, has a piece of red tape tied to his coat-tails, and that piece of red tape is a long piece, but it is not so narrow and reaches back to—well way back into what we might call the "inner circle" of the "Organization"—and—well—nobody "on the outside" has yet really followed the tape to its end—but there is a great network of red tape at the "inner circle."

Think of these 26 to 30 or so "lamp companies," each with its little army of salesmen—think of all the factories of these companies; think of the fact that they are all bound together with this red tape to prevent any wicked little salesman, perchance, to cut a price; think of the books, the auditors, the stenographers, the general managers, the district managers, etc., etc., etc., and you will see why the "Organization" needs its red tape factory.

You have your own accounts to keep and you know what it is to run a single business—think of all this—and you will understand how it is that somewhere there must be a "red tape factory" running night and day AT GREAT EXPENSE TO WEAVE "THE TAPE THAT BINDS" THIS ARMY TOGETHER, and, don't forget this either, the little one cent or so that you pay for your lamps supports this factory.

Why do you pay it? Why not buy your lamps from a factory that has no "red tape annex"—a factory that much prefers to give that extra cent to you, and can still make a fair profit?

We may some day tell you more about the intricacies of the "Organization's Red Tape Factory."

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There are thousands of lamp buyers to-day who are "getting it," and although the laws of nature decree that this is a necessary condition, we believe that there are many who do not really deserve it, and it is to them that we are beckoning. We cannot, here, go into detail, and our health isn't our last consideration—but our customer's interest *is* our first—that's because our health depends upon it.

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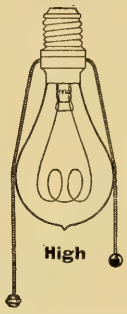

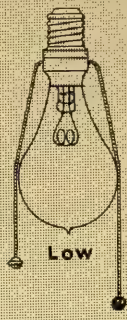

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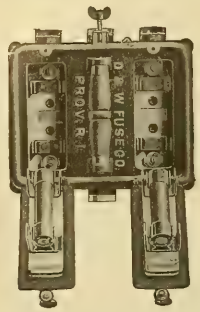

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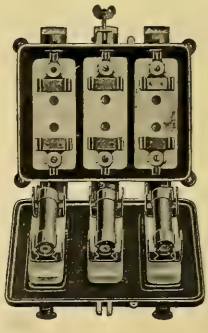

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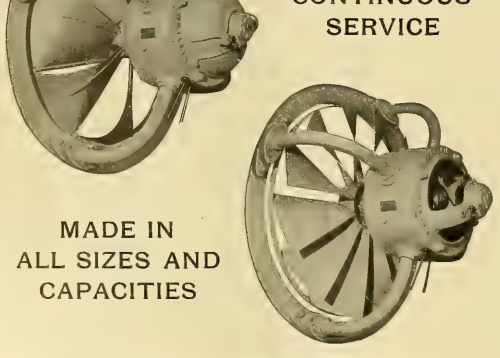

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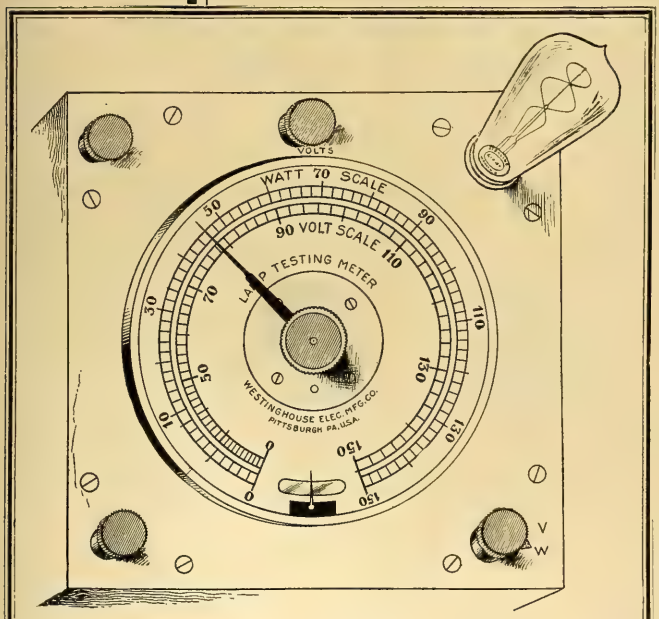

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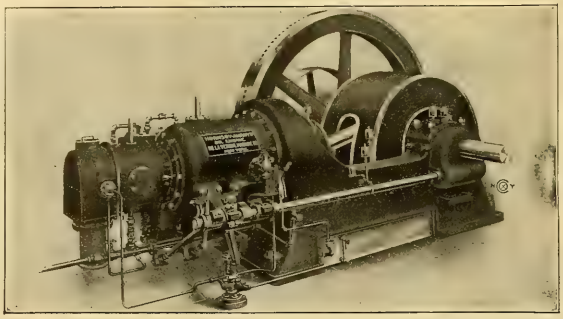

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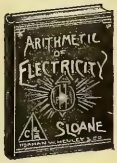

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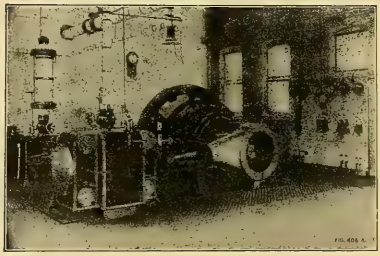

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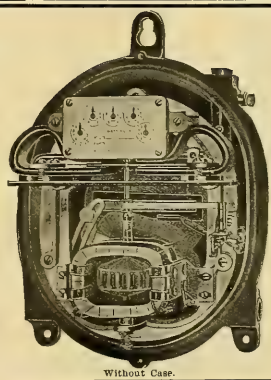

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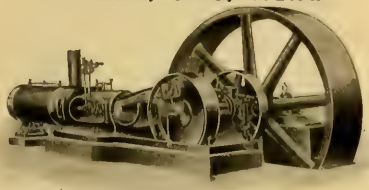

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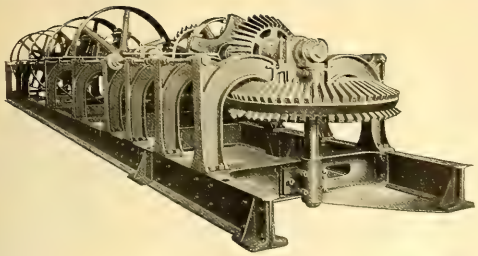

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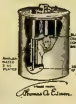

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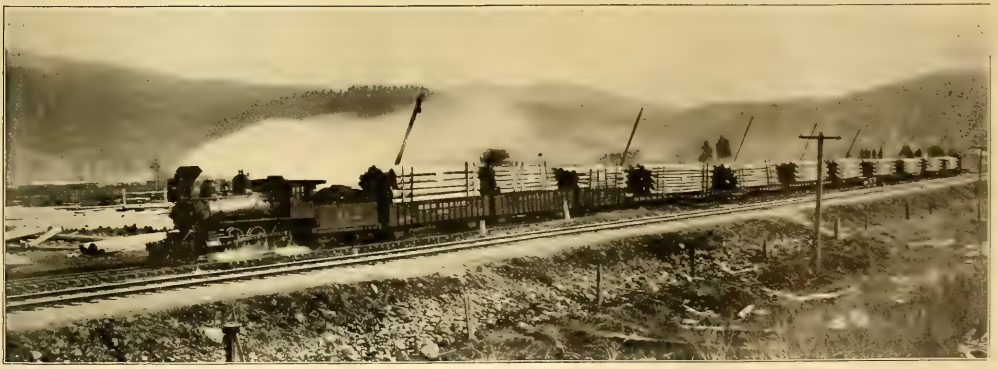

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Introduction. Index of Terms. Description of Cells and their Mode of Employment. Setting up the Cells and the Accumulator House. Charging—Storage Capacity of Various Cells—Weight per h.p.-hour Capacity of Various Accumulators. Discharging. Failures; their Causes and Remedies. Testing a Section. Summary. Index.

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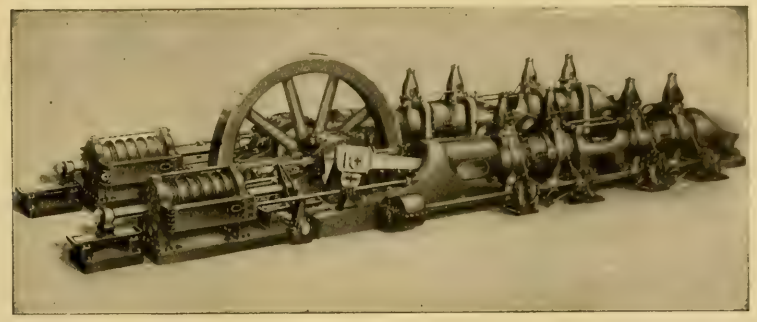

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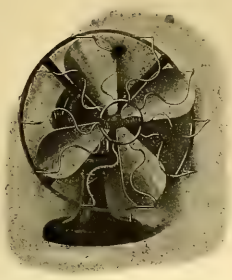

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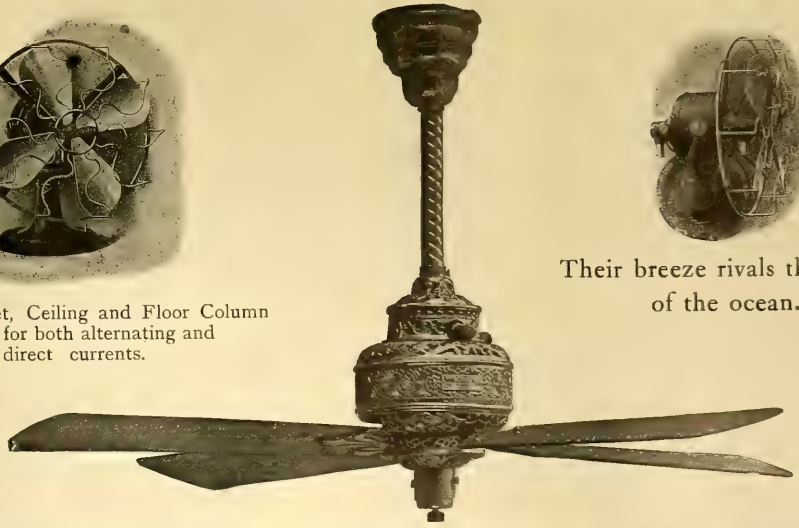

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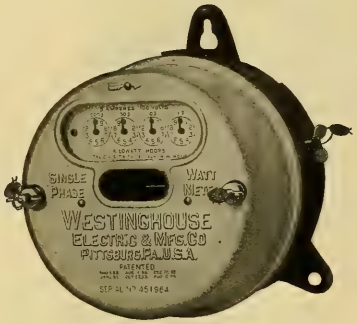

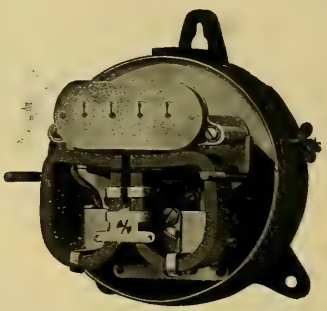

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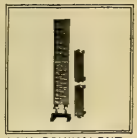

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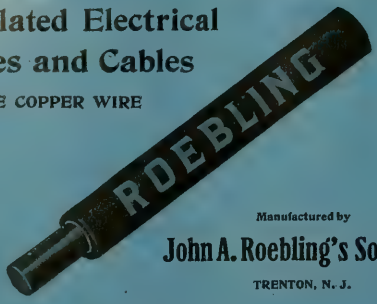

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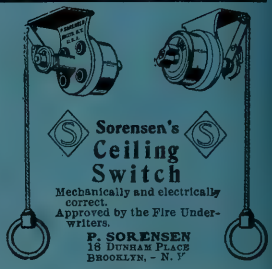

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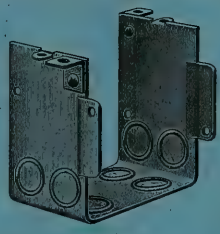

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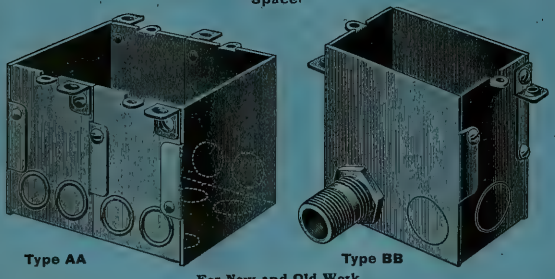

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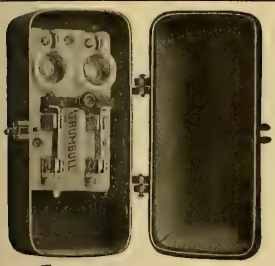

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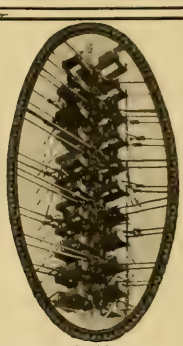

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Abeles & Taussig....20
Aiton Machine Co....4
Allis-Chalmers Company....—
Amber Electric Co....—
American Battery Co....—
Amer. Circular Loom Co....1
American Conduit Co....4
American Diesel Engine Co.—
Amer. District Steam Co....15
Amer. Elect'l Supply Co....14
Amer. El. Telephone Co....19
American Electrical Works..13
Arnold Co., The....21
Automatic Electric Co....19

Babcock & Wilcox Co....—
Badt, F. B....21
Bain, Forée & May....—
Baker & Co., Inc....3
Baker & Co., W. E....21
Beardslee Chandelier Mfg.Co.—
Belden Mfg. Co....13
Benjamin Elec. Mfg. Co....—
Berthold & Jennings....20
Bissell Co., The F....11, 20
Bliss Electrical School....—
Bossert Electric Construction Co....22
Bruer, Will F....20
Buckeye Electric Co....—
Buckeye Engine Co....15
Butterfield Construction Co.—
Byllesby & Co., H. M....21

Central Electric Co....5
Century Electric Co....4
Chicago Edison Co....4, 14
Chic. Fuse Wire & Mfg. Co....8
Chicago Ins. Wire & Mfg. Co.12
Chicago Mica Co....12
Chicago Pneumatic Tool Co..18
Chicago Telephone Co....18
Columbia Incand. Lamp Co.—
Cope, T. J....4
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co....22
Crolius & Son, E. R....—
Crouse-Hinds Co....11
Cutler-Hammer Mfg. Co....5
Cutter Elec. & Mfg. Company—

D. & W. Fuse Company....—
Davis Electric Mfg. Co....—
Dearborn Drug & Chem. Wks.15
Devine Co., Joseph P....21
Diamond Meter Company....—
Directory of Engineers....21
Dixon Crucible Co., Joseph..15
D'Oller, Jr., Co., Henry....9
Doxsee-Barrere Elec. Co....—
Driver-Harris Wire Co....5
Duncan Elec. Mfg. Co....23

Edison Decorative & Miniature Lamp Departm't....12
Edison Mfg. Company....14
Electric Appliance Co....12
Electric Storage Battery Co..3
Elect'l Trades Exposition Co.—
Electrician Pub. Company...10

"For Sale" Advertisements..14
Ft. Wayne Elec. Works, Inc..23
Fowler & Co., John H....—
French Battery Co....—

General Electric Co....11, 12
General Storage Bat. Co....12
Gest, G. M....4
Gleason, John L....—
Goodrich Steamship Lines...—
Gould Storage Battery Co....—
Gregory Electric Co....14

Haller Machine Co....22
Hart Mfg. Co....23
Hartford Steam Boiler Inspection & Insurance Co....—
Hazard Manufacturing Co...24
Helios Mfg. Co....24
Hensel & Co., John A....—
Highland Park College....21
Hoffman, G. W....13
Hoffmann, Emil R....—
Holden Anchor Co....12
Holmes Fibre-Graph. Co....8
Humphrey, Henry H....21
Hunt & Co., Robt. W....21
Hydro-Elec. Development Co21

Illinois Central Ry....14
Indiana Rub. & Ins. W. Co....1
India Rubber & Gutta Percha Insulating Company....6
International Elec. Meter Co13
International Tel. Mfg. Co...18

Jackson, D. C. & W. B....21
Jeffrey Manufacturing Co....15

Kartavert Manufacturing Co.24
Kellogg Switchboard & Supply Company....16, 17, 20
Klein & Sons, Mathias....18
Kohler Brothers....21
Kuhlman Electric Co....1

La Fayette Elect'l Mfg. Co..12
Leather Preserv. M. Corp....14
Leffel & Co., James....15
Lindsley Bros. Co., The....21
Loud's Sons Co., H. M....20
Ludlow Valve Co....—

Machado & Roller....—
Maine Hub Mfg. Co....—
Manhattan El. Supply Co....13
Manross, F. N....—
Marion Ins. Wire & Rub. Co.13
Matthews & Bros., W. N...3, 13
McCandless, H. W. & Co....21
McLennan & Company, K....12
McRoy Clay Works....4
Mica Insulator Company....12
Michigan College of Mines...—
Miscellaneous Advs....14
Monarch Elec. Mfg. Co....—
Morse, Frank W....—
Moss Tie Co., T. J....20
Mott Iron Wks., J. L....4
Mueller Company, William..20
Munsell & Co., Eugene....12

National Battery Co....7
National Brake & Elec. Co..24
National Carbon Co....—
National India Rubber Co....—
New York Ins. Wire Co....15
Niagara Tachometer & Instrument Co....7
Norfolk & Western R. R....14
North Electric Co....19
Northern Elect'l Mfg. Co....14
Nungesser Elec. Battery Co. 7

Okonite Co., The....1
Oneida Community, Ltd....1
Osburn Flex. Conduit Co....4
Ostrander & Co., W. R....1
Otto Gas Engine Works....—

Pacific Coast Pole Co....20
Pass & Seymour....—
Perrizo & Sons....20
Peru Elec. Mfg. Co....—
Phillips, Eugene F....13
Phillips Insulated Wire Co...13
Phoenix Glass Co....1
Phosphor-Bronze S. Co....19
Pignolet, L. M....12
Plume & Atwood Mfg. Co....1
Porter Cedar Company....20

Rail Joint Co., The....3
Reisinger, Hugo....—
Reynolds El. Flasher Mfg.Co.4
Robbins & Myers Co....5
Robert Instrument Co., The..13
Robertson & Sons, Jas. L....14
Rock Island Battery Co....7
Roebling's Sons Co., J. A....23
Rose Polytechnic Institute..21
Rossiter, MacGovern & Co...14
Ruebel & Wells....21
Runzel-Lenz Elec. Mfg. Co..19

Safety Ins. Wire & Cable Co..1
Samson Cordage Works....4
Sandwich Pole Changer Co..19
Sargent & Lundy....—
Schott, W. H....21
Schureman Co., J. L....3
Seymour Mfg. Co....15
Simplex Electrical Co., The..1
Simplex Elec. Heating Co....12
Smith Storage Battery Co....7
Sorensen, P....—
Speer Carbon Co....5
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Star Expansion Bolt Co....4
Steel Gain Mfg. Co....12
Sterling & Son, W. C....20
Stewart Elec. Co., Frank H..24
Stow Mfg. Company....1
Stromberg-Carlson Tel. Mfg. Company....19
Sturgess Engineering Dept..—
Switchboard Equipment Co.22

Torrey Cedar Company....20
Trumbull Elec. Mfg. Co....3

Van Nostrand Co., D....—
Vulcanized Fibre Company..24

Wagner Electric Mfg. Co....9
Wesco Supply Co....—
Western Electric Company ..24
Westinghouse Electric & Manufacturing Co....22
Westinghouse Machine Co....—
Weston Electrical Inst. Co....1
Willard Storage Bat. Co....—
Williamson & Co., R....13
Willis, G. M....21
Wilson Co., Jas. L. M....20
Worcester Company, C. H....20
Wrigley Co., Thos....—

Yonkers Specialty Co....1

Zeidler Lamp & Brass Co....7
Zeller, Geo. A., Book Co....—

For Classified Index of Advertisements See Page 6.

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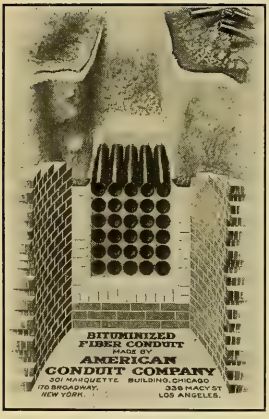

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CARBON BRUSHES
SPEER CARBON CO.
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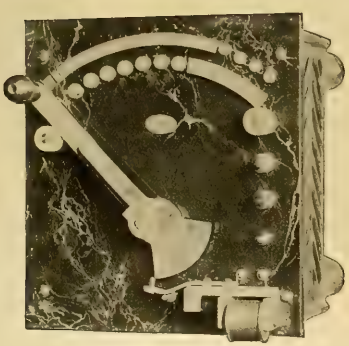
Fan Controller



This type of controller is for use with shunt or compound motors, where it is desired to obtain speeds above normal by the insertion of resistance in the shunt field circuit, and also provides for decreasing the motor speed below normal by several steps of armature resistance This method of speed control is particularly well adapted for controlling motor driven fans, as it provides a wide-range of speed control with motors of standard design.
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CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Air Deflector.
D'Olier, Jr., Henry

Anchors. (Tel. & Tel.)
Holden Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Anodes, Nickel and Copper
Seymour Mfg. Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Nungesser Elec. Battery Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Van Nostrand Co., D.
Zeller, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Aiton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Aiton Machine Co.
National Brake & Elec. Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Clusters.
Benjamin Elec. Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Crollius & Son, E. R.
McLennan & Co., R.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse Hinds Co.
Electric Appliance Co.
Gest, G. M.
McKoy Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Holden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jenninga.
Central Electric Co.
Electric Appliance Co.
Maine Rub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Switchboard Equipment Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Aiton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
Allis-Chalmers Company.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Doxsee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electrical Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Bylesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Niagara Tachometer & Instrument Co.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
McLeod, Ward & Co
Morse, Frank W.

Fixtures, Gas and Elec.
Beardsley Chandelier Mfg.Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

German Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Haller Machine Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Morse, Frank W.

Hydraulic Machinery.
Aiton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Aiton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
St. Marys Incand. Lamp Co.
Standard Elect'l. Mfg. Co.
Warren Elec. & Specialty Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, EmilR.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The
Loud's Sons Co., H. M.
Moss Tie Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain Specialties.
Peru Electric Mfg. Co.

Portables.
Faries Mfg. Co.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Bienfang & Son.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rosettes.
Pass & Seymour.

Rubber Machinery.
Aiton Machine Co.

Schools and Colleges.
Bliss Electrical School.
Highland Park College.
Michigan College of Mines
Rose Polytechnic Institute.

Second-Hand Machin'y.
Amber Electric Co.
Bissell Co., The F.
Gregory Electric Co.
Mathews & Bro., W. N.
Nat'l Stamping & Elec. Wks.
Rossiter, MacGovern & Co.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
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Soldering Sticks, Salt and Paste.
Crollius & Son, E. R.
Western Electric Co.

Solenoids.
Schureman Co., J. L.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Weston Electrical Inst. Co.

Springs.
Manross, F. N.

Steel Gains.
Steel Gain Mfg. Co.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Smith Storage Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
North Electric Co.
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service.
Chicago Telephone Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Torches.
Zeidler Lamp & Brass Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Brake & Elec. Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters,
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Aiton Machine Co.

Wires and Cables—Magnet Wires.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Driver-Harris Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 3.

You Are Part of All You Have Met

There's a big thought in this short statement.

You that go to the Convention have your little rounds of friendly pleasure. Good spirits bubble over.

But with the friendship and the pleasantries go hard and useful facts of permanent value like cargoes on rippling waters.

At a convention ideas as well as people convene.

We'll meet you at the Convention just as we have met many of you at conventions before.

We shall be glad to see you because of our past associations.

But we have something new to show you, hard business logic you will carry away, ideas about ourselves and our business that mean money to you in the future.

Look us up at the end of the long corridor.

We are part of all we have met.

The Nungesser Electric Battery Company
CLEVELAND, OHIO
GENERAL SALES OFFICE:
128 W. Jackson Boulevard, CHICAGO, ILL.

THE LIFE OF A BATTERY

Telephone Manufacturers and Telephone Companies — Manufacturers of Gas and Gasoline Engines, [illegible]

Rock Island New Patent Dry Cell Battery

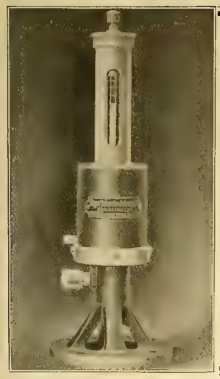
The carbon used is placed in a chemically prepared cloth and not wrapped in blotting paper, found in *other* cells. Set in a wall of chemical instead of the bare can, the method used by others, this treatment so

HOLDS THE MOISTURE CAPTIVE

that neither heat nor cold can possibly affect it. That is the reason a *hand-constructed* Rock Island lasts *nearly one-third* longer than a *machine-made* battery. The *heart* of the Rock Island is sound. There is *less* internal resistance, *more* constant tension and *better* recuperative power than are possessed by any *other* battery made. Our Standard No. 8, cheaper in the long run, does highest class work and is larger than Standard No. 6, the regular size for general purposes. Department A will send prices. Order a barrel. You'll find immediate dividends in improved service.

R I BAT

ROCK ISLAND BATTERY CO.
Ninth and Sycamore Streets CINCINNATI OHIO



NIAGARA TACHOMETERS

represent the acme of perfection in high-speed indicating devices: simplicity in construction, absolute accuracy, and require minimum attention.

The type "C" instrument shown is for direct connection to vertical shafts adapted to apparatus having high rotary speed where belt drive is not practical. We make instruments that will exactly meet your requirements. Write for catalogue

NIAGARA TACHOMETER AND INSTRUMENT CO.
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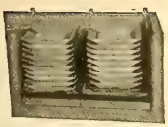

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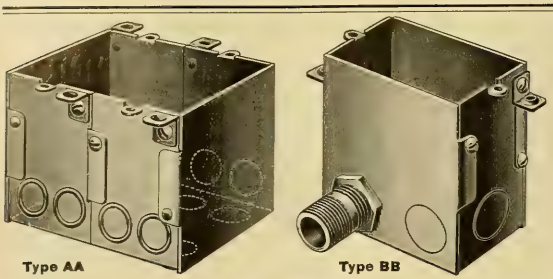

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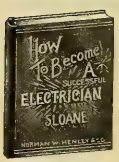

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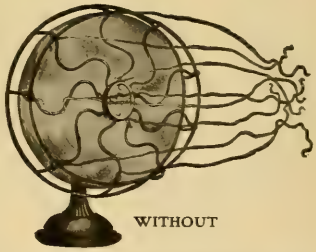
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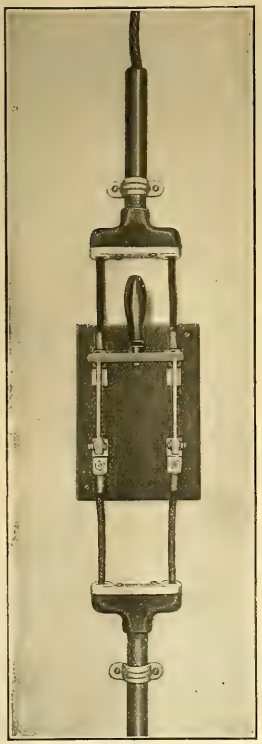

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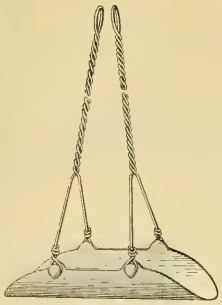

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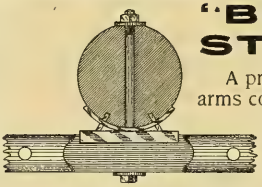

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OFFICE OF CONSTRUCTING OFFICER U. S. SOLDIERS HOME, Washington, D. C., May 10, 1906. Sealed proposals for erection of Power House, installation of Boiler Plant, Generating Machinery, Main Switchboard, Steam Laundry Equipment, Refrigeration Plant and Power House piping; also for Tunnels and Conduits for hot water distribution from Central Station, also for steam, refrigeration and electricity; construction of Pipes and Mains in Tunnels and Conduits for above; Heating and Ventilating Apparatus in New Mess Hall and Dormitory Building, will be received here until noon, June 28, 1906, and then publicly opened. Information on application, JOHN STEPHEN SEWELL, Captain, Corps Engineers, Constructing Officer.

DEPARTMENT OF THE INTERIOR, Washington, D. C., June 4, 1906. Sealed proposals will be received at the office of the United States Reclamation Service, Williston, North Dakota, until 10 o'clock a. m., July 9, 1906, for the installation of steam and electric pumping plants, and electric generating and transmission apparatus, including three pumping stations containing centrifugal pumps of 20 and 50 cubic feet per second capacity under heads of from 30 to 50 feet, driven by steam engines and electric motors aggregating 1,000 horsepower; also two 300 K. W. steam turbine generating units, a 1,000-horsepower boiler plant, and accessories, the necessary buildings and 3-mile transmission line, located in the vicinity of Williston, N. D. Particulars may be obtained from the Chief Engineer, U. S. Reclamation Service, Washington, D. C., or from H. A. Storrs, Electrical Engineer, Williston, N. D. E. A. Hitchcock, Secretary.

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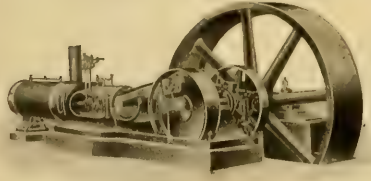

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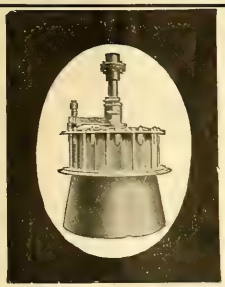

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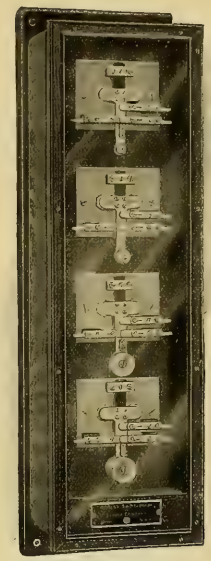

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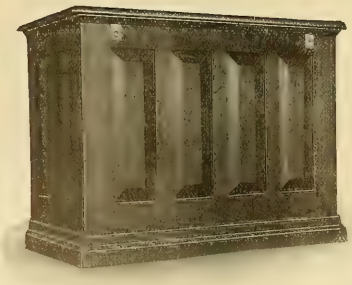

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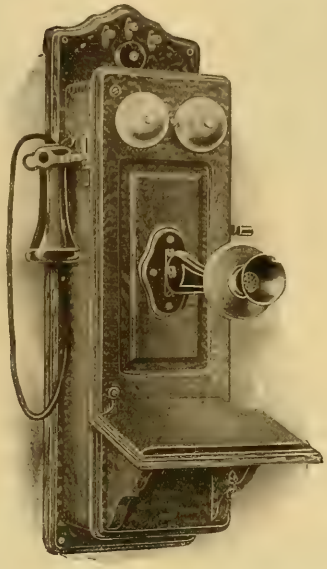

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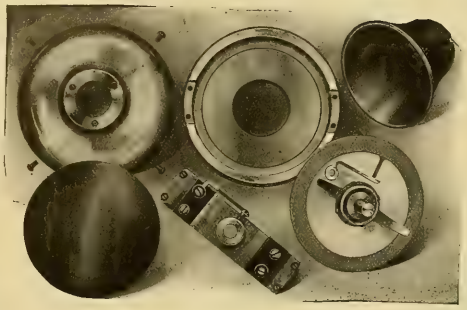

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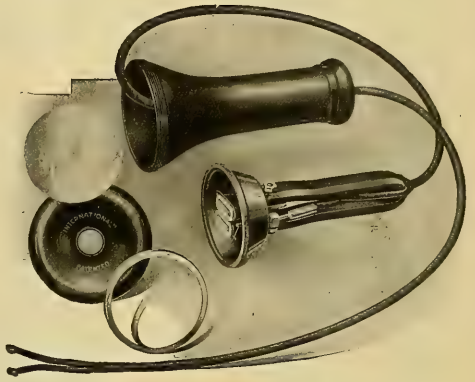

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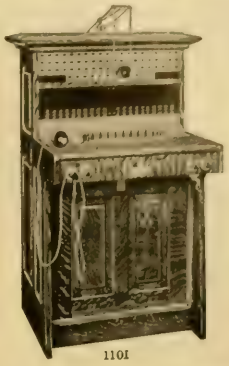

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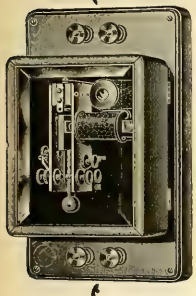

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CHAPTER I.—Receivers; II.—Transmitters; III.—Magneto Switch-Bells; IV.—Battery Switch-Bells; V.—Complete Instruments; VI.—Switches, Switchboards and Extension Bells; VII.—Batteries for Telephone Work; VIII.—Erecting Wires, Instruments, Etc.; IX.—Arranging the Circuits; X.—Intercommunicating System; XI.—Testing for and Removing Faults.
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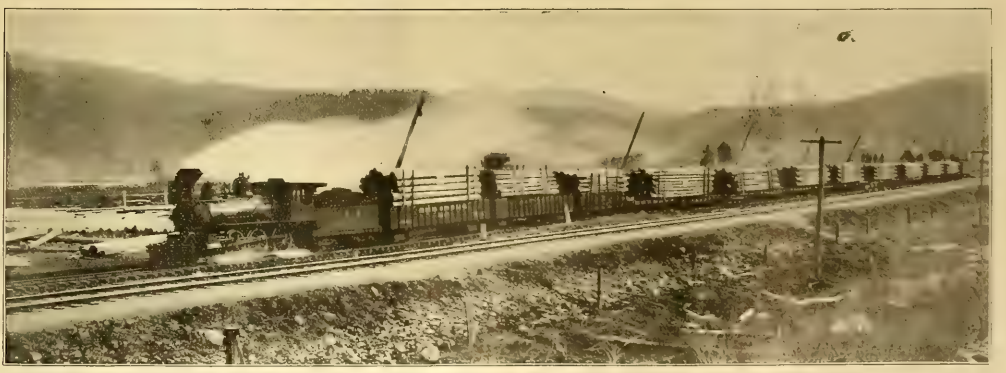

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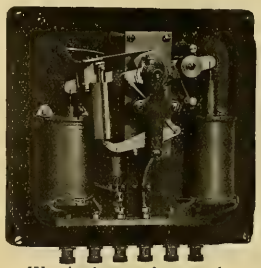

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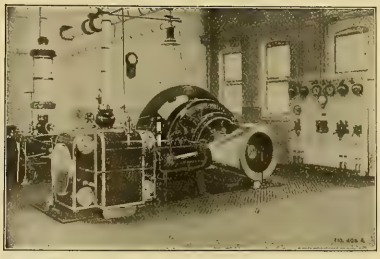

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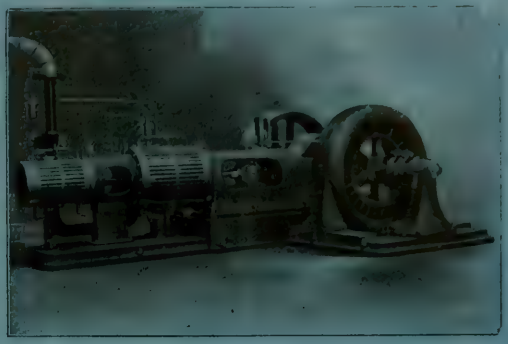

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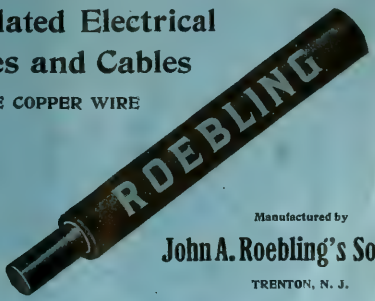

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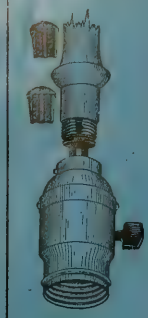

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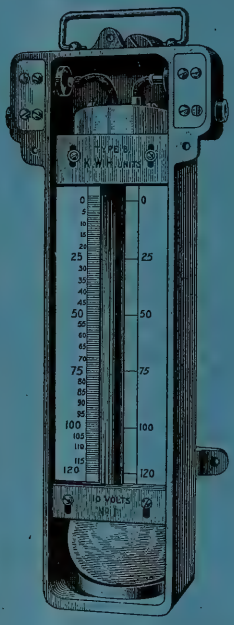

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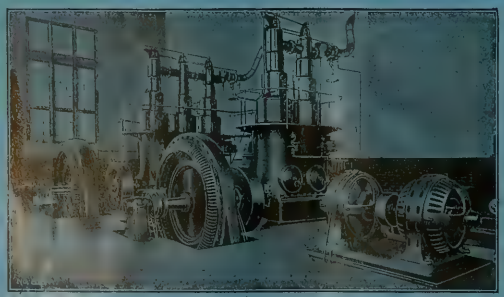

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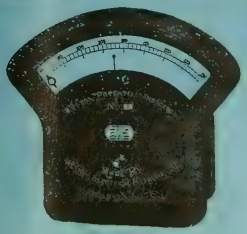

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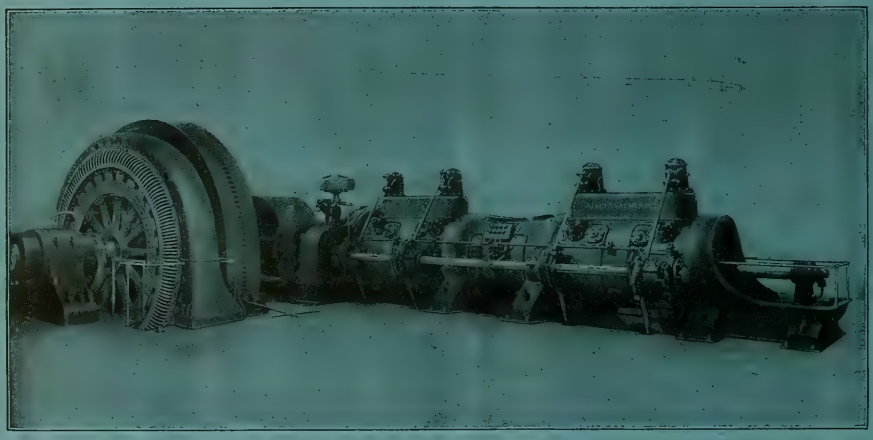

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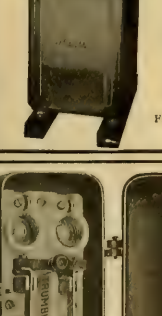

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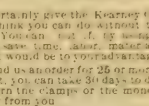

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Abeles & Taussig....20
Acme Wire Co....13
Alton Machine Co....4
Allis-Chalmers Company....2
Amber Electric Co....—
American Battery Co....16
Amer. Circular Loom Co....1
American Conduit Co....16
American Diesel Engine Co.15
Amer. District Steam Co....8
Amer. Elect'l Supply Co....8
Amer. El. Telephone Co....19
American Electrical Works..13
Arnold Co., The....16
Automatic Electric Co....19

Babcock & Wilcox Co....—
Badt, F. B....16
Bain, Forée & May....13
Baker & Co., Inc....3
Baker & Co., W. E....16
Beardslee Chandelier Mfg. Co.—
Belden Mfg. Co....—
Benjamin Elec. Mfg. Co....—
Berthold & Jennings....20
Bissell Co., The F. 11, 20
Bliss Electrical School ....—
Bossert Electric Construction Co....12
Bruer, Will F....20
Buckeye Electric Co....—
Buckeye Engine Co....15
Butterfield Construction Co.16
Bylesby & Co., H. M....16

Central Electric Co....5
Century Electric Co....12
Chicago Edison Co....4, 14
Chic. Fuse Wire & Mfg. Co. —
Chicago Ins. Wire & Mfg. Co.12
Chicago Mica Co....12
Chicago Pneumatic Tool Co..13
Chicago Telephone Co....18
Columbia Incand. Lamp Co.—
Cope, T. J....1
Crescent Ins. Wire & Cbl. Co. 1
Crocker-Wheeler Co....11
Crollius & Son, E. R....—
Crouse-Hinds Co....24
Cutler-Hammer Mfg. Co....4
Cutter Elec. & Mfg. Company 1

D. & W. Fuse Company....—
Davis Electric Mfg. Co....—
Dearborn Drug & Chem. Wks.15
Devine Co., Joseph P....12
Diamond Meter Company....18
Directory of Engineers....16
Dixon Crucible Co., Joseph..15
D'Olier, Jr., Co., Henry....5
Doxsee-Barrere Elec. Co....13
Driver-Harris Wire Co....5
Duncan Elec. Mfg. Co....23

Edison Decorative & Miniature Lamp Departm't....12
Edison Mfg. Company....16
Electric Appliance Co....—
Electric Storage Battery Co.. 3
Elect'l Trades Exposition Co.—
Electrician Pub. Company...10

"For Sale" Advertisements..14
Ft. Wayne Elec. Works, Inc..23
Fowler & Co., John H....20
French Battery Co....—

General Electric Co....11, 12
General Storage Bat. Co....12
Gest, G. M....—
Gleason, John L....12
Goodrich Steamship Lines..14
Gould Storage Battery Co....6
Gregory Electric Co....14

Haller Machine Co....—
Hart Mfg. Co....7
Hartford Steam Boiler Inspection & Insurance Co....—
Hazard Manufacturing Co....—
Helios Mfg. Co....—
Hensel & Co., John A....8
Highland Park College....16
Hoffman, G. W....14
Hoffmann, Emil R....14
Holden Anchor Co....7
Holmes Fibre-Graph. Co....—
Humphrey, Henry H....16
Hunt & Co., Robt. W....16
Hydro Elec. Development Co16

Illinois Central Ry....14
Indiana Rub. & Ins. W. Co....1
India Rubber & Gutta Percha Insulating Company....—
International Elec. Meter Co 4
International Tel. Mfg. Co...19

Jackson, D. C. & W. B....16
Jeffrey Manufacturing Co....15

Kartavert Manufacturing Co.—
Kellogg Switchboard & Supply Company....17, 20
Klein & Sons, Mathias....24
Kohler Brothers....16
Kuhlman Electric Co....8

La Fayette Elect'l Mfg. Co..—
Leather Preserv. M. Corp....—
Leffel & Co., James....15
Lindsley Bros Co., The....21
Loud's Sons Co., H. M....20
Ludlow Valve Co....15

Machado & Roller....—
Maine Hub Mfg. Co....20
Manhattan El. Supply Co....24
Manross, F. N....13
Marion Ins. Wire & Rub. Co.—
Matthews & Bros., W. N...3, 13
McCandless, H. W. & Co....13
McLennan & Company, K....12
McRoy Clay Works....16
Mica Insulator Company....12
Michigan College of Mines..16
Miscellaneous Advs....14
Monarch Elec. Mfg. Co....4
Morse, Frank W....—
Moss Tie Co., T. J....20
Mott Iron Wks., J. L....8
Mueller Company, William..20
Munsell & Co., Eugene....12

National Battery Co....8
National Brake & Elec. Co.. 7
National Carbon Co....—
National India Rubber Co.... 1
New York Ins. Wire Co....1
Niagara Tachometer & Instrument Co....12
Norfolk & Western R. R....—
North Electric Co....—
Northern Elect'l Mfg. Co....14
Nungesser Elec Battery Co. 7

Okonite Co., The....1
Oneida Community, Ltd....—
Osburn Flex. Conduit Co....16
Ostrander & Co., W. R....8
Otto Gas Engine Works....15

Pacific Coast Pole Co....20
Pass & Seymour....—
Perrizo & Sons....20
Peru Elec. Mfg. Co....5
Phillips, Eugene F....13
Phillips Insulated Wire Co...13
Phoenix Glass Co....—
Phosphor-Bronze S. Co....15
Pignolet, L. M....12
Plume & Atwood Mfg. Co....—
Porter Cedar Company....20

Rail Joint Co., The....3
Reisinger, Hugo....7
Reynolds El. Flasher Mfg. Co. 1
Robbins & Myers Co....16
Robert Instrument Co., The.—
Robertson & Sons, Jas. L....—
Rock Island Battery Co....—
Roebling's Sons Co., J. A....24
Rose Polytechnic Institute..—
Rossiter, MacGovern & Co ..14
Ruebel & Wells....16
Runzel-Lenz Elec. Mfg. Co..—

Safety Ins. Wire & Cable Co..13
Samson Cordage Works....1
Sandwich Pole Changer Co.—
Sargent & Lundy....16
Schott, W. H....16
Schureman Co., J. L....3
Seymour Mfg. Co....15
Simplex Electrical Co., The... 1
Simplex Elec. Heating Co....8
Smith Storage Battery Co....—
Sorensen, P....24
Speer Carbon Co....—
St. Marys Incand. Lamp Co.. 9
Standard Elect'l Mfg. Co....—
Standard Underg. Cable Co....—
Stanley G. I. Elec. Mfg. Co..—
Star Expansion Bolt Co....16
Steel Gain Mfg. Co....—
Sterling & Son, W. C....20
Stewart Elec. Co., Frank H.—
Stow Mfg. Company....—
Stromberg-Carlson Tel. Mfg. Company....19
Sturgess Engineering Dept..15
Switchboard Equipment Co. 1

Torrey Cedar Company....20
Trumbull Elec. Mfg. Co....3

Vulcanized Fibre Company..24

Wagner Electric Mfg. Co....—
Wesco Supply Co....12
Western Electric Company ..24
Westinghouse Electric & Manufacturing Co....22
Westinghouse Machine Co....22
Weston Electrical Inst. Co... 1
Willard Storage Bat. Co....8
Williamson & Co., R....13
Willis, G. M....16
Wilson Co., Jas. I. M....20
Worcester Company, C. H....20
Wrigley Co. Thos....—

Yonkers Specialty Co.... 1

Zeidler Lamp & Brass Co....—
Zeller, Geo. A., Book Co....—

For Classified Index of Advertisements See Page 6.

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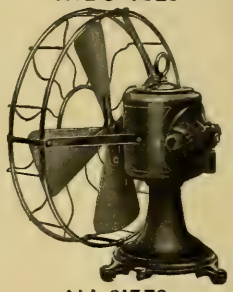
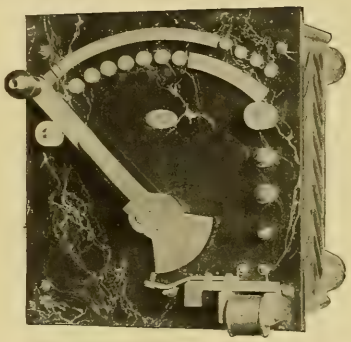


ALL SIZES

C. & H. Ventilating Fan Controller



This type of controller is for use with shunt or compound motors, where it is desired to obtain speeds above normal by the insertion of resistance in the shunt field circuit, and also provides for decreasing the motor speed below normal by several steps of armature resistance This method of speed control is particularly well adapted for controlling motor driven fans, as it provides a wide range of speed control with motors of standard design.
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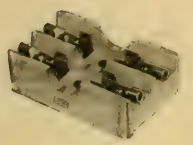
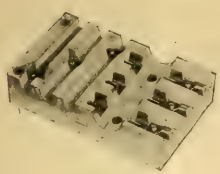


31-60 Amp., 250 V.



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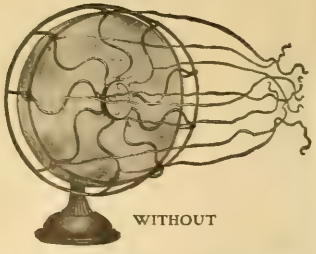

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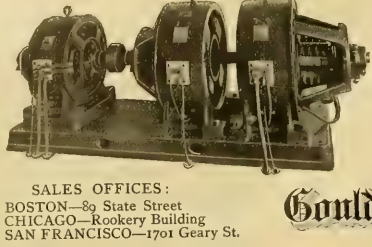

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Works: Depew, N. Y.

CLASSIFIED INDEX OF ADVERTISEMENTS.

Adjusters, Cord.
Morse, Frank W.

Adjusters, Inc. Lamps.
Morse, Frank W.

Air Deflector.
D'Olier, Jr., Henry

Anchors, (Tel. & Tel.)
Holden Anchor Co.
Matthews & Bro., W. N.

Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Anodes, Nickel and Copper
Seymour Mfg. Co.

Batteries and Jars.
Bissell Co., The F.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
French Battery Co.
Manhattan Elec. Supply Co.
Nungesser Elec. Battery Co.
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Star Expansion Bolt Co.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co.
Zeiler, Geo. A. Book Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bushings.
Stewart Elec. Co., Frank H.

Cable Hangers.
Bissell Co., The F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Brake & Elec. Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Clusters.
Benjamin Elec. Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Crollius & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse-Hinds Co.
Electric Appliance Co.
Gest, G. M.
McKoy Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Bertholdt & Jennings.
Central Electric Co.
Electric Appliance Co.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Davis Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Peru Electric Mfg. Co.
Sorensen, P.
Switchboard Equipment Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
Allis-Chalmers Company.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Dorsee-Barrere Elec. Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Eyllesby & Co., B. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

Electro-Magnets.
Acme Wire Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
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Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Field Coils.
Acme Wire Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
McLeod, Ward & Co
Morse, Frank W.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg.Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Peru Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Company.

German Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Haller Machine Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Electric Appliance Co.
Morse, Frank W.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials).
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kane Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
St. Marys Incan. Lamp Co.
Standard Elect'l. Mfg. Co.
Warren Elec. & Specialty Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Reflectors & Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnets, Autom. Wound
Acme Wire Co.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mixing Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Forse & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg. Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers.
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The
Loud's Sons Co., H. M.
Moss Tie Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Wilson Co., Jas. I. M.
Worcester Co., O. H.

Polish (Metal).
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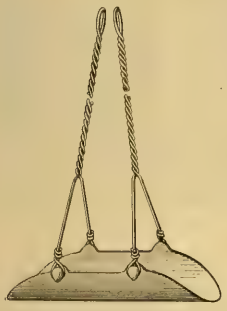

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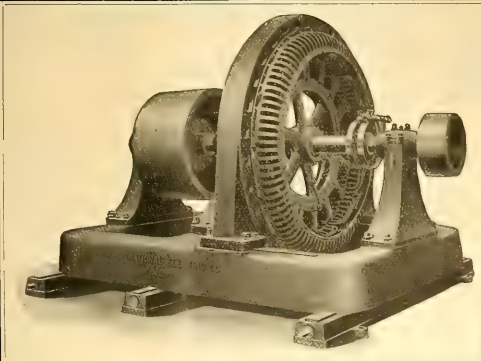

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Practical Hints on Its Construction and Operation

The scope of this eminently practical work, written by experienced authorities on the subject, is well indicated by the list of chapter headings:

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IV. Boilers and Setting.
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VI. Engines.
VII. Steam Turbines.
VIII. Belting and Shafting.
IX. Electrical Equipment—Generators—Switchboard.
X. Arc and Incandescent Lamps.
XI. Instruments.
XII. Transformers.
XIII. Line Construction.
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XV. Cost of Plants.
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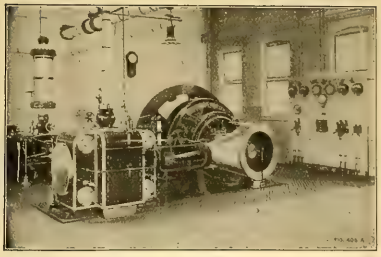

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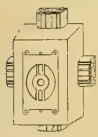

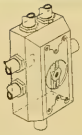

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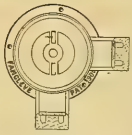

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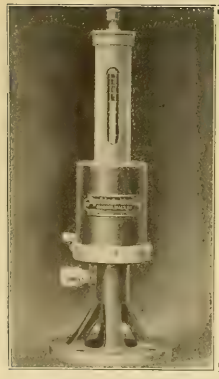

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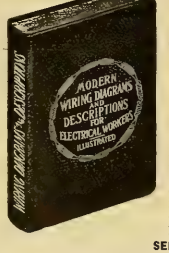

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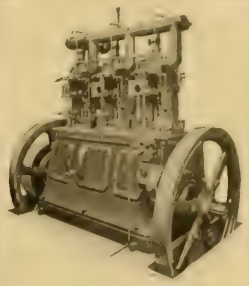

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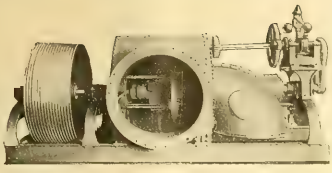

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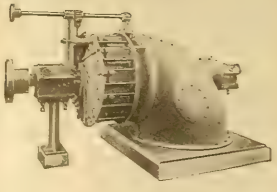

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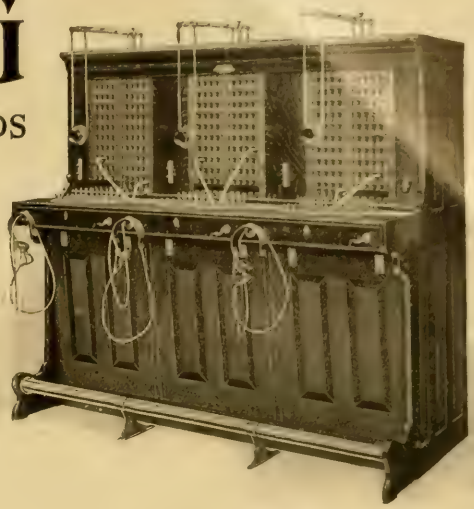

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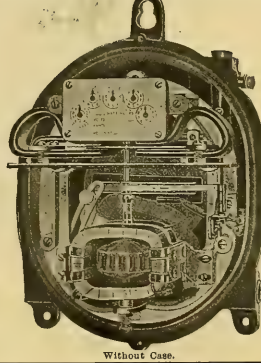

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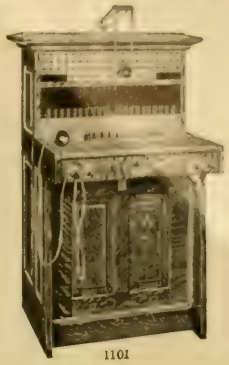

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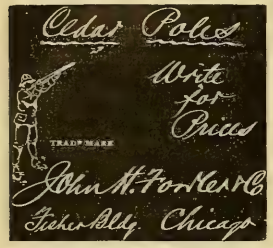

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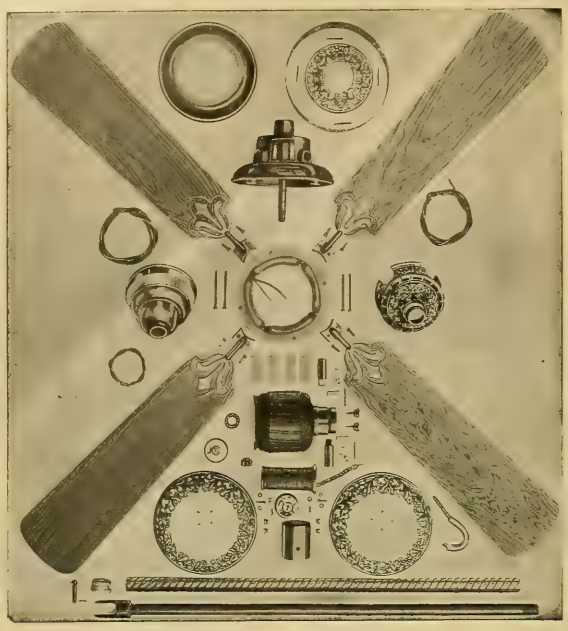

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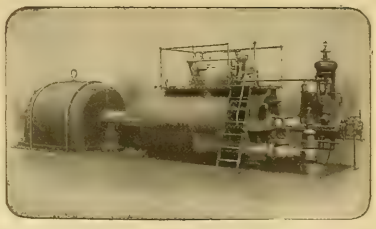

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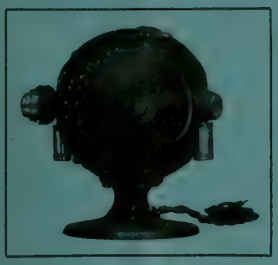

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IV The Effects of Electric Flow Outside the Circuit—Magnetism and Induction—The Electrical Units
V Electromagnets—The Telegraph
VI Electric Signaling Apparatus
VII The Relations Between Magnets and Electric Currents
VIII Induction and Reactive Coils
IX The Telephone
X Telephone Accessories
XI The Mechanical Generation of Electricity
XII The Dynamo Machine
XIII Various Types of Dynamo Machines
XIV Alternators—Polyphase Currents
XV The Electric Motor
XVI The Electric Railway
XVII Polyphase Currents and Motors
XVIII Electrical Power Transmission
XIX The Incandescent Light
XX The Arc Light
XXI Electrochemistry—Storage Batteries
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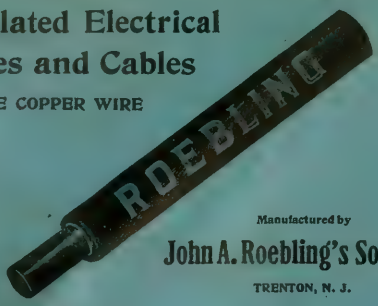

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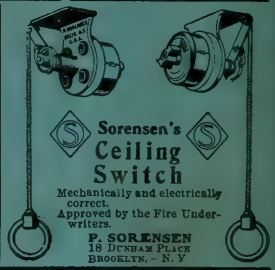

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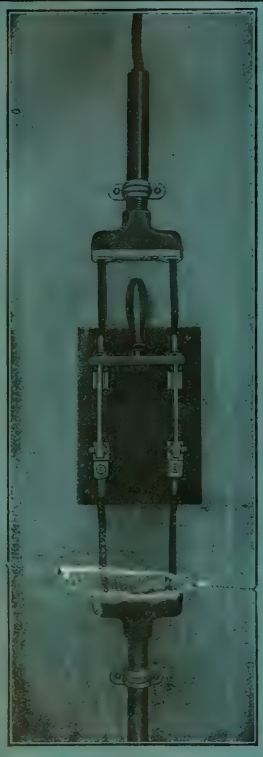

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